Skills in Changing Labour Markets

Comparative analyses of digitalization, skill formation and skills demand during recruitment in Estonia and Germany

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Dissertation zur Erlangung des Doktorgrades der Philosophie (Dr. phil)

im Fach Soziologie an der Fakultät für Kulturwissenschaften

der Universität Paderborn

im Jahr 2024

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Tag der Disputation

10.06.2024

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Abbreviations

CME: Coordinated market economy

ECS: European Company Survey

EU: European Union

EQF: European Qualifications Framework

HR: Human resources

ICT: Information and communication technologies

LME: Liberal market economy

VET: Vocational education and training

VoC: Varieties of capitalism

SME: Small and medium-sized enterprises

STEM: Science, technology, engineering, and mathematics

Abstract

Mismatched employees are a great concern to society and the economy. The German and Estonian labour markets, because of their demographic situations, are challenged to exploit their workforce potential to the full, but mismatches do arise. Skills mismatches receive particular attention because the digital transformation and its impact on work pose the challenge of evaluating outdated and future-proof skills (and how and where to source the latter). This project seeks a better understanding of the existence and conditions of skills mismatches in both countries and captures both sides of mismatches within its research framework. It analyses processes of skill formation (supply side) and recruiting structures (demand side) in Germany and Estonia on a comparative basis. By applying a most-different-systems design, insights are gained with regard to the problematic situations in both countries, with particular reference to the institutional frameworks of their economic production and vocational education and training systems (VET), and hence their varying capacities to react to digital change. The analysis of skill formation in the context of digitalization indicates path dependency: Estonia has more possibilities for (faster) skills adaptations in vocational programmes and occupational profiles than Germany within the framework of gradual change processes. In light of the digital transformation, greater importance is attached to the establishment of informal skills. This is more developed in Germany than in Estonia because of its apprenticeship system. For the demand side, a factorial survey experiment studied employer recruiting processes. The results show that informal skills are essential, especially during the recruiting process. Along with formal education (type, grades, certificate), applicants are successful when they exhibit proficiency with regard to teamwork. The study revealed recruiters' preference structures on different applicant criteria by country. This leads to the assumption that the institutional context matters greatly with regard to recruiting practices and outcomes.

1. Introduction

Skills are a pathway to employment, as well as to personal and professional development. The right skill set increases people's chances of finding decent work. A good fit in employment allows for personal growth. It is key to social cohesion because the social experience of being integrated at the workplace makes for active engagement in society. For instance, experiences of respect and collegiality have an exemplary function and contribute to people's self-confidence, which is strongly needed in the face of the significant societal and economic upheavals we currently face in the age of digital transformation and climate crisis. Skilled employees are better equipped to navigate future labour market changes. A matching work position that suits one's personal and professional requirements is a solid basis for this.

But the current situation in European labour markets is worrying. Skills gaps, skills shortages and mismatches are a challenge to employment relations. Many employees work in positions that don't match their talent and potential. Employers[1] have trouble finding new staff with the required skills. Besides these imbalances in employment positions, many European societies are also aging and shrinking, which heralds tight labour markets due to skills shortages. Future demographic developments are increasingly problematic primarily because the Baby Boomer generation, born in the 1960s, are now retiring. This numerically large group of workers is leaving a major shortage of skilled workers in the labour market. The upshot is that skills mismatches are being further exacerbated.

In public discourse, there is a marked awareness of skills mismatches and shortages because they touch on the very foundations of prosperity in many ageing European societies. There is considerable academic agreement on their adverse outcomes, which affect economic competitiveness, wealth and innovation. Analysis of skills mismatches is worthwhile because human resources and skilled labour are crucial to the attractiveness of business locations in the future, as optimal conditions are needed to enable employees to realize and contribute their full potential. The Covid-19 pandemic has benefited digitalization in the workplace, accelerating structural changes in the overall economy towards the development of a service economy. Keeping up with megatrends and mastering transformations with a well equipped and well matched workforce is decisive for competitive advantage, particularly as economic value added relies on innovation and research, driven by abundant human capital.

High-profile political action is needed to mitigate the effects of skills mismatches. Established policy responses so far refer mainly to skill formation and skills development. The European Commissioner for Jobs and Social Rights, Nicolas Schmit, stressed, however: 'We need a complete shift in mindset regarding how we approach training in Europe. Skills programmes are not a cost; they are an investment. It is imperative that European businesses – from SMEs (small and medium-sized enterprises) to large corporations – have the talent they need to thrive; and that individuals feel empowered to embark upon

[1] Throughout the text, the terms 'employer', 'recruiter' and 'HR personnel' are used interchangeably and refer to those responsible for recruiting and selection tasks within an enterprise.

lifelong learning' (European Committee of the Regions 2023). A broad alliance across the European Commission, the European Parliament, EU Member State governments, social partners and unions, and employment services supported the 'European Year of Skills 2023', which was announced in February 2023 (European Commission 2023b, 2023a). It was intended to help SMEs to tackle and counter their skills shortages in particular, but it is more than that. It is also supposed to help other measures, such as the European Skills Agenda and the Pact for Skills, to achieve their targets, for example, enhancing the level of digital skills among EU citizens, training more ICT professionals, or promoting adult participation in training. Identifying the problem regarding shortages and mismatches in terms of numbers and statistics helps to flag the urgency of the issue and propel multi-stakeholder action.

The debate on the causes of skills mismatches and suitable counter-measures to be developed and applied has stepped up a gear because of the progress of digitalization in all sectors and industries. For this dissertation project, the problem of skills mismatches is a starting point. The project integrates the analysis of digitalization and its impact on skills production and skills needs through a comprehensive analytical framework, which will be outlined in more detail below. This research perspective is significant because both the labour supply and demand sides are impacted by digital transformation and are involved in the development of skills shortages. Many policy responses and research projects focus primarily on supporting skills provision and skills supply through investments in training and education. Despite their impact and importance, answers that predominantly address the skills supply-side to tackle skills mismatches are largely insufficient. It is equally important to understand what and how skills are demanded by the labour market. Knowing employers' strategies in utilizing skills and obtaining insights into detailed skills requirements within occupations is relevant to establish measures for improvement and support on this side. With this joint and comprehensive perspective on skills supply and demand, the project contributes to a more holistic understanding of labour market matching problems and mechanisms.

Skills mismatches and digitalization

In conceptual terms, skills mismatches describe a broad range of possible situations in which labour market imbalances are related to unmatched needs and requirements. Employers' experience that the right skills are hard to find is caught concretely by the conception of skills shortages. Companies 'are unable to fill key vacant posts due to a lack of suitably qualified candidates' (McGuinness, Pouliakas, and Redmond 2017: 8). This lack of 'rightly' skilled employees applying for jobs emphasizes a qualitative mismatch situation instead of a quantitative imbalance between labour supply and demand (for example, for reasons of timing or geographical mobility barriers). Mismatches are a result of companies' recruiting processes or already exist among employees. Moreover, labour markets can be affected by multiple mismatch situations simultaneously; this is what we currently observe in the case of demographic changes, labour shortages and skills shortages (Eurofound 2015; Eurofound and Cedefop 2020).

The availability of skills and the possibility of utilizing them at work are central issues to employees and employers. In addition, digitalization is a structural condition for the existence of skills shortages. Adopting new technologies or new components within the framework of structural change requires skills that might take time to become available. This causes skills gaps in companies between the employees' skills and the skills required to perform the job. With the digital transformation, emerging and advancing technologies are entering the world of work and exerting a considerable impact on the educational and economic spheres. In this context, educational institutions must ensure that they equip graduates with the required skills. This isn't an easy task within the framework of the transformative dynamics that characterize society today. Vocational education and training (VET) institutions play a significant role in guaranteeing the skills the workforce needs to benefit from constant innovation. Up-to-date VET training is essential because it can provide the employees needed by technical labour market segments.

Rapidly changing realities are contributing to employers' uncertainties about which skills are required and need to be sourced. Enterprises in the EU have been expressing their concerns about workforce skills shortages for a while now. Because skills have become a major competitive factor, skills shortages are a top concern for employers (Manpower Group 2020). Some 77% of EU-based companies currently state that they have difficulty finding people with the skills they need. One in five employers in the EU finds it very difficult to source employees with the required skills. It is striking that recruitment difficulties occur more frequently for enterprises that have digitalized only to a limited degree compared with highly digitalized enterprises (Eurofound and Cedefop 2020; Manpower Group 2020; European Commission 2023a).

Various mechanisms drive skills shortages. On one hand, there is uncertainty about future advances in digitalization, as well as the concrete advantages and disadvantages of innovative digital tools and technologies. Enterprises are being challenged to anticipate and make decisions on work restructuring or to implement new working methods. But a particularly significant challenge is to define specific job profiles for, and to find, new personnel who are equipped and qualified for current and future work demands. It is assumed that up-to-date skills will also accompany the shift towards greater flexibility and autonomy at the workplace for employees. The increasing importance of occupation-specific skills, but also of 'task-solving skills, social and emotional competences (so-called soft skills) [may be observed] as cooperative work groups, services and management task proliferate' (Mayer and Solga 2008: 3). To harness technological developments, training in occupational specializations alone no longer seems sufficient. The Finnish Union of Professional Engineers claims, for instance, that 'people who graduated 15 years ago do not necessarily have skills that match the needs of today's working environment' (Dominik Istrate 2019).

But it is evident that the problem of skills shortages comes to light when employers are hiring new employees. This is because it is easier to adjust new job profiles or to add new hiring requirements than to make changes to existing positions (Warning and Weber 2018). Recruitment processes are therefore an immensely important culminating stage in which matching problems manifest. This is why this project particularly analyses skills demand during recruitment.

Skills shortages are therefore very much related to employers' skill utilization and human resource (HR) practices. This brings the efficiency of HR management and recruiting strategies or job offer conditions to the forefront (Eurostat 2020; Řihová 2016). As HR consultants observe, the reasons for shortages can also be found in unintended consequences within recruitment processes, for example, due to a lack of experience and investment, misguided or missing strategic planning processes, or insufficient resources (Drake International 2017; Stippler et al. 2019). In particular, there is a higher risk of shortages when companies rely on schematic and traditional recruiting methods or 'use very informal and poorly defined hiring procedures and interview protocols, have inadequate job descriptions and allocate inadequate resources to the job' (Cedefop 2012: 28). As a consequence, improving skills shortages calls for a better understanding of recruiting processes.

This emphasizes that skills shortages also impact the supply side of the labour market. It stresses the need to observe skills shortages as a matching problem in particular in relation to job-seeking graduates. Matching problems put young people in particular at a disadvantage. At the start of their employment history, they can rely only on what they learned in school, having just left the formal education system. But education providers and especially curricula have very different perspectives on skills than employers. This pertains to the employability of young first-time employees, mostly VET (vocational education and training) graduates, and their preparedness for the labour market. Here, too, a better understanding is needed of recent developments in the context of digitalization and the skills profiles of VET students, obtained in formal education.

Digitalization impacts education systems and poses challenges regarding skills shortages. At the moment, the ability to deal with basic digital technologies or to understand digitalization remains rudimentary in European societies. The Digital Economy and Society Index confirms this, indicating that one-third of European workers lack (at least) basic digital skills (2022) (European Commission 2022a). The work context adds to this situation by further integrating innovations, digital technologies, or complex new processes. This challenges existing strategies and legacy systems of education and skill formation. VET is known mainly as a provider of the skills in strong demand to implement and harness technological developments. Within the framework of digitalization, however, education often lags behind workplace practices with regard to integrating, addressing and implementing change in their formal training programmes (Cedefop 2016b). This gives rise to discussions on whether VET can provide future-proof training and cope with digitalization. This is important because beyond skill formation, skills systems are also measured by their success in ensuring a smooth transition from education to work and a good match of appropriate skills at the workplace.

Skills shortages are a problem in segments of the labour market particularly affected by enhanced digitalization because skills shifts are taking place. The spotlight is on the logistics sector and IT, but also electrical manufacturing (Cedefop 2012; Nies, Ritter, and Pfeiffer 2021; Kusmin, Saar, and

Laanpere 2018; European Commission 2022a; Vollmer 2015). These occupations are the cornerstones of a structurally changing economy because digitalization depends on them, by definition. Occupations whose training is provided by VET programmes offer students job-ready and strongly workplace-related qualifications and skills. This is advantageous because training takes place in the context of a real work environment. Learning includes observation and acquiring experience on a situational basis, which provides suitable opportunities to take up and react to skills shifts while working, for example, within the framework of more communicational tasks or social interaction (Langemeyer 2019).

When skills shortages occur, the labour market becomes unbalanced: job applicants' qualifications and occupational skills profiles don't correspond to companies' expectations. Successful completion of education does not guarantee realistic chances of good-quality and secure employment, even though the current labour market situation appears favourable in light of demographic change. Because skills mismatches refer to labour supply and demand, this project seeks to integrate both sides. This perspective is central to the project's research interest.

Looking at matching problems between job applicants and employers at the institutional level, it would appear that the relationship between education system and labour market is in tension. On this basis, skills mismatches can be traced to labour market institutions. Given the different country-specific institutional contexts in Europe, companies and education systems have different options when it comes to tackling structural change. The first question concerns how different countries are equipped to shape the digital transformation in terms of their skills and qualification systems, and the second, how this relates to their employment systems. The range of opportunities offered by different institutional conditions may vary in terms of their ability to respond to skills shortages. Therefore, it is important to take corporate recruiting behaviour and country-specific preconditions into account.

Skills shortages in Germany and Estonia: same problem, but different country-specific strategies?

Estonia and Germany are exemplary cases for comparison if one seeks a better understanding of how different European countries are tackling labour market developments arising as a result of digital transformation. Employers' perceptions of skills shortages in recruitment are similar in the two countries. In Estonia, 84% of companies say that they have recruiting problems related to the skills dimension; 24% find it very difficult to find employees with the required skills, whereas 60% find it fairly difficult. In Germany, similarly, 85% report such difficulties, while 40% report that their situation is very difficult (Eurofound and Cedefop 2020). This is one of the highest proportions in the European company-comparison survey.

For companies, few remedies are available. Their skills utilization practices often result in hiring workers with non-matching skills: one in five companies in Estonia and Germany state that more than 80% of their newly hired employees lack the skills they need (ibid.). Focusing on the skills dimensions of digitalization and the green transition, we can further observe that enterprises adapt to developments regarding their skills needs. Employers say that the knowledge and skills they need do not change very quickly, but they certainly change (ibid.). Skills monitoring and future skills anticipation by governments, and by labour market and educational actors are central challenges. Even though both countries face the same problems when it comes to hiring new employees, they have different institutional settings.

Estonia is known to be a digital pioneer in Europe. Since the 1990s, the government has established and consistently developed an e-government infrastructure that has earned an international reputation, also because of broad societal acceptance and a participatory culture. This has given rise to a business-friendly environment and ecosystem, which is especially appreciated by entrepreneurs, start-ups and investors (Margetts and Naumann 2017; Government of the Republic of Estonia). The Tiger Leap initiative of 1996 and the subsequent project Tiger Leap +1 of 2001 set out to foster these developments in the direction of a digital society. Since then, schools have been equipped with a good ICT infrastructure, and students are taught computer programming at an early age (Runnel, Pruulmann-Vengerfeldt, and Reinsalu 2009; Krull and Trasberg 2006). By contrast, German educational institutions are still waiting for well functioning wireless connection networks and other basic IT infrastructure, not to mention the integration of media education and programming languages in school curricula (Kammerl 2020). The reticence towards strengthening the media and ICT literacy of teachers and the general population (König 2020; Wößmann et al. 2017) is in stark contrast with Estonia, whose citizens show a high affinity towards technical innovation and the use of internet-related technologies (European Commission 2020b).

Estonia may be seen as a prototype for countries facing technological change and has been implementing targeted measures for some time. The transition towards an information society is strongly interwoven with Estonia's post-communist transformation and, notably, with processes of democratization, economic restructuring, and institutional, social and cultural change. These transformative developments required a fundamental shift in the structuring principle of society, which was launched very intentionally and profoundly in the 1990s. By following the outline of a Western European capitalist model, institutions sought to catch up in order to 'trigger a surge in social development' (Delhey 2001: 60, author's translation). The situation was different with regard to its digitalization strategy. From the beginning, Estonia established a digital infrastructure that enables it to couple newer and additive digital layers and is therefore adequate, efficient and forward-looking (Margetts and Naumann 2017). The institutional legacies that may promote or hinder digital transformation are therefore completely different in Germany and in Estonia.

In addition, the two countries follow different logics with regard to the education–employment nexus. Germany is known as a political economy with close links between the education/training system and the labour market. In such a coordinated market economy (CME) companies are deeply involved in VET. They offer training spots in the apprenticeship system and are actively involved in training on-site and in future VET developments. A key characteristic of the German system is that particular occupations are a central aspect of vocational education and training, and a structuring principle for the labour market. With the advent of digitalization, however, the outstanding stability of VET over previous decades in coping with changes has started to founder and become contested, for example, by (higher) educational pathways. In contrast, institutions associated with liberal market economies (LME), as in Estonia, discourage employers from participating closely in skill formation. Instead, the (future) workforce is incentivized to acquire rather general skills that are transferable to other firms or industries. Because VET graduates are not expected to have very specialized firm-specific skills, companies are prepared to provide in-house preparatory job-related training. The link between education and employment is less intensive than in CMEs. At present, VET in Estonia is still under the shadow of its Soviet past. But the Estonian government attaches strong importance to vocational skills for the future of their economy and seeks to expand them.

Reflecting on institutional variations regarding economic production and digitalization allows us to learn more about the role of institutions in shaping graduate labour market entry, employers' skills activation strategies, and the evolution of mismatches. The missing link, therefore, is understanding the relations between education and employment systems and in this way better understanding the underlying allocation and stratification mechanisms. Such labour market imbalances in the form of skills shortages are therefore brought together with country-specific conditions with regard to institutions and legacies.

Research question

The context of the digital transformation in Estonia and Germany highlights processes of skill formation (skills supply) and employer behaviour (skills demand) under situations of change. Therefore the project's leading question is: *How do skills demand and skills supply relate to each other in different institutional contexts?* Because skills shortages imply that digitalization relates to skills shifts in VET training and shifting requirements in the labour market, the two sides are approached analytically and empirically. The project's research framework enables a comparative analysis of the conditions of digitalization between Estonia and Germany, first, with regard to skill formation processes, and second, in terms of employment behaviour in recruiting situations. By studying skills supply and demand in relation to each other, a greater understanding is achieved of the conditions and mechanisms of skills shortages and their societal impacts on the Estonian and German labour markets.

Within this analytical framework, the project connects the hitherto separate research fields in the three thematic areas of digitalization, education and recruitment processes in the labour market. Linking these thematic areas represents a significant first attempt to establish a research setting that is broad enough to capture external influxes at different levels of observation and thus is tailored to understanding the link between the education and employment systems with regard to skills.

State of the art

Current research on skill formation often takes a comparative perspective. The political economy literature has provided the insight that skill formation takes on different forms because it is deeply rooted in a country's institutional architecture. By means of historical and cross-national comparisons, this literature finds proof that specific evolved institutional conditions give rise to different VET systems in Europe because education systems are in complementary and mutual dependence with other institutional conditions within a given country (Culpepper and Thelen 2008; Streeck 2011).

Skills are the central focus of research in the institutional VET literature because VET systems' main target is the creation of the occupation-specific and specialized skills needed for particular labour market segments. The production of and demand for skills follows the logic of capitalist production. Hall and Soskice (2001) define a dual typology of capitalist production. Coordinated market economies (CME) give rise to highly specific occupational skills, whereas liberal market economies (LME) provide for rather general 'switchable' or 'portable' skills. In this view, portable skills are easily transferable to other firms. Streeck (2011) further develops the dualist skills typology. He argues that the significance of portable skills goes beyond their economic meaning. Skills might also be portable because of their nature as a personal asset and depending on the structure of the respective labour market. For instance, in an occupationally structured labour market, highly occupation-specific skills are also portable.

Institutionalist research has shown why countries form different skills and skill profiles. Country-specific skill formation systems are embedded in a landscape of other important institutions for the economic production of a country. The project thus relies on a rich body of VET comparative literature on skill formation. A further study central to the project is that of Bol and van de Werfhorst (2011), who developed an indicator-based classification of VET systems in Europe in accordance with institutional variations. This enables them to analyse whether a VET system provides skills of a general or an occupation-specific character, and at what depth. The vocational orientation indicator determines the role VET plays in the general education system and the vocational specificity indicator specifies the type of skills achieved in skill formation (general or occupation-specific). In accordance with this classification, Estonia and Germany are prototypes of fundamentally different skill formation systems. The German VET system trains students largely within a dual system (strong vocational orientation and strong vocational specificity). It has strong ties with the employment system because of the close involvement of enterprises in training.

Varying vocational specificity therefore goes hand in hand with a different coupling of education and the labour market. The predominance of highly occupation-specific qualifications in Germany is linked to labour market segments that require specific profiles. This is an example of a tight coupling between the education and employment systems, with occupations as a structuring element. On the other side, Estonian students learn within a primarily school-based VET system and a loose involvement of actors outside school (weak vocational orientation, weak vocational specificity). Ties to other labour market institutions in Estonia may be characterized as rather loose. This looser coupling in Estonia due to the rather general character of skills indicates that transitions from vocational schooling to professional employment are not necessarily structured by strongly specified occupation-specific skills and qualifications (Cedefop and Ministry of Education and Research 2019; Bundesministerium für Bildung und Forschung 2020a; Müller, Gangl and Scherer 2002; Buchholz et al 2019; Blossfeld et al. 2016).

Newer comparative VET studies bring the role of skills to the fore. They disentangle the role of skills in respective economic production logics and extend previous comparative work on education systems and employment opportunities by applying these typologies to a broader spectrum of countries. Moreover, this comparative work also provides insights into how skill formation looks in times of structural upheaval and how it responds to labour market crises, for example, during the period of economic recession caused by the global financial crisis. Less recent comparative work on Estonia and Germany, or equivalent education systems, focused on digitalization as a challenge for skill formation and school-to-work transitions.

The empirical evidence so far shows that education and labour market systems are interrelated. They structure employment opportunities. Recent comparative work has studied the link between education and employment systems in a wider range of countries. Beyond the examination of student achievements in terms of formal qualifications, other types of skills have been less well researched. This is also because such skills, in particular informal skills, are less easy to certify. In consequence the importance of informal skills is often underestimated (Harteis, Goller, and Fischer 2019). Because informal skills are increasingly important in digital transformation, more focus is needed on digitalization as a challenge for skill formation and school-to-work transitions.

A second gap in the literature concerns the demand side of skills. Corporate actions with regard to recruitment mainly comprise hidden strategies, and only concrete outcomes provide indications of its success or failure (mismatches). In addition, although there are a number of theoretical approaches and empirical applications in sociological research on the relationship between skill formation systems and labour market allocation, this strand of literature mainly explores the outcomes for young people. Here, for example, independent variables such as personal characteristics, educational attainment or school grades are integrated into ways of determining employment chances in different skill formation systems. But the position of recruiters as ‘gatekeepers’ is relevant to the study of social stratification because it is mainly employers who decide whether recruitment leads to an employment contract in particular cases (Bills et al. 2017; Struck 2001). However, the availability of information on recruitment behaviour is a weak point of the literature on the demand-side of skills, especially from the standpoint of skills matching. Few studies examine the influence of employers and their structuring principles on youth transitions to the labour market, and even fewer make cross-country comparisons. The present project, with its perspective on the demand side of skills matching, therefore contributes to fill a research gap in the social stratification literature. This research gap is specified in greater detail below. It is also related to research aims resulting from the impact of digitalization because digital transformation is an important aspect of skills mismatches.

With the analysis of skills demand, the project takes up the employers’ view of mismatches. It promotes a research perspective in the tradition of inequality scholars, mainly sociologists (such as Bills 2003;

Hesketh 2000; Jackson 2009; Dörfler and van de Werfhorst 2009; Kohlrausch 2012; Solga and Kohlrausch 2013; Protsch and Solga 2015; Di Stasio and van de Werfhorst 2016). This complements the extensive literature on matching difficulties on the applicants' side of matching. With this focus, previous employer studies have determined the role of education and qualifications in matching situations and repeatedly shown that education is a crucial signal for employers. This is especially the case when the work experience of early career applicants is the only information available (Weiss 1995; Bills 2003).

Confronted with a lack of comparative data, surveys collect their own (experimental) employer data and determine which skills employers use in which recruiting situation. Protsch and Solga (2015) conducted an experimental study to detect what applicant information is important to employers as a marker of suitability. Application documents provide useful information to varying degrees. Openly accessible in such documentation is information on unchangeable personal characteristics (name, age, gender, origin), but also on formal educational qualifications. Various informal skills, however, are not easily visible in application documents. Employers uses applicants' CVs to identify different skills, including informal skills, which are more difficult to ascertain. They make use of the entire bandwidth of different skills as markers of job suitability. Not all skills signal applicants' suitability to the same extent. Predictability varies between types of skills, with employers formulating certain minimum standards. Formal and informal skills are often not interchangeable. Cognitive skills are indicated, for example, by good grades in CVs. But they do not fully compensate for a lack of non-cognitive skills and vice versa. But employers tend to reward non-cognitive skills more than cognitive skills (Protsch and Solga 2015).

A further study by Bills and di Stasio (2017) examines the impact of country-specific institutions, as well as the linkage between education and employment, on recruiting behaviour. It looks at the effects of different institutional contexts for the outcomes of recruiting processes and finds that the institutional framework and environment of education exerts an influence. Country variations with regard to the institutionally shaped importance of skills and qualifications are 'likely to affect employers' willingness to rely on educational credentials when hiring' (Bills and Di Stasio 2017: 6). More closely related to the information provided by educational certificates, Andersen and van de Werfhorst (2010) found evidence of variation in recruiting behaviour due to the institutional context. They argue that educational certificates vary in terms of their 'skills transparency' across countries: certificates are more transparent if the 'relationship between (easily observable) formal qualifications and (hard-to-observe) skills is closer'. This is more prevalent in some countries than in others, which could affect employers' utilization of formal and informal skills with a more robust consideration of informal skills, an aspect that is increasingly relevant in digitalized labour markets in particular.

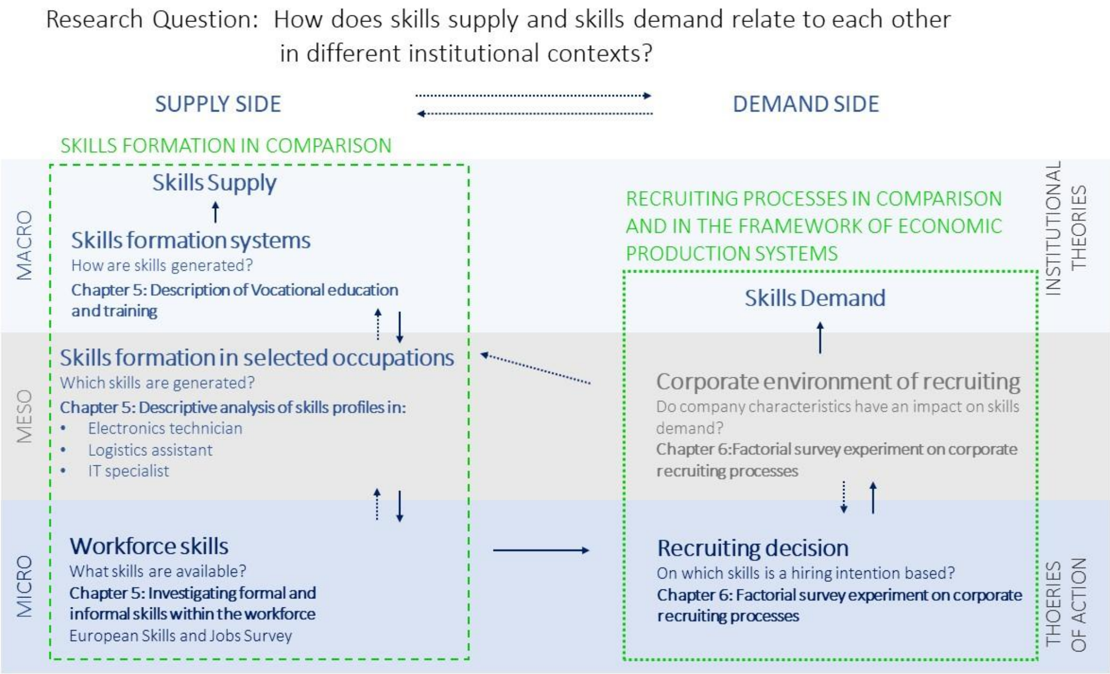
However, the role of *several different* skills and educational signals as a source of cross-national variation in labour market opportunities is, with few exceptions (Di Stasio and van de Werfhorst 2016), not often studied. Because graduates leaving the VET system rely mainly on the knowledge and skills they acquired in formal education, the emphasis on skills in recruiting situations and their relations to institutional conditions remains an important field for further comparative research. Therefore, a better understanding is needed of employers' requirements with regard to formal education (formal skills) and informal skills, equally. This perspective highlights a neglected dimension of employee–job–matching, which focuses – apart from on applicant characteristics – on substantive criteria (Bills, Di Stasio, and Gërxhani 2017; Bills 2003; McGuinness, Pouliakas, and Redmond 2017).

In addition, a richer understanding of employers' preferences in the context of digitalization is needed. To integrate the digital transformation as an important contextual factor in the study of skills supply and skills demand is crucial because of the emerging changes in the workplace and the corporate environment, as many parameters 'that had defined a job in earlier periods [are] dissolving away' (Huws 2015: 8). Digital tools and technologies are shifting priorities with regard to work tasks and the working environment, with effects on job profiles and their requirements. Labour sociological studies reveal that there is no need for a completely new set of skills or new qualifications at work as a consequence of digitalization. But needs with regard to applied skills at work are shifting. Employees now more frequently utilize communication skills, digital skills and problem-solving. This makes digitalization, in connection with skills demand, an exciting field for educational and labour market-related social science research. By comparing Estonia and Germany, this project allows us to compare the conditions prevailing around mismatches, and to assess the impact of the institutional environment of the education system and the labour market. A comparison of Germany and Estonia, which differ significantly in their coupling of education and employment, was chosen because of their major differences at the institutional level (Della Porta 2008). The present text is thus a contribution to the comparative literature, including cases with quite different historical legacies and conditions.

Research design: a comparative, multi-level and experimental approach

As already mentioned, the project attempts to fill a research gap with regard to the comparative dimension and the skills dimension. In order to do so it adopts a multilevel conception, integrating the institutional environment of the matching process into its analysis of recruitment practices. Figure 1 provides an overview of the project's conceptualization. Bills (2003) points out that, even when focusing on the demand side, the conditions under which enterprises operate in the matching process should be examined.

Figure 1: Overview of the multilevel approach



Source: Author's illustration.

The institutional settings of Germany and Estonia are considered at macro-level by studying the countries' national systems of skill formation. The process of candidate evaluation itself is located at the micro level and concentrates on corporate recruiting criteria in terms of several formal and informal skills. The project looks at these two levels in tandem and relates them to one another analytically: the country-specific conditions (macro level) provide a framework of possibilities for the actions of decision-makers at the actor level (micro level). This type of analysis makes it possible to discuss social processes in a micro-founded way. As recruiting processes are defined by their corporate embeddedness, such company characteristics are to be found at the meso level. This offers a 'link by which we can understand how such macroprocesses […] and such meso-level processes as organizational, bureaucratic, and accountability structures […] are enacted at the microfoundational level' (Bills, Di Stasio and Gërxhani 2017: 293).

Digitalization comes into the analysis as a contextual factor and is defined in terms of its socio-technical relations. Digitalization processes are embedded in societal spheres in which a discussion is ongoing about adapting to technology. This perspective differs from techno-determinist views of digitalization. The transformation involving digital technologies includes processes of digitization which achieve a 'conversion of analogue data and processes into a machine-readable format' (OECD 2019: 19). Moreover, digital technologies are considered to have reached a stage of development that represents a qualitative change. This is accompanied by far-reaching socioeconomic processes, which include digitalization, broadly understood. This involves 'digital technologies and data as well as interconnection that results in new or changes to existing activities' (ibid.: 19).

The project conceptualizes digitalization as it is actually found in the corporate environment by reflecting on these interactions and interdependencies in terms of their impact on the skills dimension, both the skills supply and the skills demand side. Speaking of digitalized labour markets, we focus on the use and application of digital technologies in the work context, as it is one of its central fields of application and development. Examining new business activities, we observe that new ‘interactions and interdependencies between technology, humans and the organization as a whole’ (Kopp et al. 2019: 293) are developing (see Chapter 2). Our approach relates digitalization to work methods, tasks and skills in VET and corporate recruiting (Matt, Hess, and Benlian 2015; Weitzel et al. 2020).

Furthermore, the project touches on digitalization at the sectoral level with regard to the occupations studied, based on their relevance to structural change and enhanced digitalization processes. The VET trained occupations of electronics technician, IT specialist, and logistics assistant are the focus of analysis. Looking at economic production and sectoral change, employment over recent years has increased substantially in the service sector and transportation (Eurofound 2017a). While these sectors are predicted to grow even further, the advanced manufacturing sector producing transport or electronics equipment is also perceived as fundamental for the future as it establishes, produces or implements the technical and technological products or techniques required for innovation. While the services transition is usually connected to upgrading in education (Baethge 2011), bottlenecks and employment growth in technical occupations indicate persistent demand for occupational and vocationally achieved qualifications in the middle range. Current bottlenecks exist for professionals, associate professionals and technicians in ICT, engineering, advanced manufacturing, health care and teaching occupations. This underlines the increasing need for high-skilled labour at the academic and intermediate levels and supplies reasons for people’s choice of occupations (Cedefop 2016b; European Union Skills Panorama 2014a).

The project’s methodological strategy includes analyses for each side of the labour market connected to skills shortages or deficiencies. The skills supply side is approached by analysing national skills development strategies (see Chapter 5). The example of VET occupations in electronics, IT and logistics draws a country-based picture of recent skills production and skills shifts in reference to digitalization. The results support the theoretical differentiation of skill regimes as an essential feature of a country’s political economy. With even more focus on the skills dimension, a document analysis of training curricula provides an overview of different skills achievements in Estonia and Germany within the selected occupations. These formally established skill profiles inform us about training content. They are compared with skills profiles and skills utilization among the workforce in electronics, IT and logistics occupations, based on the European Skills and Jobs Survey (ESJS).

Analyses from a demand-side perspective centre around the question of which skills employers require. Because no in-depth and cross-country employer studies on skills are available, a quasi-experimental survey was carried out (factorial survey). It provides unique employer data on recruiting behaviour in the context of digitalization in Estonia and Germany (see Chapter 6). The project follows the theoretical assumptions made by micro-level theories on labour market inequalities (screening theory, closure theory, Imdorf's multiple worlds perspective) and finds evidence that employers rely on several different skills to screen candidates' suitability in labour market entry processes. The factorial survey assesses the relations between these different skills. It allows us to predict which skills are particularly important for employers in electronics, IT and logistics.

Both supply and demand analyses are discussed in substantive terms (see Chapter 7). Based on a comparison between Estonia and Germany, the project investigates why particular skills are taken as indicators of candidate suitability and their relations to the institutional logic of skills supply. Although hiring candidates involves more than just evaluating a set of skills, shedding light on this under-examined facet of applicant assessment contributes to the debate on the causes of skill mismatches under digital transformation.

Besides its scholarly relevance, the project studies the educational processes and employment chances of a vulnerable labour market group. The project results are of societal significance because labour market entrants form a highly sought-after group of employees. At the same time, they are highly exposed to labour market risks. Utilizing the right skills to meet demand in a changing workplace has become crucially important for young employees either for labour market entry or to maintain a professional position (European Commission 2020a). By illustrating the link between corporate recruiting and the ability of young adults to exploit labour market opportunities, the project achieves insights that might provide advice and guidance on school-to-work transitions. Positive recruiting decisions allocate labour market entrants to particular employment positions with opportunities for good socioeconomic development. Beyond joining a company, recruiting processes have an essential societal function. They are seen as a core mechanism of social stratification. For this very reason, the perspective offered by this project is valuable as it allows social roles to be considered with regard to the access to professional jobs they provide, thereby highlighting the disadvantages facing the social group of labour market entrants.[2]

By obtaining insights that might contribute to successful recruitment, this project may have positive effects for recruiters and young people alike. So far, a large body of literature has concentrated on providing information on the negative impacts of unsuccessful recruiting or mismatched situations for young employees. Becoming exposed to labour market dynamics, as recently experienced in the Covid-19 pandemic and in direct competition with older employee groups, their limited work experience makes them vulnerable in terms of their higher risk of unemployment. Moreover, young employees are exposed to global labour developments in direct competition with other employees (sometimes worldwide)

[2] In this project, allocation in the employment system refers only to the initial phase of labour market entry (school-to-work transitions). Any long-term effects of vocational education on employment chances over the life cycle are not accounted for, hence there is evidence that an initially advantageous allocation of vocational education graduates may also undergo adverse effects in due course (see, for example, Rözer and Bol 2019; Hampf and Woessmann 2017; Forster, Bol, and van de Werfhorst 2016).

because their bargaining power has been reduced compared with that of their employee age group in earlier periods (Huws 2015). Being recruited unsuitably at labour market entry might lead to an unemployment situation that leads to further adverse effects in the future, such as poorer opportunities with regard to income, work and life satisfaction or poorer health, which could continue over the course of further stages of employment (Bell and Blanchflower 2011). Positive but mismatched recruiting decisions impact employees in terms of lower wages and job satisfaction than matched employees (McGuinness, Pouliakas, and Redmond 2017). In this respect, good recruiting decisions are essential in connection with social development.

Mismatches are linked to negative effects and limitations also for companies. When employers recruit employees who do not meet the requirements of the job, this has an impact on companies' productivity, innovative capacity and investment capacity. Matching problems may be related to employees' level of skills or educational attainment. However, they may also be a matter of skills shortages or a situation in which skilled workers are not available at all (Cedefop 2015b; Brunello and Wruuck 2019). Especially in STEM occupations (science, technology, engineering and mathematics), where the number of employees is expected to shrink, a skills shortage would result in an aggravated situation on the market (Caprile et al. 2015). Given their far-reaching implications, recruiting processes aren't just an issue for organizations but also of societal interest. Acquiring insights into otherwise hidden strategies thus helps us to reflect on processes of social exclusion and mechanisms of social inequality. Bringing such results to a broader public and making them available for institutions associated with the education system or career guidance contributes to an awareness of how graduates enter the labour market under situations of digital transformation.

Structure

After this Introduction, Chapter 2 – 'Digitalized labour markets' – introduces definitions and conceptions related to digital transformation and its impact on the world of work. To trace workplace changes, task shifts and skills shifts associated with digitalization are crucial in order to understand and empirically assess the notion of changed skills requirements. In Chapter 3 we look at skills supply and skills demand in theoretical terms: recent literature and theories on skill formation are presented in Chapter 3.1, 'The institutional context: The political economy and skill formation'. Chapter 3.2 – 'Recruiting behaviour in theoretical terms' considers the state of the art and micro-level theories on company behaviour and its corporate conditions. This is followed by Chapter 3.3 – 'Thematic integration and hypotheses' in which both perspectives are integrated with aspects of digital transformation and some hypotheses are derived.

The methodological approach is outlined in Chapter 4 – 'Research design'. Here, all the methodological steps used to try to answer the research questions are discussed. This includes the explanation of important decisions, such as why, for example, a multilevel, comparative and quantitative-experimental approach was chosen. The following chapters present the results of the empirical investigation. Chapter

5 – ‘Skills supply: formation of skills’ undertakes a comparative analysis of national skill formation systems in Estonia and Germany, with their differences and similarities, based on three selected professions (document analysis), their level of trained skills and achieved skills (descriptive analysis). Chapter 6 – ‘Skills demand: Recruiting processes’ first of all uses a factorial survey approach to examine skills in relation to each other within processes of candidate selection, followed by multivariate analyses of their relative importance to employers. Chapter 7, the Conclusion, integrates the findings on the supply and demand side and discusses them in relation to the research question.

2. Digitalized labour markets

This chapter serves to situate the topic of skills supply and the skills-based recruiting of labour market entrants in a time of digital transformation. An overview of the character of recent developments in digitalization in the labour market is necessary in order to present digitalization's external impact on the relationship between skills supply and skills demand. The fact that there are skills shortages is a manifestation that this relation is fraught with tension because digitalization challenges, among other things, skill formation processes as a result of recent developments, and affects how enterprises approach recruiting to predict which skills they will need. This chapter highlights the impact of digitalization on both the supply and demand sides in respect of skills shortages. To this end, first, conceptual and definitional approaches to digitalization are presented. They result in a socio-technical viewpoint on digitalization (Chapter 2.1). Because skills mismatches most prominently stress the skills dimension as being unmatched, the chapter has recourse to theoretical apprehensions of workplace tasks in relation to workplace skills. It explicates their association with digital transformation (Chapter 2.2).

2.1 Digital transformation

Digital technologies are impacting the labour market by making changes with regard to workplace procedures, tasks and skills. This raises difficulties for the supply side, for employers, with regard to what is now required in current job positions and with regard to future (possible) developments. A useful initial approach here is, for example, to implement personnel planning schemes, detailed market monitoring and detailed job descriptions for vacancies (Cedefop 2012; Weitzel et al. 2020). However, in digitalized labour markets describing what skills are needed for successful performance is challenging due to future-oriented dynamics.

Technological change as a structural condition of skills shortages

The concept of skills shortages captures such struggles. Skills shortages describe a situation 'whereby employers are unable to fill key vacant posts due to a lack of suitably qualified candidates' (McGuinness, Pouliakas, and Redmond 2017: 8). In other words, companies have a hard time meeting their demand for 'rightly' skilled employees (Eurofound 2015; Eurofound and Cedefop 2020). Skills shortages lead to skills mismatches in recruiting situations, when people are hired even though their skills do not fit the employment position. Such inadequately filled work positions may have severe negative implications: Skills shortages and mismatches may lead to economic inefficiencies with regard to productivity, competitiveness or performance because the available workforce's potential is not utilized optimally.

The definition of skills shortages within the framework of (skill) mismatches is a qualitative one as the 'qualitative characteristics of the supply do not match the qualitative characteristics of demand' (European Parliament 2015: 20). Other forms of qualitative mismatch refer to work experience, gender or age, but for employers, skills shortages are closely related to qualifications and skills. Skills shortages may coexist with other forms of mismatches and imbalances. For example, there may be an excess of specialists in particular sectors or occupations alongside quantitative labour shortages in terms of spatial, regional or temporal availability (ibid.).

Skills shortages can take different forms, such as structural and/or cyclical. Whereas rapid cyclical economic growth is associated with increasing skills shortages compared with economic downturns, technological change gives rise to structural skills shortages. As new technological developments occur, skills shortages arise when supply cannot keep pace with demand for skilled labour, referring to a variety of different skills that aren't immediately available (Quintini 2011). Also, structural changes in terms of sectoral shifts on the demand side and related (occupational) restructurings accompanying technological transformation can lead to an increase in the mismatch of skills possessed and skills required (Robson 2006). Because the framework conditions for the digital transformation may differ from country to country it seems important to look at these changes and the possible effects on matching problems by country comparison.

Measuring skills mismatches is commonly based on direct information obtained through company surveys. The European Company Survey (ECS) achieves comparable results across European countries. But company surveys on skills shortages risk overestimating the situation overall because they are often an expression of a cyclical and thus short-lived phenomenon (Quintini 2011). Nevertheless, the repeated observation of skills shortages over a long period in different waves of the ECS proves that skills shortages are a problematic issue in Europe as a whole, and in Estonia and Germany in particular. Although there is an awareness of such mismatches, engagement needs to be stepped up to counter such developments. Useful measures include monitoring of workforce skills and assessing future skills needs. But the European Continuing Vocational Training Survey found that only 26% of all European enterprises tend to assess their future skills needs (Cedefop 2012). In particular, SMEs are more reluctant than larger-sized establishments to engage in forward-looking personnel and skills planning activities, often because of their limited resources (Jaspers and Westernik 2008; Schröder 2016).

Structural sectoral shifts due to digitalization are evident in particular labour market segments. They have become essential to any understanding of skills shortages. Occupations within the broader STEM field in the EU are more widely affected by skills shortages than other occupations (European Union Skills Panorama 2016). While skilled labour in the STEM field is increasing, it has imposed skills demands on upper-secondary graduates. Science and engineering associate professionals have an increasingly important role in the development of niche technological products (European Union Skills Panorama 2014b). Hence, shortages are particularly pronounced in technical occupations such as engineering or ICT (Caprile et al. 2015). Employees need more expertise in sector-specific technological skills (digital skills, manufacturing methodologies) and generic skills. The latter include analytical and problem-solving skills, the ability to adapt to a new work situation, or a capacity for active learning, listening and comprehension (Eurobarometer 2010). A combination of technical skills meeting professional specifications and generic informal skills is decisive in harnessing technological developments (European Union Skills Panorama 2014b). Skills demand is changing much faster than education patterns and programmes (European Union Skills Panorama 2014a; Cedefop 2016b). Increasing specialization as educational curricula lag behind is problematic and risks serious skills shortages. That is why this project examines skills supply and skills demand within a common framework and relates both sides to digital transformation in the labour market.

Digital transformation and its socio-technical relations

To better understand such phenomena as skills shortages and mismatches, we need to take a closer look at digital transformation and its impact on the labour market. One could argue that developments driven by technological innovations have been a familiar feature of life since time immemorial, so why is such a fuss being made today with regard to digitalization and digital transformation? It is widely argued that current digital technologies are following in the footsteps of previous technological leaps as we develop towards a digital service economy.

In retrospect, certain technologies are paid more attention because – as we can see looking back – they led to massive economic and social upheavals and brought about sudden but sustained human progress. These are inevitably associated with the word 'revolution', such as the Industrial Revolution at the end of the eighteenth century. Driven by improvements in the steam engine, more powerful engines were introduced into factories that 'more than anything else, (…) allowed us to overcome the limitations of muscle power, human and animal, and generate massive amounts of useful energy at will' (Brynjolfsson and McAfee 2014: 6). This enabled the industrialization of production facilities and thus mass production, with a dramatic impact on smaller manufacturing and agricultural businesses, as well as socio-structural upheavals in terms of property ownership (Bauernhansl 2017).

In contrast to the transformations observed from a historical perspective, the influence and diffusion of current digital technology developments are predicted to be ground-breaking. They have sparked a lively social, political and scientific debate. Brynjolfsson and McAfee's (2014) much-quoted work, for example, speaks of a 'second machine age', while in other countries the suffix '4.0', as in 'industry 4.0' or 'work 4.0', refers to the revolutions of industrialization (first), the division of labour in mass production with the help of electrical energy (second) and the automation of production by mechatronic systems with the use of information technologies (third), with the assumption that the current evolving digital technologies are driving the fourth industrial revolution (Bauernhansl 2017). Regardless of the discussion on whether recent developments will be as disruptive as previous industrial revolutions, the nature of current digital technologies and their impact on the world of work are best described alongside their crucial driving factors.

Digital technologies inhabit core computer hardware and software and are able to network. PCs, computer networks and the internet have been part of (business) reality for several decades. In recent years, however, significant progress has been made in increasing their efficiency through processors, improved data storage technologies, and data exchange (Brynjolfsson and McAfee 2014). Digital technology is 'becoming ever smaller and at the same time more efficient, its components ever more cost-effective (...) which makes [it] more and more profitable' (Absenger et al. 2016: 4, author's translation). In addition, significant advances are being made in sensor systems and robotics, which, together with the availability and use of Big Data, are leading to new developments, for example, in the field of so-called 'artificial intelligence' (Mikfeld 2016). These technological achievements are supposedly going to encompass almost all areas of social life and work, and their diverse application potentials will facilitate further innovations (Brynjolfsson and McAfee 2014). This wide variety of options for application is also likely to make a difference to human–machine interactions, which date from the 1990s, for example. Digital technologies, on this understanding, not only transfer information or enable data manipulation, but create a 'living global information and communication environment whose purposes and uses are constantly changing and expanding through active use' (Boes et al. 2014: 9, author's translation). Moreover, innovation cycles have been noticeably reduced and rapidly introduced into workflows, which, in addition to technological progress and potential for development, also harbour risks for parts of the workforce, platform workers, collective representation, and the global division of labour (Mikfeld 2016; Jürgens, Hoffmann, and Schildmann 2017; Carstensen 2016; Aloisi 2019).

In terms of production, global trade and services are accelerating as a result of increased connectivity. The variety of products, and thus markets' complexity and dynamics, are expanding, requiring enterprises to react flexibly (Huws 2015; Absenger et al. 2016). The possibility of networked production has given rise to new options for simultaneous and remote value generation (Weyhofen 2019) and to new business models (Leimeister et al. 2015). However, the new character of digitalization goes beyond the development of product-based innovations or the manufacturing of new products. New business models are centred around utilizing and distributing information as an economic product and business operation with all its corresponding contractual, monetary, material and logistical aspects. This includes business activities within the platform economy that offer transactions involving physical products, services or non-physical products, such as signing up for a streaming subscription or within the sharing economy. Central to these activities is the fact that digitalization acts as a source and enabler of interactions and transactions (Knuth 2021).

To be more specific about what digitalization means, we offer the following definitions. A conceptual understanding of digital transformation includes, first and foremost, digitization. This is the 'conversion of analogue data and processes into a machine-readable format' (OECD 2019: 19). Moreover, digital technologies are believed to have reached a stage at which a new level of quality becomes feasible. They involve digitalization by using 'digital technologies and data as well as interconnections that result in new or changes to existing activities' (ibid.: 19). This includes far-reaching socio-economic processes. Cyber-physical systems (CPS) are an example of this interaction as new products. All CPS have an embedded software component within a physical system and communicate with 'global data networks with distributed and interactive application systems'. More concretely, CPS means 'smart' and 'intelligent' devices, vehicles, and equipment, as well as the logistics, coordination, and management processes that are linked to advanced internet applications (Hirsch-Kreinsen 2016: 2). Smart electric power grids that support the transition to renewable energies or intelligent traffic control systems that help municipalities to manage traffic flows and avoid congestion are examples of CPS. Multifaceted platforms such as Alibaba or Airbnb are further examples that illustrate CPS in particular business models within the platform economy. The term 'digitalization' is also used to stress the interdependencies and comprehensive impact of digital technologies. Digital transformation, at least, is understood here as a process in which digital technologies find application in the framework of digitization and digitalization, with both economic and societal effects.

Such processes of change with reference to digitalization appear within particular societal spheres. Several sociologists therefore have put effort into fathoming the reference points of digitalization in relation to society and discuss whether and how elements of digitalization can be located and addressed as subjects of a broader social theory and in more sophisticated sociological terms. Theoretical efforts, for example, emphasize why digital technologies are assigned a social dimension, how they connect to social action and interaction within social situations (for example, Marres 2017; Knorr Cetina 2009), and how technologies provide social organization through social media networks and platforms (for example, van Dijck, Poell, and Waal 2018). This is what Castells (2004) described as a 'network society'.

Nassehi (2019), for example, argues from a functionalist perspective that technology and society aren't separate spheres but 'techniques and technologies can only be successful if they are sufficiently compatible with the structure of a society' (ibid.: 16, author's translation). Such a socio-technical viewpoint is also taken by endeavours more closely related to the science and technology studies (STS) field of research which tend towards technological determinism, viewing technology as the dominant external factor of change as a result of which rationality, functionality or efficiency prevail. As Wajcman puts it, technology is perceived as a 'socio-technical product, patterned by the conditions of its creation and use' (Wajcman 2002: 351) in their particular social circumstances. The technical dimension of technology is not separate from its social one (Wajcman 2002; 2008; Weyer 2019). Because this project is interested in the transformative potential within human-technology interactions, particularly in the world of work, further considerations reflect on socio-technical products and systems in work settings in more detail.

Digital technologies applied in work settings are distinguished by their transformative power and potential for societal development, growth and wealth (for example, Bimber, Flanagin, and Stohl 2012; Hippel 2005; Boes et al. 2014); by their effects on societal restructuring with the potential to reproduce (global) inequalities, thus creating new digital inequalities (Dörre 2018; van Dijk and Hacker 2003; DiMaggio and Hargittai 2001); or by increasing commodification and dependencies due to digital capitalism (Huws 2015; Staab 2019). The socio-technical relation becomes evident when turning towards informatization, which receives attention from scholars studying the process of information exchange at work and related human social interactions, human-technology interactions, and business relations. With the exchange of information, individually bound knowledge is put into a tangible form that can be transferred using ICTs or their applications within robots. Instead of operating with a linear information layer, exchange provides an open reference structure between information objects, tools and individuals in which information is made usable and develops continuously. It creates a new space in which social action takes place (Dolata and Schrape 2013) and where technologies 'reconfigure relationships between people and the spaces they occupy, altering the basis of social interaction' (Wajcman 2008: 66). This open and recursive information space as a reference system for social action has a reflexive character and inhabits a core social process: examples include the evolution of mobile phones into smartphones as portable mini-computers or the integration of digital co-working tools (for example, Microsoft Teams) into working environments to create new social relationships, activities, and (cultural) practices which require interpretation and participation (Baukrowitzt, Boes, and Schmiede 2000), and coordination (Beane and Orlikowski 2015).

This information space is considered particularly suitable for creating new forms of economic production and activity. Hirsch-Kreinsen's analytical concept of a 'socio-technical system' (2016: 8) captures this outlined interconnectedness and interdependencies of humans and technology. This socio-technological system represents an interaction space especially for operational activities. As digital transformation processes operate within both the organizational and the employee spheres, in this view an interdependency arises between technology, organization and workers. It becomes integrated into a superordinate context of normative, strategic guidelines and value chains (Kopp et al. 2019). As in social science and technology studies, technological innovations here are regarded as neither 'deterministic' nor 'linear' (ibid.: 13) growths out of previous developments and are 'never merely technical: Its real-world functioning has technical, economic, organizational, political and even cultural elements' (Wajcman 2002: 352).

Decisions about which technologies are best implemented in the corporate environment or which should be brought to the market are powerfully shaped by these components. When they interact well, a socio-technical system often prevails (Weyer 2019). Decisions on implementing digital technologies in firms are made, in most cases, on the basis of deliberations on how to counter competitive pressures for personnel and market position in a globally networked, digital capitalism. Within the corporate reality of firms, the technological subsystem provides the essential conditions for the other two subsystems to come into play, namely the form of organization and the workers, 'which in turn have an impact on the functioning of the technological subsystem' because of their 'independent work-psychological, labour market policy. and organizational characteristics' (Kopp et al.: 14). Based on these analytical concepts, the following chapter takes a closer look at the emergence of digital technologies at workplaces and their social and work-related implications for the performance of workplace tasks by the utilization of skills.

2.2 Digitalization, changing tasks and required skills

Under the influence of digital technologies, working conditions and workplace arrangements are changing. The close relationship between tasks and skills is a crucial facet of corporate recruitment and selection processes. The following section lays out how the relations between tasks and skills are seen in the context of digitalization.

The innovations and adaptions of digital technologies contribute to the development of European economies towards a service economy. Tertiarization is characterized by the growing importance of the service sector at the expense of other sectors, mainly the primary sector (Eurofound; Duernecker and Sanchez-Martinez 2021; Eurofound 2018). It includes the evolution of services through digital applications, interfaces and developments in the underlying hardware, for example, in terms of online purchases, cashless and contactless payment, or strongly enhanced communications through messaging and mailing. This makes digital innovations and technical advances key drivers of this economic shift. Skilled labour in technically oriented occupations shapes this economic shift by pushing forward and implementing such innovations (European Union Skills Panorama 2014b; Eurofound 2020a).

This structural shift reflects an increasing service orientation in many other occupations. Working methods are observed to change not only within service sector occupations in a narrow sense. This pattern is also prevalent in more technically oriented STEM occupations or in manufacturing, in which core tasks closely involve use of technology, technical applications, or (technical or IT related) engineering. Such changes are manifested in employees' workplace reality, workplace arrangements, task structures and skills (Cedefop 2016a; European Union Skills Panorama 2020). This is why this project is particularly interested in the interplay of work activities and demand at the organizational level. Whereas in the current debate about the effects of digital transformation, the technical feasibility of full automation and the substitution of employees take a back seat, the challenge of actively shaping digital transformation takes centre stage. This includes observations on employees' working reality, their integration into new working conditions, as well as challenges at the organizational level (Hirsch-Kreinsen 2018; Pfeiffer 2019; Nies, Ritter, and Pfeiffer 2021). It affects current employees in their immediate work capacity, but also structures employment opportunities for future workers.

To present the conditions of supply and demand in digitalized settings, first I provide an overview of changes in the workplace, tasks and skills structures of employees and secondly of the skills required by employers.

Workplace

Enterprises are becoming increasingly digitalized. Within the EU, around 40% of enterprises (the same in Germany and Estonia, 2020) have integrated various digital technologies, which for employees means that new processes and technologies enter their work routines. Differentiating by company size we see that large companies take the lead, whereas most SMEs do not yet apply such technologies (European Commission 2020b). More than a quarter of EU enterprises are highly digitalized, which means that computer use, customized software applications, robot integration, and data analytics are widely used as part of a daily working routine or are likely to be introduced. High computer use but limited use of other digital technology is a pattern discerned more often in German enterprises than in Estonia. In contrast, a larger number of Estonian enterprises seem to be working extensively with robots and other digital technology than is the case in Germany. Robots and other forms of technology are particularly present in logistics and industrial companies (Eurofound and Cedefop 2020).

For companies, it can be observed that a high degree of digitalization increases economic performance and efficiency. On the employee side, however, this is often offset by health risks. For example, employees report increased demands on communication, increased volume of communication and work intensification when digital communication technologies are used (Eurofound and Cedefop 2020). Employees also often feel the pressure of permanent availability, which can make it more difficult for them to switch off after working hours, especially when working from home (Pfeiffer 2012). However, the full picture also shows that digital communication technologies enable people to work independently of time and place, thus reducing the need for long commutes and improving the work–life balance (Huws 2014).

Another aspect of general workplace change is the increased complexity of work as a result of digitalization. This complexity arises because employees apply new or more elaborate working methods, using computers, smartphones and other ICT devices, as well as apps or software. For employees, increased work complexity may increase task variation, including the application of creative new ways of thinking, solving unforeseen problems, and collaborating (Eurofound 2017b). Such new working situations often require employees to find (new) solutions on their own, and thus to learn new things. However, this may have adverse effects especially on older employees to the extent that they 'might not benefit from their experience anymore, but instead suffer because of their slightly poorer learning abilities and unfounded stereotypes' (Hildebrandt, Kluge, and Ziefle 2019: 160). In other words, they might be accused of being uninterested in training or of being at a higher health risk.

The diffusion of digital technologies within the framework of service transition processes considerably impacts employees' working situations. This process may dissolve or create new job contents, job roles, and responsibilities, and affect employees' work tasks in general.

Tasks

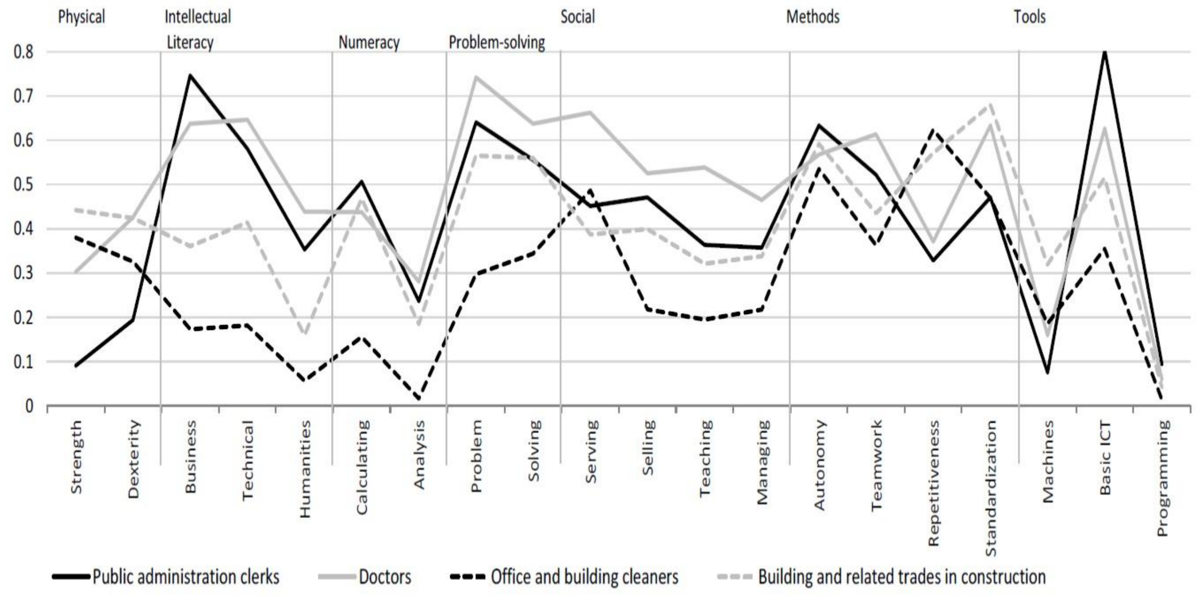
In line with the outlined shift towards a service economy, service tasks generally become more pronounced. Workplace changes in this context may include task shifts in terms of intensified and diversified communication via a range of digital platforms, interfaces and devices; increased consultancy services for customers with regard to products, systems or installations, which also includes responding to specific service requests from customers (Eurofound 2017b; Baethge 2011; Nies, Ritter, and Pfeiffer 2021; Eurofound 2020c). Most notably, tasks related to processing verbal business information, such as writing letters or financial statements, and commercial activities related to selling and advertising or 'persuasion' expand. Beyond that, social tasks such as serving, attending and collaborating are particularly important in the digital work context. This encompasses communication tasks but also the requirements entailed by autonomous organization of the workplace, given the new flexibility and options available. Moreover, digitalization affects the task structure as IT-related tasks increase at the expense of tasks involving machines (Eurofound 2018).

Tasks crucial to successful performance are likely to be transformed. As there is outlined, digital transformation changes task structures. It requires employees to be proficient in multiple tasks. Fernández-Macías, Hurley and Bisello (2018) offer an conceptualisation of tasks that concretizes their variety in the workplace (Eurofound 2018). With the occupational level as central unit of analysis, tasks are studied as analytical tools. They are divided into two main sections. The first section comprises the content of tasks themselves, whether (i) physical, (ii) intellectual, or (iii) social. The second section defines (iv) the methods and (v) the tools necessary for performing tasks.

While the set of (i) physical tasks encompasses activities that require workers to exert energy (subcategory 'strength') or more refined physical skills and coordination (subcategory 'dexterity'), the analytical dimension of (ii) intellectual tasks encompasses activities of information processing and problem-solving. Both subgroups may be further specified with regard to verbal or numeral information processing (literacy, numeracy) and information-gathering, evaluation and creativity. Based on the experience of recent decades, with the diffusion of digital technologies, intellectual and social tasks are anticipated to expand, to a certain extent, while physical tasks are reduced (Eurofound 2016). The classification of tasks as (iii) social frames them in terms of social interactions with others, which covers a broad field beyond the traditional perception of social services. Their subcategories identify various activities derived from occupational profiles: serving/attending, teaching/training/coaching, selling/influencing, and managing/coordinating. The last two task categories – methods and tools – refer to how the work is organized, and what technologies are used, and how to perform tasks rather than to specify task content. In this respect we may differentiate with regard to (iv) methods between autonomy, teamwork, and routine, and among (v) tools between the application of machines or ICT (Bisello 2018).

An exemplary illustration on how different tasks score and result in varying task profiles by occupation is given in Figure 2.

Figure 2: Task profiles of four selected occupational groups (EU15)



Source: EU-LFS data (2014) weighted; Bisello 2018.

Occupations in construction and related trades involve a high proportion of physical tasks that require muscle power and energy. In contrast, doctors perform physical tasks with refined skills and coordination, mainly using their hands. Extreme disparities are visible among the four selected occupational groups in terms of intellectual tasks. Public administration clerks and doctors include a high level of literacy and problem-solving tasks. Meanwhile, there are strong requirements with regard to gathering and evaluating complex information and finding creative resolutions in construction and related trades. In terms of working methods, teamwork is quite common among doctors, but also considerable standardization of procedures – the same seems to be the case in construction and related trades. Basic IT is in use in all occupational groups, with diminishing use of other kinds of machinery. The distribution of high scores in the selected professions with regard to tasks such as problem-solving, basic IT use, autonomy and standardization, as well as (to some extent) literacy, is fairly consistent with the average of all professions in the EU (Eurofound 2016). Although employees are required to perform multiple tasks, their degree varies. This provides insights into the respective main focuses.

This illustration of different task profiles points towards significant variations among occupational groups, as well as considerable similarities. The observation of similar task profiles indicates that the traditional association of specific tasks with certain income or skilled groups may be misplaced. Public administration clerks and office and building cleaners, for example, show equally high levels of social tasks when it comes to providing services to customers or clients. Furthermore, employees in construction are not that dissimilar in this respect (see Figure 2). Physical tasks are commonly associated with lower-skilled jobs, but also doctors perform a considerable amount of physical tasks alongside their higher skills. It is therefore useful to identify work tasks in more detail and to find out to what extent some work tasks are interrelated or depend on each other. By such an approach, a broader understanding of the variety of work tasks in an occupation is achieved (Eurofound 2016). This outlined perspective on the variety of tasks and task profiles that captures (occupational) variation thus similarities stems out of a critical reflection on theories that describe changing task demands as a result of technological change with a focus on its propensity to substitute or complement single tasks. This is on one hand the Skill Biased Technological Change (SBTC) hypothesis and on the other hand the Routine Biased Technological Change (RBTC) approach which are briefly paraphrased below.

The Skill Biased Technological Change hypothesis (SBTC) considers job tasks on the basis of a discussion of increasing wage inequality under the influence of technological change in developed economies. One of the earlier explanations of observed changes attributed to technological change was largely rooted in the assumption that change is skill-biased because technological change increases the relative productivity of highly skilled workers at the expense of low-skilled workers. The demand for highly skilled labour thus increases, leading to a linear improvement in the employment and wage structure (upskilling) (Katz and Murphy 1992). It is important to point out in this respect, however, that viewing skilled labour as existing on a continuum (even between groups) of high versus low skills may be 'extremely simple' in the sense of simplistic (Eurofound 2016: 28).

Further reference to the SBTC hypothesis is made by Acemoglu and Autor (2011). They point out, critically, that it is 'insufficiently nuanced to account for the rich relationships among skills, tasks and technologies' (ibid.: 3), in particular, because it underspecifies the task dimension and assumes that technological change is inherently skill-biased. Following Autor, Levy and Murnane (2003), the two authors reformulate the skill-biased hypothesis and propose a closer relationship between tasks and skills, within the framework of which '*task* is a unit of work activity that produces output (goods and services) [and] a skill is a worker's endowment of capabilities for performing various tasks' (Acemoglu and Autor 2010: 2). Their theory of Routine Biased Technological Change (RBTC) notes that technological change may have a range of effects on different job types, not always just a skill-biased one. In terms of increased computerization, they identify tasks that are 'procedural, rule-based activities to which computers are currently well-suited' (ibid.: 22). On their assumption, these routine tasks are easy to codify and automate and may be executed more or less by machines, whereas non-routine tasks may not. They claim that routine tasks are more prevalent in middle-skilled and middle-paid professions. Hence, this differentiation on the routine versus non-routine continuum of tasks and the possibility of replacing routine tasks leads them to assume that employment growth will take place mainly at the bottom and at the top (job polarization) (ibid.).

Both the SBTC and the RBTC models take the demand perspective with regard to technology. Technological change alters the demand for specific types of labour and the corresponding tasks and, in consequence, is closely related to unequal wage development. However, the RBTC theory emphasizes that understanding the task content of professions is crucial when assessing the impact of technological change, as technology-induced effects on potential substitution or complementarity are observed only for specific tasks in certain occupations. The approach has since become known as the task-based approach (TBA) (Autor, Levy, and Murnane 2003; Acemoglu and Autor 2010).

The task-based approach, developed by Autor, Levy and Murnane (2003), is the basis for the RBTC and lays down a conceptual theory of tasks that aims to capture the influence and effects of technology at the workplace. They add another layer besides the two task categories of routine and non-routine. They differentiate between cognitive tasks, in the sense of information processing, and manual tasks. This results in five different task categories. The first two are (i) routine-manual tasks (for example, picking or sorting), and (ii) routine-cognitive tasks (such as repetitive customer service). Both of these types are assumed to be replaceable. Apart from the substitution of technologies for repetitive manual activities, computers 'perform symbolic processing (storing, retrieving, and acting upon information) [and] they augment or supplant human cognition in a large set of information-processing tasks' (Autor, Levy, and Murnane 2003: 1284). This represents a novelty as regards the possibility of replacement. The third task category (iii) non-routine-manual (for example, truck driving), is argued to present only limited opportunities for substitution or complementarity. By contrast, Autor, Levy and Murnane examine only the limited capabilities of computers to substitute cognitive tasks (for example, managing, persuading and solving novel problems). They split this task category of non-routine-cognitive tasks into (iv) non-routine-analytic and (v) non-routine-interactive (ibid.).

The main challenge of the task-based approach is to proceed from theoretical outline to empirical investigation (Sebastian and Biagi 2018). Although this theoretical conception of tasks within particular jobs has been applied empirically (by Autor, Levy and Murnane) and has led to a growing literature, some criticisms have been raised concerning its validity as a 'conceptual basis for measuring tasks' (Matthes et al. 2014: 2). Apart from concrete operationalization of tasks, the expert database that is used is considered to be subject to limitations in the sense that the task descriptions obtained with expert assistance remain at the occupational level, which implies a homogeneity with regard to the respective occupations and workplace realities. It thus lacks transferability over time and with regard to other country contexts. Alternatively, individual accounts of various tasks under the aegis of the task-based approach, as performed in different occupations, have been collected via population surveys (Christoph, Matthes, and Ebner 2020). Since the hypothesis of Routine Biased Technological Change is largely constrained by its varying operationalizations in terms of tasks, researchers are working on developing their conceptualization of job tasks (see, for example, Rohrbach-Schmidt and Tiemann 2013; Sebastian and Biagi 2018).

In addition, there have been criticisms of the task-based approach and its further applications with regard to the boundaries of task categories. The imprecision of assignments to task categories and whether they also involve other critical content-related dimensions, such as workers' individual workplace experience, remains considerable. It may cause 'circular reasoning', as Pfeiffer and Suphan find (2018: 211). Another shortcoming is the basic understanding of tasks. The task-based approach does not necessarily refer to forms of cooperation and agency when work tasks are carried out because it is based on a technically focused view of how work tasks are carried out (Eurofound 2016: 30), in which input (labour, capital, or other inputs) is transformed into output. In this framework, the task-based approach regards the input from human workers (labour) or machines (capital) as dependent 'in a rich but intuitive manner on cost and comparative advantage' (Acemoglu and Autor 2010: 4).

This economic view of the use and diffusion of technology clearly contrasts with the abovementioned sociological point of view, which considers applications of technology within an interdependent interaction space (humans, technology, organization) embodied in normative and societal conditions. This is why a multi-dimensional understanding of task profiles with regard to their content and methods seems a fruitful alternative. It captures the variety and concurrency of different tasks based on employees' working reality (Bisello 2018; Eurofound 2018). With these task categories and task changes in mind (physical, intellectual and social tasks, and task methods and tools), we next consider what is needed to carry out such tasks.

Skills

Changes in the composition of task structures and workplace organization are not without impact on the required workforce skill profiles (Gekara and Thanh Nguyen 2018; Eurofound 2018). Tasks are characterized as strongly related to workplaces within particular occupations. Tasks are a matter of what is to be done, whereas skills are acquired by a particular individual. Skills can be described as abilities to function and to develop oneself. In the work context, they enable people to perform different tasks. Because skills can be shaped and changed with socialization and through instruction, a central arena for the acquisition of skills is education. Skill development in the early years of schooling makes investment in it particularly rewarding. But family background and the social environment also play influential roles in shaping skills (Heckman and Kautz 2013).

Tasks and skills are closely related. Skills are, on one hand, required in order to perform tasks, but they also enable people to work and to improve or develop skills *while* performing those tasks (Matthes et al. 2014). However, there is no necessity for them to be matched: 'A job's task profile and its incumbent's skills may coincide, but the incumbent may also lack at least some of the skills necessary to perform the required tasks; likewise, he or she may have skills that are not necessary to perform job tasks' (ibid.: 5). The existence of a considerable divergence between tasks and skills suggests unfavourable or erroneous application and utilization of skills. As already argued, patterns of such mismatches, such as overskilling or underskilling of employees, may have problematic consequences (McGuinness, Pouliakas, and Redmond 2017). Undoubtedly, of course, a person may possess multiple skills at different levels and choose which skills to allocate to specific tasks (Acemoglu and Autor 2010).

Precisely because the digital transformation is bringing about so many changes, it seems interesting to take a more comprehensive look at the skills needed to manage the transformation. Digital transformation accentuates the processes of informal learning and the application of informal skills. It was argued above that digitalization introduces more unpredictability, flexibility requirements and insecurities to the workplace when corporate restructuring takes place or new technologies are brought in. It leaves employees to some extent trying to figure out how to cope with their new work demands (Huws 2015; Kraft 2002; Pfeiffer 2018). Because the relevant skills are gained mainly through workplace practice and experience, the corporate workplace as an environment for learning, for example, in the context of vocational education or continued education, is receiving more and more attention. Besides support for learning provided by the employer, the workplace is coming to be perceived as a place of learning. While in tailored work processes, working and learning are separated in principle, digitalized work processes and environments integrate the two. This encompasses, on one hand, how something is learned at the workplace (structures, methods), and on the other, what is learned (content and target) (Böhle and Sauer 2019; Meyer 2019; Dehnbostel 2021).

To cope with the demands of digital transformation, employees make greater use of their informal skills and combine them with their professionally acquired formal skills in a particular work situation. Therefore, several studies have concluded that transversal informal skills are valuable assets in managing transformation processes. They have become crucial prerequisites for maintaining one's own capacity to work and hence stable productivity, and as such are well rewarded by employers (Nies, Ritter, and Pfeiffer 2021; Huchler 2017; Pfeiffer 2018).

By looking in more detail at the variety of informal skills applied in digital contexts, Pfeiffer (2018) rules out that employees need to truly understand, apply and monitor the results of (technical, social or technology related) processes at the workplace. This is not a one-off task but includes tracing and processing different kinds of – developing – information. Employees gain process and overview knowledge, exchange information, and develop analytical skills (Gekara and Thanh Nguyen 2018; Mayer and Solga 2008; Nies, Ritter, and Pfeiffer 2021). Because cross-departmental and interdisciplinary collaboration and cooperation often take place in mixed teams, teamwork is increasingly needed and a prevalent part of daily work routines in many cases. Moreover, teamwork enables employees to self-organize, opening up possibilities for creativity (Gallie et al. 2012). The requirements for teamwork thus correspond to the tasks of autonomous workplace organization, as reported by employees.

Beyond processual workplace requirements, developments towards a rising number of service tasks require employees to utilize informal skills, ranging from communication to self-management, cooperativeness and empathy (Schludi 2018; Carstensen 2015). In this context, problem-solving skills are receiving greater attention (Gale, Wojan, and Olmsted 2002; Hirsch-Kreinsen 2014).

Moreover, enhanced tools and technologies for communication go hand in hand with a general increase in basic IT applications throughout almost all occupations and job hierarchies. This makes ICT skills an increasing transversal requirement at workplaces (Eurofound 2017b). The term 'ICT skills' refers to an understanding of how digital technologies can support communication, creativity and innovations. It is often used interchangeably with 'digital skills' (for example, Cedefop 2021). The term 'digital skills' is in widespread use, although definitional clarity is hard to come by (for example, European Commission 2019).

ICT skills are understood here as skills that 'include the ability to use, access, filter, evaluate, create, program and share digital content (…) but also to be able to manage and protect information, content, data, and digital identities, as well as recognize and effectively engage with software, devices, artificial intelligence or robots' (European Union 2019: 10). This definition includes aspects of digital literacy and communication, as well as active participation in terms of understanding, creating, and programming content, consideration of safety aspects, and interaction in digital environments. This points towards a comprehensive knowledge of ICT which integrates computational literacy, as well as competence in information usage as regards media and the internet. Deep ICT skills are required in occupations that integrate new IT, such as new software, or that perform data management and analysis. This strengthens the importance of digital and data-related skills (Hildebrandt, Kluge, and Ziefle 2019), as well as an understanding of abstract technical systems in the workplace (Böhle and Sauer 2019).

In theoretical terms, Becker (1964), prominently, defined a range of different skill types. In economic terms, an individual's human capital is a 'stock of knowledge and skills which enter individuals' (and firms') production function directly' (Humburg and van der Velden 2015: 25). Becker proposed a differentiation between general and specific skills. Specific skills are acquired in the course of training, either in education or in the workplace. Both schools and firms operate as training institutions and integrate 'complementary elements' (ibid. 30), depending on the amount of formalized knowledge required. For example, new specialized skills are usually first acquired in the course of training in the context of work because firms tend to recognize and value such skills as a result of experience and practical observation. As skills increase in importance and demand, however, these skills receive greater formalization and are acquired in training provided by educational institutions. Both skill types share the fact that they are productivity-enhancing and based on investment. When it comes to the advantages gained by different actors, while '[g]eneral training is useful in many firms besides those providing it' (Becker 1964: 11), there is no incentive for a particular company to invest in it because it is mainly the employee who is expected to obtain its returns. On the other hand, specific training that provides specific skills 'increases productivity more in firms providing it' than in other firms. Such specific investments are worth a company investing because it will capture at least some of its returns (for a detailed view on skill formation in accordance with economic logic and structures, see Chapter 3.1). The key distinction with regard to skill types is thus their degree of transferability, which expresses a form of demand in the labour market. Becker takes a theoretical and economic approach because he is concerned with the efficient allocation of training costs and their returns. The bottom line is that skills are general in that they are portable and can be used productively in more than one workplace, while specific skills are not portable.

This idea of skill portability was further elaborated by Hall and Soskice (2001), who distinguished between '*specific* and *co-specific* assets', on one hand, and '*switchable* assets' on the other (17, emphasis in original), linking the preference for one or the other to different types of capitalism. Going beyond the duality of skill types and in the tradition of the demand perspective, Estevez-Abe, Iversen, and Soskice (2001) state that 'in a modern economy, skills are essential for firms to compete in international markets, and depending on the particular product market strategy of firms, they rely on a workforce with a certain combination of firm-specific, industry-specific, and general skills' (2001: 181). Similarly, Iversen and Soskice (2001) address the portability of skills but beyond Becker's conception of general skills as economically portable and specific skills as not portable. They add a distinction related to skill content and level. In this framing, work skills are either of a general kind in the sense of being economically portable, broad and at a high (academic) level, or of a specific kind, being specialized, narrow and at a low (non-academic, occupational) level.

Wolfgang Streeck takes a very critical view of this latter assumption, under which the portability of skills 'resides not in their market situation but in their intrinsic nature as "assets"' (2011: 16) (asset theory). The indicators of portability, content and level, in his opinion, lead to 'three allegedly congruent bipolar distinctions folded into one bipolar mega-distinction between two types of preference-producing work skills' (ibid.: 16). In particular, he emphasizes that general skills needn't necessarily always be at a high level. For example, workers who possess primarily unspecific in the sense of non-particular skills – segmentation theory refers to them as '*Jedermannsqualifikationen'* ('anyone's skills', Sengenberger 1987: 120, author's translation), which are easy to replace and therefore located in the external and secondary labour market segment (see Chapter 3.2) – and who thus lack educational credentials wouldn't fit in the classification of general high academic skills but rather in the category of broad and portable skills. Furthermore, Streeck states that specific skills needn't necessarily be low level and occupational. He cites the example of a highly skilled expert who holds particular expert knowledge in 'early Byzantine military history' (ibid.: 17). Conversely, he argues also that specific skills can have at their disposal a particular broad and commonly shared skill base, as in the case of occupational skills in related occupations, and furthermore that specific skills can be portable. What makes such specific, in the sense of occupational, skills portable is, as Streeck finds, the institutional condition of skill formation and the trust, value and acceptance it receives from both students who acquire those skills and employers that demand them. In the German apprenticeship system, occupational skills are highly standardized, training at the workplace is quality tested, and examinations are conducted by a tripartite public board, which confers high credibility on them. In addition, 'a skilled worker certificate indicates that (…) a worker has acquired the *tacit* skills that come with actual work experience' and the '*extra functional* skills needed for applying himself to a difficult task over an extended time, as finishing an apprenticeship'. Both are 'exceedingly portable' (ibid.: 24).

Based on his criticism of skill bipolarity, Streeck opts for multi-dimensionality. He rules out eight possible skill combinations with regard to the characterization of skills (Table 1). High (academic, professional) skills, as well as low (non-academic, occupational) skills, can both be broad or specific in substantive terms, as well as portable or not portable in the economic dimension. An office cleaner, as shown in Table 1, predominantly possesses skills of a broad, portable and non-academic kind. In contrast, a brain surgeon also has broad skills that are economically portable to more than one employer, but are relatively narrow and professional. This outline of skill types opens up greater possibilities for thinking about and capturing the 'intrinsic nature of such skills: whether they are academic or not, explicit or tacit, or functional or extrafunctional' (ibid.: 9).

Table 1: General versus specific: substantive versus economic skills

		Economic definition	
		General = portable	Specific = not portable
Substantive definition	General=broad	Mathematics *Office cleaning*	Astrophysics *Car assembly (Japan)*
	Specific=narrow	Brain surgery *Central defense*	Byzantine history *Car assembly (U.S.)*

High (academic, professional)

Low (non-academic, occupational)

Source: Streeck 2011.

With the claim that specific in the sense of specialized and occupational skills can be transferable, Streeck provides a theoretical argument backed by empirical evidence regarding workplace requirements and working conditions. Dörfler and van de Werfhorst (2009), for example, find that 'tacit (knowledge) or experiential knowledge acquired in a given workplace may be valuable in other workplaces as well, and the same holds for extra-functional skills such as "good work habits" and the ability to show up on time, cooperate with others, work under stress and the like – which are important work skills that are best learned at work' (ibid.: 9). The workplace becomes a central arena for specialized skill formation where it genuinely provides occupational skills, but also portable skills. This makes it a theoretical concept that is highly relevant when studying VET students' skill profiles and employers' recruitment processes in terms of skills.

Streeck's conception of skill types provides a good basis on which to further depart. It lays the foundation for the kinds of skills employers may seek to apply in digital work settings. Because informal skills are portable in both substantive dimensions, broad and narrow, they are regarded as essential. Moreover, they are critical working skills valued by employers, in high-level professions in the service sector and in occupations in production alike (Nies, Ritter, and Pfeiffer 2021). Therefore, Streeck's conception of skill types (Table 1) allows us to add informal skills to both skill levels, high-academic and low-occupational, as well as to the main differentiation between broad and narrow. This project allocates informal skills to the portable, economic segment and finds, in short, that informal skills are transferable, rewarded by employers, and multi-dimensional in nature. However, the theoretical outline leaves open a more explicit specification with regard to the variety or concrete types of informal skills.

Several conceptual attempts therefore capture a set of informal skills regarded as necessary for the (digital) work context. A relatively broad EU policy definition subsumes under informal skills the 'ability to identify one's capacities, (…) deal with complexity, critically reflect, make decisions, (…) learn and work collaboratively and autonomously, (…) seek support when appropriate and effectively manage (…) social interactions' (European Union 2019: 11). This broad conception comes close to Streeck's approach, when he speaks of tacit skills and extra-functional skills that accompany general and specific skills. Such skills indicate personal capacities such as endurance or persistence or the ability to learn, or reflect skills acquired through work experience or experiential learning.

The notion of informal skills alongside formal skills can also be found in Cedefop's conception, although without reference to theory. They differentiate between fundamental skills (literacy, numeracy, ICT and language skills), transversal skills, and technical skills. In this terminology, transversal skills include communication, teamwork, customer handling, problem-solving, learning, planning and organizational skills. Also, the OECD distinguishes between key fundamental skills, such as literacy, numeracy and problem-solving in technology-rich environments and focuses on learning, keeping up to date with developments, and performing in collaboration with others. In the new PIAAC, the OECD integrates informal skills which are required for success in the labour market. The conception distinguishes such informal skills into interactive and social skills, physical skills, learning, and socio-emotional skills (OECD 2021b). These conceptualizations emphasize that there is a shared understanding of the wider concept of informal skills, if not in detail, and distinctions between particular informal skills. The separation between formal and informal skill types seems reasonable. It is part and parcel of the process of learning. While formal skills such as literacy, numeracy or language skills are commonly developed through guided formal learning processes, with fixed learning content, informal skills are characterized by informal, meaning experiential, self-instructed learning and the application of tacit knowledge. They are guided by processes of observing, participating, trying out and imitating what has been observed. Because informal skill application is based on previous (own or observed) experiences, which are structured subjectively and contextually, they neither expire nor become invalid nor obsolete quickly. A further advantage of informal skills is that they are primarily rooted in oneself. With that knowledge, the validation of informal learning and informal skills is an additional aspect that makes such achievements available for external observation and recognition (Böhle and Sauer 2019; Baethge 2011; Pfeiffer 2012).

As shown, under the outlined conditions of digitalization, employees tend to make use of informal skills in their work. There is widespread agreement that in the course of digitalization, the workplace constitutes an important learning arena for informal skills and requires a supportive corporate environment (Dehnbostel 2021). How demand patterns accompany such an application of skills in digitalized environments in terms of requirements as regards specific occupational formal skills, educational preconditions, or qualification requirements is the subject of ongoing and controversial debate. However, there is considerable empirical evidence that describes large-scale trends. The ongoing discussion revolves around the question of whether it is possible, through or in connection with digital technologies at work, to find patterns of general re-, up- or downskilling of employees (for an overview see: Hirsch-Kreinsen 2020) or to find indications of obsolete skills derived from projections of potential for automation and rationalization based on automatable tasks (for example, Dengler and Matthes 2018).

In a recent study, Baethge-Kinsky (2020a) investigated, in case studies, job task profiles and skill requirements, juxtaposing various informal skills with formal skills. He analysed the skills composition required to perform job tasks and found indications of gradual rather than disruptive change. Digitalization does not lead to entirely new informal skills 'but … accentuates them more strongly than in the past' (2020: 8). Especially communication and cooperation skills, abstraction capabilities, and problem-solving skills come to the fore, while specialized occupational knowledge and traditional skills 'have not become superfluous' (2020:7). Also, knowledge gained within education and training 'does not become less important, but rather remains an important basis of successful work' (2020: 7).

Similarly, but with a stronger focus on education levels, Pfeiffer et al. (2017) showed that employees with vocational training are more likely than unskilled and semi-skilled employees to draw a line between different skill dimensions, set goals for the application of skills and take their requirements into account (Pfeiffer et al. 2017). This allows us to emphasize the role of educational background in processes of skill application and within the context of digitalization. (Vocational) education is 'not only important in terms of professional requirements, but also for coping with informal demands' (Nies, Ritter, and Pfeiffer 2021: 3, author's translation). In terms of certified education, it is further observed that informal skills receive greater attention and also qualifications when, for example, in the context of vocational education and training, enterprises, as well as vocational training schemes promote them actively in workplace settings and the educational context (Helmrich, Hummel, and Neuber-Pohl 2015; Coles and Wequin 2009; Janssen et al. 2018; European Union Skills Panorama 2016).

Besides employees, companies are 'more than ever reliant on employees contributing their skills – mostly acquired informally and in a self-organized fashion – to organizational development and innovative work design' (Meyer, 2019: 11, author's translation). Although there are no indications of rapid or disruptive change in skills application and outdated knowledge (Eurofound and Cedefop 2020; Baethge-Kinsky 2020a; Knuth 2021), the accentuation of skill application seems to have shifted slightly. Increasingly, mobilizing employees' informal skills, in addition to professional or occupational skills, contributes to employers' ability to reduce the uncertainty that comes with digital transformation (Baukrowitzt, Boes, and Schmiede 2000). Whether the multiple dimensionality of skills and the increasing importance of informal skills in digital environments is observed equally in recruiting processes is a central matter of interest in this project. The following section, therefore, provides further theoretical arguments in relation to recruiting processes in the context of digitalization and skill formation processes.

3. Theoretical framework

3.1 The institutional context: political economy and skill formation

After discussing relevant developments in relation to the digital transformation, this chapter is dedicated to describing the relationship between skills supply and skills demand. To start with, this chapter concentrates on the skill supply side. It presents, first of all, empirical evidence on processes of skill formation and, second, theoretical assumptions with regard to country-specific skills systems. Continuing from what has been shown about the relationship between tasks and skills in digital transformation (Chapter 2), this chapter takes a more theoretical approach to skills.

It notes first that skills perform different functions in different economic production systems. The concept of the Varieties of Capitalism (VoC) offers a framework suited to a comparative perspective on the relevance of skills and skills recognition. The chapter thus contributes to the research question by laying out theoretical ideas on skill formation systems. It underlines the importance of considering the institutional conditions framing skill supply and demand. By looking at skill strategies from a comparative perspective, insights are gained into how countries behave within their institutional context and how they can respond to changing skill requirements in relation to digitalization. These theoretical considerations enable us to examine whether some institutional preconditions of skill supply are more supportive than others in dealing with structural digital transformation processes.

3.1.1 State of the art: skill formation systems and graduate skills

The relevance of skills to the economy has been explained by a variety of theoretical approaches (see Chapter 2.2). In this perspective, the production of skills is strongly relevant to economic production and the institutional context in which skills are acquired through training and recognized. In particular, Hall and Soskice (2001) refer to capitalist production when they relate their dual typology of specific/co-specific skills and portable 'switchable' skills to their dual differentiation of capitalist production in the form of a coordinated market economy (CME) or a liberal market economy (LME). In this way, they relate the skills dimension to a predominant and preferred skill pattern in one or the other capitalist system. A post-dualist typology of skills was established by Iversen and Soskice (2001) with a differentiation between firm-specific, industry-specific, and general skills. Chapter 2.2 finds reasonable grounds to rely on Streeck's further theoretical development (2011). This is because Streeck not only considers the economic portability of skills between firms, but also integrates the type (general or specific skills), level (academic or occupational skills), and multidimensionality of skills with regard to situations in which they might be portable (portable or non-portable skills). Beyond their portability in economic terms, skills might therefore also be portable as a personal asset.

With this theoretical conception, Streeck (2011) has provided a profound framework for use with different skill types. He makes it clear that certain skills are transferable across companies or across an economic sector, but that this is not the case for others. This mechanism is common in the labour market, so that there is a structuring principle in the way employers now evaluate, use and (economically) recognize employees' skills. This strand of literature also deals with reorganizations of economic production and the challenge of responding to technological change, with its possible effects on skills. As seen in Chapter 2.2., the multi-dimensionality of skills is essential to understanding the process of digitalization.

We shall now look more closely at the institutional foundations of the different skills and skill systems. The varieties of capitalism approach is a useful basic theoretical outline in that it detects differences and similarities across countries. It is an explanatory framework for the institutional setting of national political-economic systems that are associated with other social and political conditions and outcomes. Understanding different outcomes in terms of skills production with reference to the importance of institutions in economic production is therefore interesting.

Skills production systems in Estonia and Germany differ in terms of the Varieties of Capitalism (VoC) approach. The two countries have different coordination mechanisms in their institutionalist architectures and different preference structures with regard to skills recognition. This perspective on the different political economies (see Chapter 3.1.2) is seen as a first crucial step to differentiate skill formation in particular country settings and, furthermore, looks more closely at types of skills in changing contexts (related to the developments identified by Streeck).

The VoC approach (see Chapter 3.1.2) conceptualizes ideal-types of institutional arrangements with characteristic modes of coordination, with different skills being produced and foregrounded. Because earlier institutionalist or comparative capitalist approaches relied mainly on a perception of institutional conditions in isolation, the approach has made progress by linking major institutions that define capitalist production with each other. This conception has been given empirical foundations, has undergone theoretical amendments and has the support of a considerable body of research. For instance, the typologies are seen as robust historically and in situations of crisis. With the development of labour market liberalization, VoC scholars adjusted their conception to these changes and modified their central theoretical assumption about labour market coordination (Martin and Swank 2012; Iversen and Soskice 2009; Hall and Gringerich 2009).

Attempts have been made to go beyond a dualistic approach to variety (e.g., Thelen 2012). Although the juxtaposition of coordinated market economies and liberal market economies is seen to illustrate the most important differences between the 'Anglo-Saxon' and 'Rhenish' economies (Hassel 2015), these ideal-types often don't fully fit other types of capitalism, for example, in France. That's why further attempts have been made to extend the duality, for example, by adding a third type of capitalism known as the 'dependent market economy' (Nölke and Vliegendthart 2009). This type of capitalism refers in particular to the Visegrad group of countries in Central and Eastern Europe. A further approach beyond duality is made by Amable (2003). Based on empirical investigation, he outlines a typology of countries divided into five groups. An overview of rather general critics of the Varieties of Capitalism approach can be found in Hancke, Rhodes et al. (2008), and in Crouch (2005). As the present project is concerned with skills, we approach varieties of capitalism in terms of empirical investigations on the origin and effects of varying skill formation systems.

The political economy literature has discussed various types of skill formation and their differing capacities to change. This is taken up here because the different institutional and historical legacies of current transformation processes are worth examining in light of digital transformation. The political economy literature understands the education system, for example, in terms of how it complements and is mutually dependent on other institutional conditions within a country. Using historical and cross-national comparisons, this literature shows that different institutional conditions have evolved in a country-specific manner, as a result of distinct skill formation systems. Among other things, within this framework the political economy literature examines differences between VET systems in Europe regarding their institutional arrangements (Culpepper and Thelen 2008; Streeck 2011).

Bol and van de Werfhorst (2011) developed an indicator-based classification of skill formation systems by distinguishing education systems in terms of their institutional conditions and studying their outcomes. They contribute to the comparative educational literature in two respects. First, they enhance our understanding of the institutional diversity of European education systems. By including indicators on institutional characteristics of education systems (external differentiation, standardization and vocational orientation) in their database of comprehensive sources, they reach comparable and replicable results on country variations as regards education systems for a large number of countries. The conceptual consistency allows them to rank countries in each of these three dimensions. Second, they link these institutional variations systematically to a variety of educational outcomes (allocation, attainment, equal opportunities, preparation for taking part in society). Bol and van de Werfhorst find evidence that education systems do not perform equally with regard to the particular functions of education. One central function is to offer equal opportunities to all students. In relation to institutional characteristics, they observe that in more vocationally oriented education systems students undergo allocation sooner than in other types of system. Furthermore, stratification and the prominence of the dual system in education improve students' integration in the labour market, although a higher degree of stratification is also seen to lead to less socio-economic equality. A high degree of standardization in the education system is observed to lead to lower average performance, but schools with more autonomy are able to enhance student performance.

Besides classifying VET systems in terms of their institutional characteristics using factor analysis and multivariate estimations (Bol and van de Werfhorst 2011) or similarly, cluster analysis ((Salas-Velasco 2023), other comparative research efforts have attempted to use the ideal typologies method to look at VET systems and VET outcomes to lay the ground for comparative research. Busemeyer and Schlicht-Schmälzle (2014), for example, combined the characteristics of employer involvement with public commitment, resulting in a 2x2 typology of ideal-types of VET systems. Another example of typologies is the more recent work of Rageth and Renol (2020). They find three ideal types of VET systems in Europe and base their ideal typology on Niklas Luhmann's social systems theory in an effort to explain the significance of actors in terms of the links between the education and employment systems. They see indications that these ideal-types are connected to particular VET outcomes, and that the power-sharing model provides a suitable fit for labour market entry, or to explain the problematic consequences of unemployment or skill mismatches.

On the subject of indicator-based comparative VET research, the findings of Bol and van de Werfhorst (2011) are congruent with other comparative studies on the labour market placement of students. Making comparisons in terms of the distinctive features of upper secondary education, and considering VET graduate allocation, there is common ground to the extent that labour market placements of graduates from dual training systems happen more smoothly than in school-based training because of institutional coupling, but also, among other things, the comprehensive working experience within apprenticeships (Dietrich and Abraham 2018; Triventi et al. 2016a; Täht, Saar, and Kazjulija 2016).

The value of specific skills obtained in VET, as well as a strong link between schools and employers are particularly beneficial for young people's employment chances in vocational systems, and in particular in apprenticeship systems (Breen 2005). However, the initial labour market advantage seems to reduce over time. Studies find that VET graduates achieve labour market allocation at an earlier stage than school-based system graduates at the start of their career, but have lower employment opportunities later on (Choi, Jeong, and Kim 2019; Hanushek et al. 2017). However, it is not clear whether these life-course effects can be derived systematically from the institutional framework of the training system, or whether they arise from other living and working conditions (Hanushek et al. 2017; Forster, Bol, and van de Werfhorst 2016). In this context, the structure and standards of vocational education and training, with their provision of particular skills during training, should be considered when it comes to the analysis of labour market placements and future labour market outcomes.

Mutual expectations and acknowledgement of VET constitute an important aspect of institutional variation in training systems. Skill formation systems differ, as we have seen, in terms of the provision of different types of skills. To recognize these different skills and to be able to utilize them for the benefit of the economy is also related to incentives and motivations on the company side. In the logic of the VoC approach, firms have incentives to engage in skills production in a variety of ways and depending on the specific logic of capitalist production. But recent studies find that not only engagement in skill formation, but also skill recognition varies among countries. Heisig (2018) and Heisig et al. (2019) found evidence that the relationship between formal qualifications and skills differs markedly across countries. National education systems use standardized learning structures to develop skills that can be interpreted as signals of knowledge and competence. However, education systems differ in terms of skill transparency. In education systems that are skill transparent the association between formal qualifications and gained skills is strong. A high level of skill transparency therefore also provides information about the learning environment in which skills are developed.

When it comes to understanding differences between countries, the historical institutionalist literature has insights on the establishment and development of skill formation systems in the respective country context. The historical pathways of the skill formation systems in Estonia and Germany couldn't be more different. As a country in Central and Eastern Europe (CEE), we see that Estonia's recent history is strongly marked by the breakdown of Soviet rule and regaining independence in 1991. But even compared with other CEE transitioning countries during that time, Estonia's transformation has been particularly dynamic, despite the challenges arising because Estonia didn't have any market elements in its central planning system to draw on. For this reason, Estonia has experienced a comparatively radical and fundamental reorganization of its economy, politics and society all at once. In order to process these changes from a planned economy to a functioning market system, Estonia followed highly (economic-)liberal principles with only a moderate role for the state (Täht, Saar, and Unt 2008). In particular, Estonia, among other CEE countries, provides suitable grounds for studying experiences of the recent comprehensive historical transformation and their effects on current transformations due to digitalization. From the perspective of political economy, several analyses categorize Estonia as having adopted a liberal institutional structure (Lane and Myant 2007; Lane 2016; Täht, Saar, and Unt 2008; Loogma et al. 2019).

The provision of education was also affected in this process. The reorganization of the former Soviet education system included an expansion of educational opportunities and a new VET system. A historical perspective on systemic transformation since the fall of the Soviet regime is particularly relevant when it comes to the establishment of the VET structure in Estonia. Loogma et al. (2019) argue that the historical path dependence of the education system and educational reforms during the Soviet period can be related to the structure of the education system today. Most importantly, the authors see the historical roots of the Estonian education system as a causal mechanism for the structural conflicts of academic and vocational education today.

For many decades Germany has had a distinctive dual education and training system which is widely known domestically. Vocational education and training in Germany are organized collectively. That is why it is often called a 'collective skill formation system' (Busemeyer and Trampusch 2012: 4). The aspect of coordination relates to different actor constellations. Companies are strongly involved in training in terms of financial matters and implementation, as already explained (in more theoretical detail in Chapter 3.1.2). But intermediary organizations also take part in VET, for example, cooperating in the process of administrative and VET reforms. Further characteristics of Germany's VET system include the fact that it provides occupation-specific skills, certified and acknowledged by the labour market, and that skill formation takes place at the workplace level because VET predominantly takes the form of apprenticeship training. The German VET system has deep historical roots and is seen in relation to the establishment of national labour markets. Public recognition of and commitment to VET is seen as high (ibid.).

The institutionalist political economy literature provides a framework for studying the interrelations between institutional arrangements across different countries. Most of the political science literature on capitalist production regimes studies skill formation systems not in isolation, but in close connection with broader production logics. The literature pays considerable attention to that. Although there are detailed accounts of the different institutions surrounding training systems and the different types of skills they focus on, as well as how different countries support particular employer strategies, this branch of the literature pays less attention to why particular skills are regarded as important.

Particularly for sociological research, the outcomes of such different skill regimes are interesting in terms of understanding the association between the structuring of educational opportunities and social stratification and the effects of institutional architecture. Comparative accounts of different skills, the importance of the level of such skills, and their combined effects on labour market outcomes are of considerable interest when it comes to the results obtained on the impact of digitalization on work, organization, and technological change from the sociological and labour organizational literature (see Chapter 2). Looking at this relationship in an institutionalist perspective can be extremely fruitful.

The next section therefore continues to present – mainly sociological – empirical evidence for the link between employment systems and education systems in different institutional settings. It provides insights into what is known on the effects of the institutional architecture (and, in particular, of different skill regimes) on educational chances. The branch of literature presented closely examines qualifications and skills obtained in different skills systems, sometimes on a comparative basis. Providing an overview of this relationship helps us to understand the institutional roots and current procedures of skill formation and of skill recognition principles in different countries. This is necessary to pursue the project's interest in skill mismatches, in terms of which countries' employment and education systems seem to be out of balance.

Educational qualifications function as a proxy for labour market allocation. The level and type of formal schooling provide graduates with a way of signalling competence and represent reliable indicators for employers. Comparative vocational educational research studies different skills production systems. In terms of the complementarity and coupling of systems in different countries, however, 'there is very limited knowledge on the role of vocational credentials at labour market entry in CEE countries, particularly applying a comparative perspective' (Kogan and Unt 2008: 390).

With regard to the employment system, Täht, Saar, and Unt (2008) emphasize that Estonia has changed significantly since the fall of the Soviet Union. Previously, labour market entry was strongly credential-based, and entry processes were administered institutionally. The socialist state assigned access to specific positions in the labour market depending on the type of schooling. The relations between education and, in particular, trained occupations was close and stable – also because employers had to follow strict regulations when filling positions. During the 1990s, such formal links between attained qualifications in particular school types and labour market position were abandoned and schools, teachers and employers obtained greater autonomy. As a result, the employment system in Estonia underwent major changes and switched from a rather closed labour market system to a more open system. In today's Estonian employment system, the link between formal qualifications and labour market position is rather weak (Saar 2005; Kogan, Unt, and Saar 2007; Täht, Saar, and Kazjulija 2016; Saar 2008; Müller and Kogan 2010; Krull and Trasberg 2006; Saar, Unt, and Kogan 2008).

This effect is also evident regarding Estonia's vocational education system. Ümarik (2015) looks at this structural decoupling between employment system and VET system in Estonia. Following some theoretical considerations on the looser, more flexible links between the two institutional systems, she studied how the practical training parts of the school-based VET study programmes are organized and assessed by relevant stakeholders. She found that decoupling is more evident in training fields in which the practical training components are less elaborately structured and in which organizational, coordinative and communicational problems exist among key VET actors, such as practical trainers. In this sense, Ümarik is able to provide empirical insights into cooperation and coordination problems and to illustrate the interplay between agency and structure in changing contexts of VET provision.

For Germany, the close coordination between skill formation and labour market institutions results in close relations between educational qualifications and labour market allocation (e.g., Gangl, Müller, and Raffe 2006; Müller and Shavit 1998; Müller, Gangl, and Scherer 2002; Allmendinger 1989). There is a credential-based system of stratification which decides on labour market positions. Skills are developed in several direct and indirect learning processes, in which schooling plays a major part. Young professionals leaving VET education are equipped with a full set of multiple skills, qualifications and first work experiences. With regard to the first labour market placement after training, there is comprehensive knowledge of the relative advantages of general education versus vocational education in (Western) countries (Allmendinger 1989; Müller and Shavit 1998).

Based on longitudinal data and sequential analyses, Müller, Gangl, and Scherer (2002), as well as Brzinsky-Fay (2007), for example, show that transition patterns into working life in Germany tend to lead relatively continuously to employment compared with other countries. A stable transition pattern corresponds to the stable institutional configurations of extensive vocational training systems. This finding is also supported by further sequential analyses of the state of affairs in Germany, which additionally show that ideal-type transitions into employment increase over cohorts, but also change more frequently (for example, due to returns to education) (Brzinsky-Fay and Solga 2016). The high degree of organization and coordination in the differentiated German education system maintains a close linkage between the education and employment systems (Hillmert 2002, 2010; Brzinsky-Fay and Solga 2016).

The relevance of qualifications among vocational training graduates has been studied in particular in the perspective of the guiding principle of occupations. Dietrich and Abraham (2018) focus on the advantages of the apprenticeship system for students and their transition processes. They found that these advantages go to both students and companies. Mutual experience during training gives both actors informational benefits, whereby in particular students trained at a given company have a comparative advantage over applicants from the general applicant pool because the time spent at the company allows a realistic evaluation of their expected productivity. Moreover, the trainee gains company-specific knowledge and skills (ibid.). There is a reasonable expectation that in-company trainees will be taken on after completion of training. However, the rates at which companies take on trainees have not remained stable in recent years. The company panel of the Institute for Employment Research shows that after a long-term decline to 57 percent in western Germany and 39 percent in eastern Germany, the rates at which companies take on trainees are on the rise again, although they depend on cyclical developments and were recently affected by the Covid-19 pandemic (Frei, Kriwoluzky, and Putzin 2021). However, we find differences of turnover among vocationally trained occupations and regarding gender. These differences indicate that more research is needed on why and under which conditions skills matter to employers.

This empirical evidence shows that education and labour market systems interrelate and structure employment opportunities. Beyond the comprehensive comparative stratification literature that examines student achievements in terms of formal qualifications, other forms of skills are less well researched, which is also due to the fact that other skill types, in particular informal skills, are less extensively certifiable (Harteis, Goller, and Fischer 2019). This means that the importance of informal skills is often underestimated. In contrast, the possession of formal skills is indicated by certified qualifications acquired through formal education in the relevant educational and training institutions and through structured and purposeful learning (ibid.). The degree of formalization of formal skills is by definition higher than in the case of informal skills. Informal learning might be goal-oriented but it is unstructured and usually not certified.

What this overview has outlined is that a wide range of comparative approaches capture skill formation developments by highlighting their institutional configurations. The linkages of education to employment systems capture education mainly under the dimension of school type, or indicate the importance of school-leaving certificates as relevant criteria for recruiting. Beyond such criteria, informal skills gain importance at the workplace and at task level when it comes to digital transformation, but also, as the literature review shows, in education processes. Looking at a western European and a Central and Eastern European country in comparative perspective gives us the opportunity to study the education and labour market link within the framework of the institutional environment, diversity and dynamics that shape skill formation processes, and moreover, under the circumstances of historical transformation and transformative development. So far, there has been little research that takes a comparative look at skill formation and skills demand in Estonia and Germany within a single research framework.

In the next section, the strong focus on skills continues and helps to explain institutional variations of skill formation systems in Europe and their relation to skills.

3.1.2 Institutionalist theoretical approaches to political economy

Taking a broad social scientific understanding, institutions provide a framework for behaviours and alternative behavioral possibilities. As a stable structure of expectations, they provide orientation and thus enable social action. Their permanence explains why institutions might foster internal social rules through socialization and integration habits and particular norms. There are a number of different traditions and social science approaches to the analysis of the form and function of institutions. With a view to the project's goal of analysing structures and systems of skill formation and the scope of action of corporate actors with regard to skills, we focus on the role of institutions in economic activities.

Institutions play a central role in economic dynamics. For the project's comparative perspective, the 'varieties of capitalism' approach is a useful theoretical framework. Firstly, because it captures the coexistence of different capitalist models and diverse forms of institutional architecture in different countries, particularly with regard to differences at the national level; and second, because it 'brings the firm back into the center of comparative capitalism' (Hall and Soskice 2001:4). In this way, the approach targets company behaviour and examines how it is affected by institutions of political economy, most notably by systems of labour market regulation, education and training, and corporate governance. Besides the comparative perspective, a better understanding of the skills dimension in skill shortages in Europe requires a theoretical framework to explain the logic of production and recognition of skills. The key idea behind the comparative capitalism approach is adapted to this aim.

Capitalism comes in a variety of forms. Political economies can be differentiated by modes of capitalist coordination. The fundamental premise of this approach is that society and economy are interwoven and interdependent. The strength of an institutionalist approach to political economy is that it considers the interrelations between collective action in general and collective rules in the economy in particular, in contrast to the theoretical principles of other forms of social science-based institutionalism, such as neo-institutionalism (Hasse and Krücken 2009), which, for instance, concentrates more on aspects of the legitimacy, perception and processing of information in the regulation of social action within the framework of institutions.

Within the perspective of comparative capitalism, it is possible to distinguish economic (actor-based) considerations on the basis of country comparison and to relate them to other institutional sub-systems, such as vocational education and training. The interrelations between various sub-systems imply that they are integrated and have functions within a country's distinct institutional architecture. This looks at economic interests in relation to other spheres of society and explains the coordination between economic production and the decision-making of social, economic or political actors. This approach to institutional diversity is, however, rejected by scholars who assume the convergence of optimal institutional arrangements established in a specific historical timeframe, and also by scholars who reference capitalist models as ideal-types (Hay 2020).

Varieties of capitalism

The 'varieties of capitalism' approach (Hall and Soskice 2001) provides a conceptual framework suitable for explaining capitalist institutional diversity. Institutions are seen as coordinating mechanisms for achieving equilibrium. In this respect, it is vital to understand institutions as a framework for the activities of economic actors within the context of capitalist production and to distinguish how behaviour is affected by political-economic institutions. In a narrower sense, institutions are viewed in terms of providing a framework for strategic interaction in that they enable companies to solve coordination problems.

Hall and Soskice's approach (2001) makes it possible to examine more closely the strategic interactive moments that influence the actions of corporate actors. The varieties of capitalism approach thus focuses 'on the kinds of institutions that alter the outcomes of strategic interaction' (ibid.: 5) in the coordination of economic production. It aims to explain the variation and differences among national political economies because, as they argue, 'many of the most important institutional structures – notably systems of labour market regulation, of education and training, and of corporate governance – depend on the presence of regulatory regimes that are the preserve of nation-state' (ibid.: 4). As a result, firms as central actors within that structure derive comparative institutional advantages from the design of national economic institutions.

These advantages become visible when one looks more closely at firms and their coordination problems in several fields. In the sphere of *industrial relations*, firms have to cope with the coordination of bargaining over wages and working conditions with their labour force. *Education systems and training conditions* secure a workforce with the required skills, give firms incentives to invest in education and contribute to the competitiveness of the overall economy. Because *corporate governance* can give rise to coordination problems in terms of access and returns to finance and investment, the area of *inter-firm relations* opens up a space for possibly problematic situations among other corporate enterprises. In addition, *employee relations* are essential determinants of cooperation and employee commitment to the company. By trying to solve these coordination problems, Hall and Soskice argue that these relational fields are connected with each other and that 'firms can perform some types of activities, which allow them to produce some kinds of goods more efficiently than others because of the institutional support they receive for those activities in the political economy, and the institutions relevant to these activities are not distributed evenly across nations' (ibid.: 37). In consequence, coordination mechanisms complement the institutional setting.

The varieties of capitalism literature, in its original conception, distinguishes between two ideal-types of coordination mechanism. In liberal market economies (LME), firms coordinate their activities in terms of hierarchies and competitive market arrangements that rely on formal contracts. In contrast, in coordinated market economies (CME), companies rely on coordination and strategic interaction in activities and exchanges with other companies or actors. The mechanism by which economic activities and exchange relationships between companies are governed corresponds to the extent of institutional support. For example, 'where dense networks of business associations support collaborative systems of vocational training (…) those same networks may be used to operate collective standard-setting' (ibid.: 18). Hence, it is argued that these institutional regularities do not vary randomly but are complementary in several areas of corporate endeavours. In terms of recruiting, this means that candidate selection processes take place in relation to other strategic corporate actions and institutional conditions and are not to be taken in isolation. This institutional complementarity reinforces the differences between capitalist production regimes and opens up a comparative perspective on capitalist systems and firm (recruiting) behaviour within these systems.

Germany can be regarded as an ideal-type of coordinated market economy. Firms engage in strategic interactions through close relationships with partners or clients, through dense inter-firm business networks, and collaborative ties (ibid.). All these economic actors are highly organized and maintain social relations that take a long-term perspective and contribute towards achieving mutual recognition. Membership of industry associations is still essential to achieve common standards or organize technology transfer, although member retention has been an issue over recent decades (Hall 2008). Around half of German employees still benefit from (mostly sectoral) collective agreements, although their coverage rate has been slightly decreasing (IAB 2020; OECD 2021c). By European comparison, Germany is somewhere in the middle between countries such as France, with very high coverage, and the Baltics, Poland, Hungary, and Ireland, with only rudimentary coverage (Lübker 2020). Wage bargaining at the industry level between unions and employer associations makes it quite difficult for firms to poach workers.

Despite economic liberalization, many of these principles and coordination capacities have remained intact over the years. They are reinforced by the internal structure of cooperation within the firm in the form of social partnership, for example, when works councils participate in improving working conditions. Coordination is most evident in the area of education and training. The availability of highly specialized and industry-specific skills is a central market strategy of firms within a coordinated market economy. It leads them to engage in skill formation and to ensure the availability of these occupational skills in accordance with their needs and interests (see below). This demands rather long-term employment relations to provide that the firm's investment in skills pays off (Hassel 2015). Because such industrial relations strategies promote a long-term perspective and encourage product differentiation, technological innovations in CMEs are diffused rather gradually and incrementally than radically (Hall and Soskice 2001).

Estonia by contrast falls under the type of liberal market economy (LME) (Feldmann 2006; Lane 2016). Its institutional context relies mainly on market relations to solve firms' coordination problems and encourages radical innovation, which is especially relevant in highly technological and fast changing sectors, such as IT and telecommunications. According to Hall and Soskice (2001), this is due to inter-firm relations and corporate organization patterns that provide firms with opportunities to quickly establish a new range of products with new business strategies or to overtake other firms easily. Where labour market regulations are relatively lax and labour mobility is common, companies are able to dismiss workers easily when a new product line doesn't really work out, or to poach skilled workers from other companies. Union membership in Estonia, as well as collective bargaining coverage are low compared with other European countries (Statistics Estonia 2015; OECD 2021c). Most agreements are struck at company level. Only one central employers' organization, the Estonian Employers' Confederation (ETTK), takes part in social dialogue. The ETTK last entered into tripartite negotiations with the Estonian Trade Union Confederation (EAKL) and the government to reach a national minimum wage agreement in 2018 (Eamets and Tiwari 2018). The ETTK is the largest employer organization with a membership of around 2,000 businesses (employing 250,000 people) out of more than 88,000 businesses in the country (ETTK 2021). This shows that 'the institutional infrastructure promoting centralized wage bargaining is much more limited in Estonia' (Feldmann 2006: 839).

Originally, the VoC approach was used to analyse western European countries. But this approach can be transferred to countries in Central and Eastern Europe because many of these countries reoriented themselves and turned to capitalism immediately after the fall of the Soviet Union. This path was supported by political leaders, social forces and economic actors alike, so that a form of post-communist capitalism gradually emerged. However, this took on different characteristics. This can be analysed based on observable responses in real cases. This indicates a need to capture more detail on the evolution of capitalism in the former post-communist political economies. Current theoretical work, for example, considers further theoretical extensions and amendments relevant, in particular to better integrate the rapid catch-up processes at the outset of fundamental transformation and their peculiarities with regard to institutional architecture (Gardawski and Rapacki 2019). For Estonia, as for other systemically transforming countries, this means contextualizing the typological classification within the framework of Estonia's recent history.

Unlike institutions in Western European countries, which were established in the course of industrialization, Estonia's institutions are recent and have evolved in the context of a global market and already industrialized economies (Feldmann 2008). When the country gained independence from Soviet rule in 1991, the challenge was to establish new economic and political systems under a systemic crisis mode and almost from scratch. It required comprehensive state policies and decisions given how little was available in terms of legacies that might help with the establishment of institutionalized cooperation because of the lack of 'decentralized coordination and also the extent to which the Soviet regime was discredited in Estonia' (ibid. 2006: 844). Policies in such a phase of fundamental, not just economic transition, however, also provide opportunities to pursue far-reaching radical reform. The decision to undertake massive privatization of firms through a 'Treuhand model' (ibid.: 847), together with a strategy of liberal foreign investments favoured capital and interests from outside the country and weakened the position of former (Estonian) owners and long established interests (ibid.). Based on a neoliberal consensus among its elites, Estonia launched policies in the early 1990s towards a market model of coordination. Further reforms and institutional arrangements continued on a path towards a liberal market economy (Eamets and Philips 2000).

A key aspect of this institutionalist perspective is the assumption that institutional arrangements are coherent and complement one another in different dimensions. It turns out that institutions are interdependent. The principle of institutional complementarity assumes a positive relationship between complementarity and efficiency, which promotes economic performance (Amable 2016; Crouch 2005). Because the primary aim of the present project is to understand the different logics underlying skill formation and skill recognition in the labour market, a more functionalist view of institutions is seen as useful. We have shown that skill mismatches and skill shortages threaten economic performance, which highlights the link between the employment and the education systems. The varieties of capitalism approach provides us with theoretical reasons to explain this link within a given country's institutional architecture, which is likely to be distinct from those of other countries. The next section remains with the theory of institutional diversity and focuses on how this affects educational processes, learning environments and the actors involved in them.

The institutional context of skill formation and recruitment

The provision of training is closely interwoven with complementary political-economic institutions related to the labour market. Firms are nationally embedded into the institutional architecture. They rely on skills and skill production nurtured by the economy. In this sense, a country's knowledge system is strongly related to economic production as different modes of production depend on certain skill profiles. That's why the provision of training is integrated into the particular institutional conception of capitalist production and is considered a central institutional component within it as it has implications for a range of political, social and economic outcomes (Hall and Soskice 2001).

The institutional arrangements in Germany and Estonia provide certain incentives at the individual level. Institutions in coordinated market economies are associated with strong incentives for firms to provide training, and for students to acquire specific skills. In liberal market economies, by contrast, institutions 'discourage strong employer investment in skill formation' (Culpepper and Thelen 2004: 24). This gives students and workers incentives to train to acquire rather general skills which they can apply independently of particular firms or sectors. This exemplifies the point that skill formation systems have differing degrees of vocational specificity.

This results in different sets of relations between skill formation and labour market institutions. In particular, the institutional structures in the two types of economy we are concerned with offer firms different incentives. For firms that function as stakeholders in skill formation, institutional structures and institutional regulation provide guidance and orientation, for example, in terms of incentives to invest in training (Hall and Soskice 2001). But this country-specific set up also shapes the environment within which recruitment takes place (Paauwe 2013). Firms are affected by it in particular when they are sourcing talent with a vocational educational background for training or job positions. Their incentives are shaped not only by the corporate environment but also by the institutional structure.

Looking in more detail, the approach stresses the role of corporate actors as crucial elements in the capitalist economy, in particular because Hall and Soskice's conception of the varieties of capitalism is actor-centred and reflects the theoretical considerations presented by Mayntz and Scharpf (1995). They define institutions as 'norms of appropriate behaviour' (ibid.: 45, author's translation) that provide orientation and establish a mutual certainty of expectations with regard to behaviour and actions (ibid.). In their rather narrow understanding, however, institutions are not considered to be determinate: 'Institutional factors rather form a – stimulating, enabling or even restricting – *context* of action' (ibid.: 43, author's translation, emphasis in original). This institutional context has a twofold effect on the behaviour of individuals. First, it provides resources for action in which the actors make their strategic decisions. Second, there are formal and informal rules of conduct and procedures that shape the orientation for action. Accordingly, actors define their social role under the influence of the institutional structure but are still prepared to act autonomously to a certain extent. Actions are strongly normatively structured in that they are guided by rules. With regard to these rules, Mayntz and Scharpf argue, on one hand, that they must be collectively and consensually recognised in order to be valid. At the same time, they are detached from personal relationships and exist even if people do not know each other personally.

Mayntz and Scharpf (ibid.) call this an 'inclusionary relationship' (ibid.: 40, author's translation), in which all corporate actors are made up of individual actors as members. But corporate actors are more than just the sum of several individuals because organizations are constituted through institutional regulations (ibid.: 48). For example, state regulations determine which processes, purposes and goals a company has to fulfil in order to be allowed to participate in economic value creation. Such institutional rules express distinct nation-state conditions and conventions. Therefore, actions within the framework of organizations reflect the mutual reference of specific institutional frameworks and the individual capacity and motivation to act.

Because the mechanism of institutional complementarity and rational consideration also applies in the field of skill formation, this leads to mutual interactions of vocational education and training with other political-economic institutions. Firm investment in training well illustrates this complementary behaviour with other institutions. In coordinated market economies, firms are motivated to invest in training and to move into high-quality segments of the economy. This is because industry-level bargaining compresses wages and enables firms to obtain returns on their high investments. In liberal market economies, by contrast, the institutional structure sets conditions under which firms react to changes on the labour market with workforce dismissals. This mechanism disincentivizes strong investment in training. Firms are prepared to add to the general skill levels of their employees with in-company training, but by training them in firm-specific non-transferable skills from which they can derive a good return (Culpepper and Thelen 2004).

For recruiters as a stakeholder group this means that institutions provide orientation in terms of country-specific education systems, as well as information on skills. This institutional orientation enables firms to solve coordination problems and guides them along paths that promise economic success. For instance, a close correspondence between education and training, on one hand, and corporate governance principles on the other provides recruiters with a stable sub-system (the country-specific education system). Education systems provide certification, which provides a standardized measure and standardized information. Recruiters are eager to take advantage of institutions, which can make a fundamental contribution to reducing the uncertainty they face.

Under the varieties of capitalism approach, the basic assumption is that actors make rational choices. Despite its value for explaining the differences between national political-economic institutions, the argument that vocational training institutions and other sub-systems complement one another has motivated critical reflection on why institutions resist change or why the integration of new institutions might produce unexpected side effects. In this vein, the more functionalist view of institutions taken here leaves aside the process aspect, which focuses on institutions' roots and sustaining principles within a broader historical, political, and social context (which also makes it easier to examine changing conditions).

This theoretical outline looks at recruitment in its institutional context. Recruitment is examined theoretically within corporate and institutional frameworks by looking at the structuring principles of the political economy and its interwovenness with the education and training systems. To understand the allocation of individuals to jobs, it is useful to turn to micro-level considerations and the response of recruiters to the formal and informal skills made available by specific national education systems.

3.2 Recruitment behaviour in theoretical terms

After highlighting supply side processes and theoretical considerations, this chapter continues with demand side processes. It reflects the employer side of skills matching, taking up the empirical evidence on recruitment behaviour and recruiters' preference for education and skills. We look at the literature that approaches recruiting processes in terms of how well they are able to achieve the best possible fit in employment relationships. Under circumstances of technologically induced social change, companies are under even more pressure to rethink their strategies to attract young talent and to review their evaluation criteria. Focusing on company behaviour in matching situations is promising because it highlights the determinants of employment opportunities.

The chapter goes on to examine the theoretical foundations of recruiting behaviour within the narrow scope of micro-level (employer) search and sorting theories. Such theories reveal why education and skills have such predictive power for employers (Chapter 3.2.2). Recruiting is considered a difficult task 'because labour is the most heterogeneous of all inputs' (Cedefop 2012: 21).

This is why the presented theories look at the matching of people to employment using an individualist orientation towards the applicant side, in terms of which the outcome of matching – and stratification in employment – is based on individual characteristics (Spence 1973; Phelps 1972). However, the present project aims to reflect recruiting processes also in their corporate and societal context because solely micro-level considerations 'simply [overlook] the role of inequality in institutional processes generally, and closure enacted by institutional and dominant group actors that reifies existing stratification hierarchies — factors beyond the control of any given individual' (Roscigno, Garcia, and Bobbitt-Zeher 2007: 18). Therefore, the theoretical outline of recruiting processes also integrates theoretical approaches that explain the mechanisms of organizational strategies, actor constellations and corporate roles (Chapter 3.2.2).

3.2.1 Empirical work on skills and education in the recruiting process

As institutionalist research suggests, employers see themselves as integrated into different frames of action, depending on the context in which they operate and how the institutional architecture makes available incentives for action. In this sense, it is interesting to take a closer look at these actors. More specifically, existing research is presented that classifies the behaviour of recruiters as agents of firms. In the search for suitable personnel, they are the ones who structure access to employment positions. But there is a research gap in country-comparative research on corporate behaviour with regard to their demand for skills, in two respects.

First, comparative work based on an institutionalist perspective shows what demand for education and skills would be rational. Institutions provide guidance on the signalling value or the meaning of education and skills in different skills systems. A variety of theoretical approaches and their empirical applications in sociological research, therefore, refer to the effects of different skill formation systems on educational opportunity, labour market allocation and equal opportunities (van der Velden and Wolbers 2006; Gangl, Müller, and Raffe 2006; Müller and Gangl 2006; Andersen and van de Werfhorst 2010; Heisig and Solga 2015; Blossfeld et al. 2016; Schindler 2017; Triventi et al. 2016b; van de Werfhorst 2019; van de Werfhorst et al. 2019). However, this strand of literature is strongly characterized by the particular perspective taken on young people. This provides a good empirical basis for examining how the institutional context of VET (macro-level, partly meso-level) is reflected at the individual level (micro) and thus provides comparative insights into the relationship between the education and employment systems.

However, there is a lack of comparative literature that addresses the demand side perspective of matching. Only a few studies examine the influence of employers and their structuring principles on youth transitions into the labour market, and even fewer make cross-country comparisons. By focusing on the demand side of matching, the project contributes to a research gap in the social stratification literature (see first section below).

Second, the project serves to fill a research gap in the skills demand literature because it analyses a broad spectrum of educational characteristics. Previous comparative studies have examined the expectations, function, and predictive value that recruiters place on education and skills. However, the focus is more often on formal skills (mostly literacy and numeracy). Informal skills are little certified in the education system but are of great importance in digital labour markets. In approaching informal skills more concretely as signals during recruiting processes, the project gains insights into the relationship between qualifications and skills. Therefore, in what follows we look also at what we know from studies of work and labour studies analysing digitalization at the workplace (see the second section below).

With that, the project and the analysis on the demand side are located in a research gap pertaining to different disciplines. On one hand, the economic and labour studies digitalization literature provides insights into the nature, extent and consequences of skills mismatches in light of digitalization, but usually does not provide detailed enough information on their causes. With regard to the causes, research on recruiting practices is essential, and the sociological comparative stratification literature is particularly valuable. However, this literature lacks a view of different skills and a country comparative approach.

Recruiting behaviour: the signalling value of formal and informal skills

The comparative approach to skill formation systems provides insights into variations in the relations between formal qualifications and labour market allocation. The information what can be derived from skills varies in accordance with the different relationships between education and labour market institutions. Some education systems are seen to be more transparent with regard to skills than others. Scholars have observed that skills transparency increases with the amount of tracking within an education system, and if there is a strong vocational orientation in a country's secondary education system (Andersen and van de Werfhorst 2010; Bol and van de Werfhorst 2011). Heisig (2018) measured empirically the complex relations between educational attainment, actual skills and labour market outcomes. Formal qualifications are more informative about an individual's skills when there are large skill differentials among educational groups and when groups are more homogeneous. He finds support for the relevant assumptions and concludes that the signalling value of educational qualifications varies considerably across different economies. Demand-side studies within the social stratification literature base their approach on this signalling value (Spence 1973), or on skill transparency. They highlight which applicant skills hold predictive power for employers, and why.

Empirical investigations have long relied on standard measures of education. Meanwhile, the number of (international) databases that integrate the actual skill levels of individuals, besides other educational or employment-related information, is growing. This opens up the possibility of analysing the skills dimension in skill supply in greater detail (for example, the PIAAC or ESJS workforce surveys). Also on the demand side, we can note the increasing importance of skills. The European Company Survey (ECS) is one of the rare databases that surveys European countries with regard to recruiting. In a five-year cycle, it provides information on recruiting practices and recent problems. The latest wave of the ECS was published in 2019 (Eurofound and Cedefop 2020).

Results among all European countries confirm that employers use education and education-related skills as selection criteria. The criteria include experience, personality, education and skills. The survey collects information from recruiters on the most important evaluation criterion used when recruiting new employees. The answers are given for every European country and can be linked to company characteristics. ‘A personality that fits the company’ finds major support in Sweden (48%), Denmark (47%) and the Netherlands (40%), but it is also the most important applicant characteristic for evaluation for many German recruiters (35%). In Estonia, however, 20 percent of employers agree that this is their most important applicant criterion. The strategy of around 19 percent of respondents in Germany and Estonia is to base their evaluation on several characteristics, not just one. For a further 22 percent of employers in Estonia, and 18 percent of employers in Germany it is most important that the applicant has all the skills necessary to do the job and does not require any additional training. This approach is pursued at least by employers that rate educational criteria – educational and vocational qualifications – as essential (14% in Germany, 15% in Estonia). In Germany, the importance of education increases from 14 percent for SMEs to 22 percent for large enterprises. Having all the required skills and a suitable personality are more important for employers in SMEs than for other sized companies. Also in Estonian enterprises, education is a more predominant recruitment criterion in larger enterprises (20%) than in smaller ones (14%), although here recruiters put the highest priority on work experience in a similar job position. Sectoral differences reveal that possession of all the required skills and experience are regarded as most important for recruiters in industry, and least important in commerce and financial services (ibid.).

These recent results provide an overview with which to make a start. Employers analyse the candidates’ profiles in terms of a number of characteristics, many of them using multiple criteria for assessment. Particularly relevant are personality, skills and education. However, the items asked about in the ECS do not provide insights into what kind of education, educational type or qualification is sought, nor how employers identify ‘a suitable personality’. Confronted with a lack of comparative survey data, researchers in one strand of the literature conduct their own (experimental) employer surveys to determine which skills employers use for assessment and in which situations.

CVs include formal schooling and provide information on certificates they have acquired, as well as the type of school they attended. The literature identified early on that academic characteristics are less important for recruiters than, for example, ambition, motivation, communicative skills or interpersonal skills (Kelley and Gaedke 1990; Caldell and Burger 1998). These early findings motivated sociological studies to engage more deeply with the signalling value of various applicant characteristics, broadly divided into cognitive and non-cognitive skills.

One of the first systematic investigations from the employer perspective on the relative importance of several skill types and skill levels in the course of recruiting was done by Humburg and van der Velden (2015). Based on a discrete-choice experiment among recruiters in eight European countries (Czech Republic, France, Germany, Poland, Spain, Sweden, the Netherlands, and the United Kingdom), they simulated the first stage of recruiting when recruiters evaluate written application materials from university graduates and obtained results about recruiters' preferences. In a second step, another choice experiment was used to identify more directly the observed skills on which hiring decisions were based by employers in these different countries. Their findings revealed that employers pay most attention at the first stage, at which they narrow down applicant numbers, to CV attributes that promise high occupation-specific knowledge, low training costs and rapid adjustment of applicants to the workplace. Using a similar strategy, employers use skills to decide which applicants to accept. Exhibiting professional expertise (having a degree in a field of study that matches the job position), together with interpersonal skills is highly relevant with regard to employers' notions of employability. Also important are innovative/creative skills, organizational skills, or commercial/entrepreneurial skills. However, lacking professional expertise or interpersonal skills can hardly be compensated by other skills. Their findings indicate that some skills are more important for job entry, while others are more relevant for professional development in later stages. Because the study analysed recruiting for university graduates, the findings are hard to compare with those of applicants leaving upper-secondary education due to significant differences in age, previous work experience and field of study.

In a similar vein, but only for Germany, Protsch and Solga (2015) studied the effects of a number of CV attributes for labour market entry. They modelled CVs indicating formal cognitive skills and non-cognitive skills, which they sent randomly to hiring companies on the apprenticeship market. The results of the field experiments using the correspondence test method show that employers are able to derive different types of skills, formal and informal, from applicants' CVs. Moreover, they use them to screen for suitability. Because Protsch and Solga measured the signalling value of both skill types in CVs, they were able to contrast their different signalling effects. 'Employers define thresholds for the two skills criteria at the first selection stage' (ibid. 2015: 523). This finding is a counterargument to other sociological and economic studies according to which applicants' skill signals are ranked in a linear way, following the logic of 'the higher the better'. However, signals of formal and informal skills are often not interchangeable. Cognitive skills are shown, for example, by good grades in CVs. They do not fully compensate for low non-cognitive skills and vice versa. But employers tend to reward non-cognitive skills more strongly than cognitive skills (Protsch and Solga 2015). These findings are valuable in so far as they reveal employers' strategies with regard to the evaluation of different kinds of skills in written application documents (CVs and references). Because it is a common strategy of recruiters to seek markers for personality and social traits, this study found empirical evidence that recruiters also rely on signals of informal skills discernible in CVs and application materials.

For the German applicant market, further experimental studies detect a high relevance for formal education (grade) and social skills for applicants on the apprenticeship market. Having additional ICT skills is particularly rewarding for this group (Piopiunik et al. 2018). These single case studies-based employer data contribute to a more systematic research strand on school-to-work transitions from this perspective (see also, for example, Fossati, Wilson, and Bonoli 2020; Hipp 2020; Protsch and Dieckhoff 2011; Kübler and Schmid 2015), but they cannot address whether the employers' behaviour is conditional on the institutional context – on the framework within which they are making decisions – and so this does not provide insights into potentially varying skills depending on the skill formation system.

Di Stasio and van de Werfhorst (2016) take up the necessity of comparative research on the topic. They investigated the reasons for varying recruiting schemes in a two-country setting and applied a comparative perspective to recruiting behaviour in the Netherlands and England. These two countries represent very different institutional contexts. They found that employers base their hiring decisions on potential candidates in terms of various educational filters, which supports the assumption that the institutional framework is meaningful for the analysis of matching situations as it accentuates certain educational features and their importance for employment. By using a factorial survey, they were able to show, based on varying institutional settings, that evaluations differ between England and the Netherlands (Di Stasio and van de Werfhorst 2016). This encouraged them to reflect on other countries and add the aspect of institutional change, which has become an important analytical dimension due to the current digital transformation.

This line of social stratification research reveals that a variety of information on education is important to enable employers to form an opinion on applicants. They use a broad range of educational signals in comparison with each other. These studies have started to gain a better understanding of the signalling value of education and skills, partly in terms of cross-national differences. In this way, the studies complement the stratification literature on different allocation mechanisms, depending on education systems and the given level of 'skill transparency'. They also look at whether other contextual factors, such as other macro-level institutional conditions, have an impact. The project contributes to this endeavour by providing direct measurements of skills (formal and informal) and tests the skill transparency approach empirically on a comparative basis.

In light of the digital transformation, it would seem worthwhile to seek even deeper insights into the education–skills nexus. As skills shortages continue, disentangling which skills are needed receives more attention in public discourse and needs empirical investigation. The literature on informal skills is located within the sociology of work and organization, and informal skills are discussed in terms of their contribution to employability. This indicates that it would be worth studying their signalling value in graduate recruiting processes. Analysis of formal skills in contrast to informal skills is almost non-existent. Therefore, this project addresses this research gap and supplements the available country specific studies and their explanations of recruiting behaviour. In this respect, the comparative dimension makes it easier to identify explanations of why recruiting patterns might differ.

Recruiting behaviour: a process in stages

In addition, the literature on the various stages of the recruiting process is presented because the recruiting process itself is a critical procedure, assigning candidates to unfilled vacancies, and matters for the analysis of social stratification. Regarding its target group, recruiting graduates for vacancies is not much different from recruiting other groups of employees, at least in terms of process (Humburg and van der Velden 2015; Bills, Di Stasio, and Gërxhani 2017). It 'seeks and obtains potential job candidates in a sufficient number and quality that the organization can select the most appropriate people to fill its job needs' (Gatewood and Field 1987: 7). This still shared baseline definition of recruitment puts the emphasis on organizational practices and activities in order to attract, evaluate and select potential employees. Recruiting is a complex process and employers often engage intuitively, contributing their own experiences and making assumptions about benefits and risks associated with various sources of recruiting or instruments. Employers need to consider, for example, the objective of recruiting, the target population, employees' search behaviour, and the availability of information (Breaugh and Starke 2000; Lang et al. 2011; Tardos and Pedersen 2011).

There is broad agreement in the literature that recruiting requires several steps as one of the main purposes is gradually to reduce the pool of applicants (Gatewood and Field 1987; Corte, Lievens, and Sackett 2006; Protsch and Solga 2015; Breaugh and Starke 2000; Boudreau and Rynes 1985). Corte, Lievens and Sackett (2006) therefore show that employers apply different recruiting methods sequentially. They find that multiple recruiting steps require decisions at each stage of the process. Although it would be optimal in terms of making solid predictions that all the recruiting and screening methods were administered to all applications, time, logistics and cost restraints often make it unfeasible. However, the various steps differ considerably in terms of the form of recruiting.

The literature differentiates between two general forms of recruitment activities: internal and external. In internal recruitment, the enterprise draws on a pool of employees already in place or uses informal contacts. Early labour market studies documented that internal recruiting was long a common practice (Bills, Di Stasio, and Gërxhani 2017). More recently, the latest wave of the European Company Survey (2019) collects cross-nationally comparable information on workplace and recruiting practices from almost 22,000 human resource managers in all 27 EU countries and the UK. It reveals that internal transfers are the first strategy of 36 percent of European enterprises. However, when sourcing new employees, the majority of enterprises look outside the existing employee pool (Eurofound and Cedefop 2020). Because of this and given that labour market entrants usually don't have a wide network to rely on, internal sources of recruitment are deemed less relevant for graduate recruiting processes. For this reason, the project focusses on formal graduate recruiting processes.

Search activities and methods of evaluating applicant information are more comprehensive in external than in internal processes. Employers reach out to a larger pool of jobseekers and receive a larger number of applications (Tardos and Pedersen 2011). Hiring enterprises try to attract especially younger candidates through social media channels. After search activities and information distribution, incoming applications are screened, commonly in a sequential mode, using less expensive instruments first, and more expensive ones later, when the applicant pool has been reduced (Cole et al. 2007). König et al. (2011) reflect on the rationale behind these differentiated procedures. They found, when investigating personnel practitioners` strategies, that HR managers consider specific procedures to be particularly relevant only for certain stages and that selection stages are used for different purposes.

Recruiting and decision-making instruments are frequently used first to review the incoming application documents and to sort out formally unsuitable candidates. If successful in the first recruiting stage, applicants are invited to the second round. In a second step, a personal meeting (job interview) takes place in which candidates are sometimes tested on their ability, skill levels, performance and personality, or are asked to submit work samples or perform trial days. Often, a hiring decision is made on the basis of the personal meeting and subsequent tests (hiring stage) (Boudreau and Rynes 1985). This pattern is prevalent regardless of industry sector, organization size and job type (Gatewood and Field 1987).

A written application usually comprises an application form or resumé and has certificates or references attached. In the first review stage, employers consider education, previous experience (also internships), interests and activities as important information as they may indicate skills that are necessary for the job (Randazzo 2020). In the recruitment of labour market entrants, education stands out because previous work experience is mostly non-existent. Regarding the resumé, further matters of concern are linguistic correctness (Martin-Lacroux and Lacroux 2017), length (Blackburn-Brockman and Belanger 2001), preparation (Elgin and Clapham 2004), as well as layout style and form (Randazzo 2020; Arnulf, Tegner, and Larssen 2010). The rise of professional online networking platforms (for example, LinkedIn, Xing) and social media have changed the way applicants present themselves beyond the resumé.

Early studies found that the initial review process is usually conducted quite quickly. Reviewing resumés usually takes employers less than a minute, several minutes at most (Elgin and Clapham 2004). Although the time needed for screening is low, internet use has increased the number of incoming applications, and has also increased direct applications. Therefore, e-recruiting tools promise efficiency gains and may support recruiters in their activities at several stages. Digital tools, employee and employer networking platforms and automation supplementing HR processes are applied in particular during the first recruiting steps (Pongratz 2021). Algorithm-based tools are able to suggest suitable candidates automatically in response to job advertisements. With these technological developments, e-recruiting tools emerge as cost-saving possibilities. In active sourcing on career platforms, augmented reality may function as a recruiter, sorting incoming applications and recommending suitable candidates to the company (Staab and Gesche 2019). However, such enhancements have raised considerable criticisms with regard to candidate diversity and the difficulty of overcoming stereotypes (Staab and Gesche 2019; Kayser-Bril 2020). Overall, through the increasing use of digital platforms, recruiting technologies and software, new reference points are emerging for these recruiting steps and are having a significant impact on the role and function of HR practices within enterprises, for example, with regard to standardization, centralization, and fair and equal treatment (Eurofound 2020c; Staab and Gesche 2019). How this potential is being exploited is still rather unclear. An employee survey in Germany for example revealed that the potential of bot-supported e-recruiting is not yet being widely exploited (Weitzel et al. 2020).

Based on extensive personnel-related literature on the way recruiters use information, social science studies focus more on the societal dimensions of allocation processes in the labour market. Most studies, however, are either highly aggregated or highly individualized (Granovetter 2010; Kelley and Gaedke 1990). Although the process and purposes of recruiting scarcely differ between labour market entrants and other employee groups, the scope of signals of suitability varies. Because employers search for applicants mainly externally, this source of recruiting is also relevant for professional graduates. With respect to vocational graduates, however, studies differ in terms of the points in time defined as transitional. In Germany, entering the apprenticeship market is often seen as a first step into the labour market. Enrolment in an in-company training programme often counts as an entry position and the local trainee market becomes the first market for those starting their careers. This is because, for an in-company training place, the process related to and decisions concerning VET trainees is the sole responsibility of the training company (Protsch and Solga 2015; Zschirnt and Ruedin 2016b). A significant proportion of apprentices are taken on by the company providing their training after they have completed their vocational training, but there are also a number of graduates of the dual system who apply to other companies after graduating (especially in the IT sector). A number of studies also look at this step of school-to-work transition in Germany (e.g., Brzinsky-Fay and Solga 2016; Seibert and Wydra-Somaggio 2017; Forster, Bol, and van de Werfhorst 2016).

Utilizing this information on applicant documents is key for employers. Single CV attributes provide information for the several recruiting stages. The lack of further information on applicants, however, means that employers act under considerable uncertainty (Bills 2003). One strategy for employers therefore is to sort the field of applicants in order to narrow it down to the most suitable. This screening in terms of particular productivity criteria helps them to predict which candidate will perform best in the vacant job. In this context direct measurements of skills available to employers remain very rare due to the sparse data base. But for the purpose of stratification and understanding inequalities in labour market placements, it is tremendously important to better understand the mechanisms involved in recruiting processes.

Recruiting behaviour: the organizational context

Although this analysis focuses on a selection of applicant characteristics in terms of education and skills, it should be emphasized that recruiting decisions rarely consider only these content-related applicant components. Substantial empirical evidence shows that employer preferences can also be grounded on and are formulated in terms of non-changeable personal attributes or signals of these attributes, such as personality, gender, age, ethnicity or social background (see, for example, Almeida, and Dharmage 2016; Diehl, Friedrich, and Hall 2009; Boos-Nünning 2008; Imdorf 2010; Rivera 2012; Granato and Ulrich 2014a; Cable and Judge 1997; Graves and Powell 1995).

In particular, Imdorf and Scherr (2015) point out that the selection processes of young people interested in vocational training take place in a private-sector context and a company environment, which make it difficult to evaluate discriminatory practices. Nevertheless, especially in view of the consequences of decisions at the threshold of entry into a profession, occupational discrimination is a serious and still under-researched issue. Correspondence tests such as in Zschirnt und Ruedin (2016a), Veit and Thijsen (2021) or Zschirnt (2020) make a start renewable energy sources decomposing discrimination at this stage. Another important aspect in terms of gender is not only the different productivity assumptions by gender, but also the fact that some informal skills are stereotyped in terms of gender (Quadlin 2018).

Furthermore, with regard to the company environment, the literature review (Chapter 3.1.1) has shown that institutions provide orientation for companies because they are embedded in an institutional architecture. Education systems provide educational certificates which count as standardized measures and give standardized information. The reason recruiters respond to such institutionally based behaviour is that institutions make a fundamental contribution to reducing the uncertainty that recruiters face. In the case of education, educational certificates are an expression of institutionalized cultural capital, in Bourdieu's sense (2009), and confer institutional recognition on educational achievements. Applicants' skills are recognized as institutionally based information. Institutions create reasonable grounds for recruiters to rely on this information for applicant comparisons, given that they consider the institutions themselves as trustworthy. If so, certificates and institutions that develop these skill sets contribute to solving recruiters' 'trust problem' and uncertainties (Haupt and Ebner 2020: 25).

These aspects are related to what companies associate with training in certain occupations. Haupt (2012) and Haupt and Ebner (2020) discuss this under the aspect of social closure in the labour market. With regard to Germany, they argue that trust in occupational certificates achieved through vocational education and training is based on their degree of institutionalization and standardization (ibid.). Because Germany has a strong apprenticeship system, the importance of occupation as structuring principle and institution for labour market allocation is discussed. In an empirical investigation of occupations as a labour market institution, Damelang, Stops, and Abraham (2018) studied the effects of occupational regulations for mobility patterns based on an employer survey in Germany. They showed that occupational regulation enhances the prevailing level of information for employers and reduces uncertainty in matching situations. Given an applicant's credentials, employers establish expectations about their knowledge and skills acquired in school and training. This is particularly prevalent in labour markets in which VET graduates are looking for jobs because they have gained the relevant occupational credentials and have invested in very occupation-specific skills. Moreover, occupations function as 'closed shops' because they define occupational qualifications that highly structure access to job positions. Damelang, Stops, and Abraham's (2018) findings therefore lead to the conclusion that in some labour markets, as in Germany, occupational closure is an additional mechanism during recruiting processes.

Digitalization and the relevance of informal skills

As shown, the current sociological stratification literature addresses relations between education and employment and distinguishes countries in terms of the influence of their institutional setup on this relationship. However, this literature is less concerned with the 'work' dimension of labour market allocation. As we have seen, employers are increasingly using informal skills as valuable information with which to decide on an applicant's employability. This result is underpinned by workplace studies that furthermore observe the increasing relevance of informal skills, and, if such skills are missing, skills mismatches. The next section therefore reviews the relations between workplace tasks and workplace requirements in terms of skills. As the purpose of this project is to study recruiters' evaluations of formal and informal skills, the project aims also to contribute to the literature on sociological work and labour studies, with particular reference to digitalization.

The changing nature of work due to digital technologies has increased employers' difficulties in identifying the main job tasks and the main skills required to perform them, and to determine whether a particular job applicant possesses these skills (Cedefop 2012; Weitzel et al. 2020). Ideally, a worker's qualifications (including skills) will meet the requirements that distinguish a particular professional position (bundle of tasks), the recruitment process having achieved this matching in the case of new hires. The close relationship between tasks and skills is therefore a crucial facet of corporate recruitment and selection processes.

In preparation for recruitment, companies consider the key tasks related to the position. According to job design theory this includes defining responsibilities and key collaborating and cooperating (internal or external) entities and providing an exact job description so that the formal recruitment process can start (Eurofound and Cedefop 2020; Drake International 2017; Grant et al. 2010). Along with the job description comes the consideration of which skills are required for successful performance (Jaspers and Westernik 2008). A matching of person and position is achieved when both the applicant and the hiring company come together in a shared understanding and agreement (Bills, Di Stasio, and Gërxhani 2017; Gatewood and Field 1987). However, successful employment relations are increasingly regarded as problematic because many companies are struggling to specify the requirements and skills that will be needed in the future in light of the digital transformation.

The latest results from the European Company Survey (ECS) give concrete examples related to this problem. They reveal that only 25 percent of employers agree with the statement that all newly recruited employees possess the skills required to perform the job successfully. The vast majority of companies in the EU, 77 percent, state that they have difficulty finding people with the skills they need and 20 percent of EU employers find it very difficult. In relation to digitalization, we see that such recruiting difficulties occur more frequently in enterprises that are digitalized only to a limited extent compared with highly digitalized enterprises (Eurofound and Cedefop 2020; Manpower Group 2020). In Germany, this impression exceeds the European average: almost 40 percent of employers state they have major difficulties recruiting (39% very difficult, 46% fairly difficult), whereas Estonian enterprises reflect the European average (24% very difficult, 60% fairly difficult) (Eurofound and Cedefop 2020).

To identify skills, and to know which skills are relevant for the future, employers apply strategic planning or skills monitoring in their workforce. To identify informal skills in recruiting situations, we have seen that employers utilize information available in school reports or CVs (Protsch and Solga 2015). Further possibilities include trial workdays or internships to assess informal skills within real workplace settings, especially with labour market entrants (Solga, Baas, and Kohlrausch 2012). Generally, however, it was observed that the basic structure of human resource selection remains widely unchanged and that employers rely on routine activities (Amladi 2017; Gatewood and Field 1987; Protsch and Solga 2015).

It is important to determine the skills dimensions in which digitalization is particularly present. Again, comparative insights into different European countries on the effects of digitalization are scarce. The European Working and Living Conditions Survey (EWCS) thus investigates employees' workplace changes, work intensity and increasing time pressure. Insights regarding qualitative workplace changes provide a picture of the side-effects of new technological processes or tools. Based on workplace descriptions and job profiles, recruiters determine which skills to request from new hires.

While high levels of digitalization are observed to affect enterprise performance, for employees, work intensity and availability of time are important. The EWCS shows that 36 percent of employees working in the EU (2015) experience stress from tight deadlines and working at high speed 'around three-quarters of the time' (33% in 2015) (Eurofound 2017b). Among managers, professionals and technicians, frequent disruptive interruptions are an additional concern. For 15 years, from 2000 to 2015, such work intensity increased for EU employees, especially those working in technical occupations (European Foundation for the Improvement of Living and Working Conditions, waves 2000; 2005; 2010; 2015[3]). Autonomy with regard to time is more difficult to attain in work fields that deal with customers and clients because customer demands dictate their pace and rhythm of work. Such customer orientation is common in logistics and warehousing, because the expected – and shortening – delivery times, as well

[3] Because of the Covid-19 pandemic, Eurofound had to terminate the next wave of the survey, originally scheduled for 2020. Therefore, further time series observations for the illustrated indicators are currently not available.

as the increasing spread of additive manufacturing technologies have a considerable influence on employees' experience of receiving, picking and dispatching goods (Roth et al. 2015). Autonomous transport systems, which take over the physical transport and control of goods from employees, may be used in cooperation with employees and function intelligently in a swarm (Straub et al. 2017).

Autonomy for employees to arrange their time during a working day is closely related to perceived work intensity and well-being (Eurofound and Cedefop 2020). It tends to consolidate at a high level, and even tends to intensify, as the results from the EWCS indicate (Eurofound 2017b). Digital communication technologies may in this regard enable a temporal equalization when they facilitate working independently of time and place and outside the regular workplace. This is the reality for about 30 percent of the EU workforce (ibid.). Other studies have found that blurred boundaries are associated with risks of a spatial and temporal dissolution of working boundaries and affect the organization of working time in relation to other aspects of life, as well as the reconciliation of work and family life (Huws 2014; Pfeiffer 2012; Lott 2014; Lott and Abendroth 2022).

Besides work intensity, complexity of work is becoming an increasingly important issue to a majority of the EU's workforce. While in all professions, 63 percent (2015) of employees say they perform complex tasks, employees in technical professions do so to a much higher degree (European Foundation for the Improvement of Living and Working Conditions waves 2000; 2005; 2010; 2015). Further common challenges for employees are solving unforeseen problems on their own (83% agreement, 2015) and learning new skills (72% agreement, 2015). In Estonia in particular one-third of employees are struggling with this and need further training to cope with their daily duties and tasks (ibid.). Over the course of the past 10 years, there has been a considerable increase in new working methods and devices used (computers, smartphones and other ICT devices). Taking an optimistic view, the complexity of work in terms of its cognitive requirements points towards positive task variation, which includes the application of creative new ways of thinking and working (Eurofound 2017b).

These results emphasize that despite greater autonomy, flexibility or creativity, employees' work–life balance is becoming a serious issue. When it is difficult to distance oneself from work due to feeling pressure to agree to constant accessibility, when working in one's free-time is necessary to meet work demands, or when one is asked to go to one's workplace at short notice the boundaries between work and the private realm are being blurred (ibid.). This requires a high degree of self-organization and self-control in terms of time use and privacy. An additional problem is working outside the usual workplace, where occupational safety and health regulations cannot be provided and controlled for by the employer (Carstensen 2015). In particular, employees describe an increased work intensity and frequent interruptions as stressful and entailing psychological risks (Lenhardt, Ertel, and Morschhäuser 2010; Baethge and Rigotti 2013). Another double-sided coin is autonomy: new working situations often require finding (new) solutions on one's own and thus learning new things. This may adversely affect older employees in particular to the extent that they 'might not benefit from their experience anymore, but are instead suffering [because of] slightly worse learning abilities and unfounded stereotypes'

(Hildebrandt, Kluge, and Ziefle 2019: 160), for example, being accused of not being interested in training or of being at a higher health risk.

When tasks change, other skills need to be applied. On one hand, changed skills are applied at the workplace because work tasks are changing. This situation also imposes changed demands on the learning and competence development of employees. Baethge-Kinsky (2020b) studied industrial companies. His findings reveal that a core set of occupation-specific tasks will continue to be in demand. Alongside this, traditional workforce skills are not becoming obsolete, but are being supplemented by other skills, such as new technical skills in information technology or the ability to take a more theoretical approach to problem-solving when optimizing processes. Digitized work is almost universally associated with requirements with regard to communications and organizational skills. However, digitalized work is also strongly characterized by working in thematically linked but locally independent (global) processes. These processes are accompanied by the emergence of particular cross-disciplinary skills, such as ‘communication, cooperation, abstraction capabilities or problem-solving’ (ibid.: 11).

Informal skills are acquired informally, often unintentionally (Dehnbostel 2021). Pfeiffer (2018) emphasized that employees incorporate impressions and reflect on experiences while working and while learning. This is confirmed by ethnographic observation of how skills are applied and developed in the workplace. In addition to formal knowledge, a study by Nelson on the skills of repair workers confirms these findings by highlighting informal knowledge ‘embodied in heuristics, work styles, and contextualized understanding of tools and techniques’ (Heckman and Kautz 2013: 31). Skills are subject-specific and individual. They enable people to act and to develop further. Because skills can be shaped and changed with socialization and through instruction, schooling is a central arena for the acquisition of skills. Besides that, family background, the social environment and work experience also have central roles in shaping skills (ibid.). With regard to vocational training, education takes place at workplaces and during internships. Informal skills are also acquired in this way. The application and utilization of different skills at work has always been a fairly routine matter, but it receives more attention in research. The educational stratification literature looks at skill profiles more deeply by examining their role in successful labour market placements, taking a closer look at skill demand patterns and mechanisms. The present project contributes towards the recent literature in two ways: the project contributes to the social stratification literature by asking which skills (informal and formal) are relevant to employers, but it also contributes to the labour sociology literature on digitalization.

3.2.2 Theories on decision-making in recruiting processes

Hiring is a decision-making process under conditions of uncertainty. To understand employers’ concrete decisions with regard to one applicant or another, one has to examine the significance of search costs and information in the recruitment process. This chapter explicates the theoretical concepts related to employers’ decision-making in formal recruiting processes on the basis of applicant criteria.

Human capital theory (Becker 1964) is based on the assumption that individual action involves a rational choice between alternatives, based on appropriate calculations and adequate information. Understood as an ideal-type, the underlying model of *homo economicus* is capable of unrestricted rational behaviour. Decision-making comprises rational consideration and weighting of alternative courses of action, as people supposedly strive for the highest benefit for the lowest cost or effort. The driver here is a person's desire to maximize the benefits available in each case (Brüsemeister 2013). This consideration is situation- and context-specific. However, awareness of possible alternative actions and complete information are necessary in order to sort preferences logically, keeping them consistent with the aim of maximization. Hence, an actor's decisions are subjectively rational, appropriate in terms of how that actor sees the world, but not necessarily objectively rational (Becker 2017).

Simon (1955) strongly criticized this conception of humans as fundamentally rational agents. In his perception, humans have relatively bounded rationality that limits presumably rational decision-making. He accorded more importance to changing economic and living environments and prosperity as the scope for economic action widens. A lack of transparency and the existence of uncertainty in a complex reality overtaxes individuals, so they may only grasp parts of it. Using a satisficing strategy, individuals do not maximize but seek relief by limiting their search for information at any particular time. When it comes to recruiting, the employer does not just keep on searching for other applicants but at a given point starts a selection process between applications received so far (Berlignierie and Erdsiek 2012).

This perspective underlines people's cognitive limitations and their inability to assess all relevant information in a complex environment. This becomes even more central in digitalized environments, in which the internet has reduced the cost of obtaining information, but the sources and quantity of data have increased exponentially. This means that people are not able to act in accordance with perfect rationality (Campitelli and Gobet 2010). Instead, decisions are taken on the basis of adequacy and in terms of whether an alternative is satisfactory or not. We can deduce that employers, in their recruiting procedures, adopt criteria to rationalize selection decisions.

But what criteria do employers use and how? As for the main target group for recruitment, VET graduates, the information problem is amplified. Although there is a great need for them, labour market entrants represent a fundamental and widely discussed problem for corporate recruiting. Companies have limited information and hence a narrow range of assessment criteria because such potential employees lack labour market experience and have fewer specific skills (Dietrich 2015). The information asymmetry is higher with regard to labour market entrants than other employee groups (Humburg and van der Velden 2015; Bills, Di Stasio, and Gërxhani 2017). This makes it even more challenging to detect and deduce markers for productivity and suitability and leads recruiters to work with the sources of information that are most easily available in the formal application materials provided by labour market entrants, which derive from their education.

Table 2: Selected theories and mechanisms of education within the recruiting process

Perspective	Theory	Mechanism
		Productive capacities
Skills	Human Capital Theory	Education as provider of productive skills
		Education as positional good
Institution: Education System	Screening Theory	Education as a signal for plausible productivity
Job	Job Competition Model	Education as signal for future trainability
		Closure mechanisms
Institution: VET System	Social Closure Perspective	Education as an entry ticket (occupational closure)
Organization	Imdorf's Multiple World Perspective	Multiple criteria as signals for suitability (social closure, productive capacities and workplace culture)

Sources: Solga 2005; van de Werfhorst 2011; Di Stasio and van de Werfhorst 2016.

Table 2 overviews key micro-level theories that explain employers' decision-making and their use of educational criteria. They reveal the underlying mechanisms by which different aspects and perceptions of education determine chances of success in the recruitment process and hence employment opportunities. The literature distinguishes between different educational mechanisms: education as an indicator of productive skills, education as a positional good, and education for social or occupational closure. These selected theories with their respective mechanisms are introduced in what follows.

Education as a signal of productivity

Education provides a signal of productivity. This is based on human capital theory and explains how education is used as a signal within the recruitment process (see Table 2). The focus lies on skills: schooling produces skills and abilities that employers regard as relevant to job performance (Becker 1964). On one hand, achievement and income level depend on how much someone has previously invested in their general and specific human capital through the successful attainment of educational qualifications and work experience. On the other hand, achievement also depends on how much an employer is willing to invest in an employee's human capital. A person with higher educational qualifications and specific work experience is expected to perform better than someone with a lower level of education and only a little work experience. Education is a determinant of labour market chances when – as suggested by human capital theory – the acquired skills serve the recruiter as an indicator of whether an investment in an employee is likely to pay off and under what conditions. Employers therefore reward different levels of skill. These differences more or less directly determine labour market attainment because it is rational for employers to prefer a person with higher qualifications than someone with lower because higher productivity can be assumed. Similarly, it is reasonable for people to invest in their human capital. Here, education reflects processes of institutionally based schooling and educational socialization that determine individual human capital. Observable attained educational qualifications and work experience provide recruiters with a measurable indicator of educational achievement.

Differences in employment chances are, in these terms, a consequence of individual educational efforts in schooling and investments in personal human capital. They are regarded as legitimate, regardless of whether this is achieved due to the candidate's social background or 'a categorically structured evaluation and perception of educational efforts as well as structurally unequal educational opportunities' (Solga 2005: 61, author's translation). Such differences in employment opportunities are considered legitimate, without taking into account the fact that educational efforts and investments in human capital are often categorized and used as a basis for evaluation, and that structural inequalities pervade access to education. Boudon (1974) presents empirical findings that view these different returns to education as socially determined because the costs of education (for example, monetary costs) or the evaluation of educational decisions vary greatly in different social milieus. However, these latter aspects are rarely included in the analysis of employment opportunities in terms of education. Solga (2005) argues that both aspects, namely the legitimization of unequal educational opportunities and the justification of recruitment decisions, are based on the assumption that the different levels of productivity correspond to returns to education. This reinforces the view that education is a mechanism of meritocratic selection. Although the theory is fundamentally based on learning (Weiss 1995), this aspect 'is simply assumed away' (Bills 2003: 450).

Screening and signalling theory offer incremental improvements within the human capital tradition by raising awareness of information. They 'focus on the ways in which schooling serves as either a signal or filter for productivity differences that firms cannot reward directly' (Weiss 1995: 134). Both theories find that the incompleteness of information on the market hinders economic operations, and thus has an effect on rationality in decision-making. For employers acting under uncertainty and a lack of information, this means incurring costs to actively obtain applicant information (screening). This is in contrast to what signalling theory envisages, namely individuals actively providing relevant information on necessary market signals. The difference between screening and signalling is mainly that in screening, the employer reacts first, while in signalling, the individual moves first (ibid.).

Screening theory highlights the perspectives of employers. To Stiglitz (1975), screening is a mechanism by which employers try to reduce their uncertainty within recruiting situations and derive the applicant's capabilities as regards job performance. Applicants possesses information about their abilities and skills, but these remain or can remain hidden from others and the recruiter. Spence (1973) considers that employers therefore receive an image that the individual presents (signalling) and that ultimately determines the assessment. When it comes to applicants' observable characteristics information is divided into two categories, unalterable and alterable[4]: 'Unalterable attributes [e.g., sex, race or age are referred to] as *indices*, reserving the term *signals* for those observable characteristics attached to the individual that [are] subject to manipulation by him' (Spence 1973: 357, emphasis in original), for example, education. For screening, various combinations of market signals are used. Hence, these signals are associated with groups of applicants (ibid.). This means that based on group characteristics, employers utilize signals that may indicate a job seeker's potential value. For employers, the potential value of an job seeker is linked to the expectation that employees will undertake further training at low cost to the company, acquire specific skills in the workplace and demonstrate commitment and motivation.

Because signals are observed indicators that aren't tested in each case, the association of signals with (past) group performance becomes important (Solga 2005). A market signal succeeds in its objective of improving decision-making to the extent that it reflects expected individual performance. In this vein, education is used as a significant market signal in recruitment because educational achievements – among other things – are widely recognized by society as indications of potential or future productivity and occupational achievements (Riley 1976; Spence 1973). According to screening theory, education hints at potential productive capacities (see Table 2 above). A school certificate 'gives broad information about the plausible productivity of anyone holding such a qualification' (van de Werfhorst 2011: 523).

Recruiters, when relying on a variety of educational signals, use an education system's sorting and filter function (Weiss 1995). Just as in human capital theory, screening theory is based on the assumption that education is an expression of individual effort. Thus, in contrast to human capital theory, in which observable educational certificates reflect a candidate's productivity-enhancing skills gained within the education system, screening theory adds a mechanism based on the assumption that educational information not only indicates a person's learning, commitment and skills but hints towards processes of self-selection and external selection (Solga 2005). From this it follows that an applicant's years of school attendance, the type of school they attended, and the final certificates they acquired provide insights into what makes them stand out (education as positional good) to employers. Weiss (1995) puts forward the example that the marginal benefits of one further year of schooling might exceed the expected value a student might gain in terms of productivity. However, rather than the effect on productivity, it's the combined effect of one (more) year of learning with 'the effect of being identified as the type of person who has 12 rather than 11 years of schooling' (ibid.: 134) that students signal and employers screen for.

Because such information is easily accessible through the application materials, it is well suited for categorizing and grouping applicants in terms of their educational success and choices at different levels and in accordance with the formal characteristics of the education system. The basic principle of

[4] In sociology, this distinction is more commonly presented in terms of ascribed characteristics and achieved characteristics.

screening theory is that recruiters prefer candidates whose signals indicate higher educational achievements over those with lower educational achievements because it is assumed that education provides information about the individual's willingness and ability to learn, but also reflects characteristics such as motivation and work virtues.[5] Accordingly, the criteria for evaluating performance within the education system correspond to those used by recruiters to assess future productivity. As Hirsch summarizes:

> Education may serve as a pure screening device or filter, through which employers identify individuals with certain qualities that the educational process tests and certifies but does not itself produce. (…) Since direct information about these attributes [intelligence, motivation, discipline; H.S.] would be extremely expensive for employers to acquire, a proxy for the information is obtained – notably in credentials of some form as evidence of the candidates' passage through the education system. (Hirsch 1977: 47 in Solga 2005)

Screening theory highlights education's sorting and filtering function by focusing on the signalling value of education. Thus, it allows us to determine applicant assessments on the basis of a broader range of signals by considering a variety of educational credentials as sources of information. This includes educational signals that are easy to detect, for instance, type of school or information about skills in the school-leaving certificate. But it also makes it possible to detect those skills that are hard to observe by the hiring company but which serve as proxies for cognitive abilities, personality, or informal skills (Hurtz and Donovan 2000; Gericke, Krupp, and Troltsch 2009). This theoretical outline of different educational signals that employers use is well suited for investigating graduates' employment chances.

However, criticisms have been raised concerning the correspondence between market signals and productivity. As screening theory puts it, it is not based on the actual observation of applicants but on assumptions. This simplifies the recruitment process and reduces the situation's complexity as it increases the employers' probability of selecting high-performing, productive individuals. However, Solga (2005) discusses such procedures as a process of social categorization: employers define groups based on various market signals and assign individuals to these groups in terms of their acquired characteristics. It thus overlooks individuals' capacities and instead uses generalizing group stereotypes. Because the group stereotype is taken to predict the applicant's performance and (future) productivity, Solga (ibid.) speaks of statistical discrimination.

Screening and signalling theory understand productivity as being constant. They do not consider within-group differences. Queuing theory (Thurow 1979) aligns with these theories in that employers' recruiting decisions are based on a probability assumption of future productive capacities – but in

[5] The assumption of equal distribution of educational chances made by human capital-based theories singles out effects arising from students' social and cultural background, and from the structural as well as institutional conditions of schooling and learning. See, for example, Boudon (1979) for the impact of social status on educational decisions, Bourdieu (2009) on the relevance of cultural capital, Sørensen (1970), Bowles and Gintis (1976) or Geißler (2005) on structural effects, or Hasse and Schmidt (2012) on institutional discrimination. Also, the achievement of informal skills is neither detached from social origin (Dörfler and van de Werfhorst 2009) nor separate from experiences and achievements in the education system (Solga 2005).

relative terms. Thurow's job-competition model puts applicants into a waiting line (labour queue) and jobs into another line (job queue) (see Table 2 above). The applicants are ordered by their educational attainment. When the two lines meet within the framework of labour demand, employers recruit those applicants first who are at the front of the queue. According to this model, when it comes to the labour queue, it isn't an applicant's absolute achievements that are crucial, but their achievements in relation to all the other applicants. This means that applicants can't be expected to fit perfectly (or absolutely). Hence, trainability is important as a predictor of future induction costs (van de Werfhorst 2011). The underlying mechanism uses education as a proxy for trainability and relates this primarily to the workplace dimension. For recruiting, this means that, even 'if schools do not teach specific job-relevant skills, they do enhance trainability, thus making the highly schooled more valuable to employers and making educational credentials a rational screen' (Bills 2003: 445f). What unites these sorting theories is that education is a suitable and rational screen for the probability that an applicant possesses particular productive capabilities. And both screening and queuing theory imply that 'education functions as a positional good' (van de Werfhorst 2011: 524).

Because screening theory relies fundamentally on information from educational institutions, Miller and Rosenbaum (1997) take up this issue. They ask, somewhat sceptically, whether employers put their trust in particular sources of information, such as educational institutions, or merely rely on their social contacts (for example, referrals or networks) to obtain applicant information. They argue that such assumptions and inferences about reductions in individual productivity overlook the many complex social aspects and social relations that may contribute to economic success.

Education as an entry ticket

The theories of applicant selection presented so far assume that applicants and recruiters operate in homogeneous labour markets. However, recruiters also consider the workplace and its structuring principles. Segmentation theories stress that the 'occupational structure of job positions isn't just more important than individual educational achievement but is also logically prior to it' (Solga 2005: 78, author's translation). In this way, segmentation theories extend previous considerations on recruitment with the perspective that the requirements of a given job vacancy, and thus labour demand, can be occupationally structured. Because the corporate employment system impacts the structure of job positions, it becomes relevant for the analysis of how people are allocated to jobs. Specific requirements with regard to educational qualifications might be set and need to be considered by recruiters, depending on the labour market segment the job is in. Education, especially occupations under the aegis of VET, also functions as a kind of 'entry ticket' (see Table 2).

Segmentation theories draw attention to the fact that although corporate employment systems feature two main actors, employers and employees, their mutual relations vary. If the link between employers and employees is close, labour market relations are seen as substantially closed as opposed to flexible. On the other hand, in the case of only weak ties between employees and employers within the employment system, relations between the company and the market are more important (Köhler and Krause 2010). Doeringer and Piore (1971), considering that the links between employers and employees shape the organizational logic of work positions within a company and determine its relationship to the overall labour market. Following this logic, corporate employment systems may be distinguished from the general labour market, but are also part of it. The general labour market may be broken down into several sub-markets or labour market segments.

Doeringer and Piore (1971) introduced the 'dual labour market' hypothesis, which describes a differentiation of sub-labour markets in a horizontal perspective into internal (firm) and external (market) labour markets, on one hand, and in its vertical segmentation in terms of employment risks into primary ('good jobs') and secondary ('bad jobs') labour markets, on the other. Both types are characterized by different mobility barriers and entry patterns, and have their particular function and control systems. The predominant pattern found in the United States, for example, is characterized by a distinction between good internal (primary internal) segments and bad external (secondary external) labour market segments (ibid.). Sengenberger and Lutz extended this duality into a segmentation that comprises three predominant segmented fields: primary-internal markets, 'bad' secondary external markets, and the new category of primary-external labour market segments (1974 in Köhler and Krause 2010).

- In primary-internal labour market segments, firm-specific qualifications are usually in demand, connected to high corporate investment. Because these firm-specific qualifications are not marketable on the general labour market, it binds both sides, employers and employees, to each other. Moreover, it results in a mobility pattern that provides opportunities primarily for firm-internal upward mobility and creates certain job security guarantees. Consequently, it's not the market but organizational structures and hierarchies that determine this corporate employment system (Doeringer and Piore 1971).
- In secondary-external labour markets, also called 'everyone's labour markets' (*Jedermannsmärkte*) (Sengenberger 1987: 212, author's translation), rather unspecific knowledge and qualifications are required, namely those everyone possesses. There are fewer opportunities to acquire firm-specific knowledge with which one would have access to internal mobility opportunities. Therefore, the workforce in secondary-external segments is expected to remain in rather low-skilled jobs with low degrees of job security. This results in high degrees of mobility between companies (inter-firm mobility) and control by the market (Doeringer and Piore 1971).
- In contrast, the extended segmentation concept (Köhler and Krause 2010) considers the additional segment of primary-external markets. In this labour market segment, occupation-specific qualifications are important. They are regulated, certified and ultimately standardized by labour market institutions with the involvement of relevant actors, for example, through dual vocational training systems. These occupational qualifications correspond to structured job profiles. Due to the high degree of standardization of qualifications, mobility and career opportunities are

considered valuable for employers because switching between companies is not associated with loss of income or reputation and employers presents flexibility opportunities to downsize or increase their personnel without significant transaction costs (Köhler and Krause 2010).

Within these three types of corporate employment system, the two groups, employers and employees, have different points of reference. Employees strive to secure their subsistence, which is obtained primarily through income from labour, where the level of income, as well as its security, is essential. The reference point for employers is the availability and flexibility of employees. They often depend on recruiting new employees from the inter-firm labour market. In the recruitment process, educational credentials and labour experience are considered important for labour entry. However, their relevance in recruitment depends on the type of market segment in which the job is placed (Haupt 2012).

When it comes to recruiting new staff, two aspects are crucial. Labour market segments, on one hand, provide a horizontal, functional and occupationally based structuring of the employment system. On this basis, recruiters, when hiring for vacant job positions, consider which work segments the open positions are in, which determines the requirements related to professional profile. Professional requirements are guided partly by institutional specifications and official regulations (for example, laws on work permits and their inspection). This underlines the impact of vocational education systems in their function of providing qualifications. For applicants, this means that acquiring occupational qualifications results in good or less good chances of finding a job, depending on the labour market segment. Hence, the acquisition of occupation-specific qualifications is also seen as 'a supplier strategy that exploits the market power gap between qualified and unqualified suppliers of the former – whereby employers determine which qualifications are power-relevant by defining their jobs in terms of qualifications' (Solga 2005: 83, author's translation).

Secondly, particular labour market segments may be characterized by a vertical structuring of the employment system in which qualifications function primarily as an organizational principle. In this sense, educational certificates are also attributed a symbolic meaning, not just a functional one. Through the licensing of professional positions, in which various labour market and employment institutions are involved, educational certificates become 'symbols of formal entry requirements' (ibid.: 84).

Recruitment decisions are therefore thematized as mechanisms of social closure, in terms of which the assignment of professional positions is symbolically mediated. With reference to Max Weber, closure occurs when a rule specifies which actor is granted exclusive access or receives privileges due to a given resource and based on their membership of a group. An occupational qualification is a suitable resource that provides access to such associated professional positions (Haupt 2012). Whether such occupational closure is based on formal recruiting rules – for example when there are official licensing laws (lawyers, physicians), or on informal recruiting rules, which instead express corporate expectations and the symbolic dimension that underlies them – occupational qualifications are linked directly to the candidate

(Haupt and Ebner 2020). In situations in which there are no legal requirements for specific qualifications, recruiters engage in 'educationally appropriate' staffing (Solga 2015: 83), where homogeneity of educational background makes their recruitment decisions rational and meritocratic. For the gatekeeper, this promises legitimation (ibid.). Consequently, applicant differences, for example, in terms of education or personal characteristics, are conceptualized by segmentation theory as structural and institutional factors that help with achieving organizational targets. Education is, in this perspective, not so much an expression of individual achievement or a market signal but is treated as a formal entitlement for gaining access, in other words, as an entry ticket (see Table 2). With regard to this education mechanism, occupational credentials gained within the framework of institutionally chartered VET education are particularly important.

Criticism of the segmentation approaches described above has gathered momentum, especially since the 1990s. Such criticism emphasizes that structural changes in the labour market, especially trends towards commodification and precarious employment, produce uncertainties and call into question a stable segmentation of employment into labour market sub-systems. Köhler and Krause (2010) thus assume that segmentation is still prevalent but will become more dynamic and unstable. In this sense, the segmentation approach is well suited as a framework in which to analyse labour market entry processes of students who obtain their qualifications in the vocational training system and acquire specific occupational skills and credentials because the approach provides explanations for closure mechanisms in the labour market.

Multiple criteria as signals of suitability

Similarly, Imdorf's conception (2010) contributes to the integration of workforce characteristics, workplace relationships and the organizational infrastructure into the theoretical modelling of recruiting. He argues that the various applicant characteristics are used to try to predict not only productivity but also how they might fit into particular corporate spheres. Employers use an applicant's educational credentials or ascribed characteristics to assess the applicant's suitability (see Table 2). For this purpose, Imdorf (ibid.) developed an organizational theory of personnel selection that brings together cognitive and psychological reasoning within the human resource management literature with an analysis of organizational contexts and structures. Although the approach targets students' transitions from general schooling to apprenticeship positions during their vocational education in the dual system (in Switzerland), it contains findings that are generalisable to other transition processes, such as completing vocational education and entering the general labour market.

The central assumption is that employers try to evaluate candidates in terms of their *suitability* and fit within the company context. Candidates are recruited when they score well in three distinct dimensions, which Imdorf calls 'worlds'. According to Imdorf, these multiple 'worlds' are the core matrix of orientation in which gatekeepers evaluate candidates and on which they base their recruiting decisions. The worlds are (i) the *industrial world*, (ii) the *domestic world,* and (iii) the *project-oriented world*.

While an applicant has to be as productive as possible within (i) the industrial world (ibid.: 270), Imdorf also points towards a social connotation of productivity that highlights social relations in the workplace, and does not view productivity purely in the economic sense of individual capacity and output. He notes that recruiters are interested in finding applicants who are productive in the sense that they follow instructions and apply their capacities and skills. But it is equally important that applicants do not hinder or oppose corporate management decisions but fit well into the hierarchical structures of the company.

Beyond that, the applicant's cultural characteristics have to be in line with those of the company within (ii) the domestic world (ibid.: 271). The social network of relations within a company and the company's workforce are another core aspect of the recruiter's considerations. By knowing and respecting the interests of the workforce and integrating them into their selection decisions, recruiters are guided by the workforce's social structure. For example, cultural aspects are characterized by respecting superiors or gaining trust. This should 'guarantee conflict-free horizontal and vertical social relations in the company' (Imdorf 2012: 11). If an applicant has only a low level of cultural capital it would harm the company insofar as social conflicts could arise and disturb the climate of peace within the company (Imdorf 2010). When considering which applicant is the best social fit, the recruiter wishes to avoid possible future tensions among employees (ibid.). With regard to these essential recruiting considerations in the industrial and domestic worlds, Imdorf follows theories of vertical and horizontal mechanisms of social closure.

The project-oriented world (iii) (ibid.: 273) emphasizes relations outside the company's workforce with relevant corporate partners or customers. It describes the requirements expected of applicants with regard to customer contact or contact with partners. The applicant has to achieve a high level of actual or potential customer satisfaction. The hiring company anticipates and thus represents the customers' or clients' needs already in the recruiting stage, when the applicant's resources or requirements with regard to customer/client retention are examined. Such requirements could include 'sales-related criteria such as a pleasant appearance, "good" manners or appropriate language' (ibid: 274, author's translation, emphasis in original). The assumed performance of the candidate may contribute significantly to the success or failure of the company.

Applicants are assessed against the background of various, sometimes conflicting coordination requirements. Costs and benefits are weighed up with regard to all three 'worlds'. Recruiters, as responsible persons operating within a corporate environment, are also required to assess the candidates in terms of whether they might disturb the balance in one or all three worlds. Given the multidimensional requirements, recruiters are aware that a perfect match will probably not be found but only the most suitable in the circumstances. This approach draws heavily on entrepreneurial logic and companies' educational requirements. According to Imdorf's theory, education signals suitability within the framework of organizational logic.

On this basis and with reference to Simon (1955), recruiters base their decision-making on a candidate in terms of a satisficing strategy. Besides cost-benefit considerations, this means that recruiters act under time constraints, being exposed to uncertainty about the applicant's qualities, and the need to achieve acceptance and support for the recruiting decision among the related constituencies (workforce, management and partners), which also depends on their legitimacy in relation to these groups. Simon (1955) recognized that the company is ruled by its own internal logics which become effective during the recruiting process.

While the recruiter considers the applicant's performance in these three worlds rather than taking a single measure as central, applicants need to 'demonstrate their ability to fit into these different worlds of the company' during the different stages of the recruiting process (Imdorf 2010: 276, author's translation). Imdorf has provided empirical findings on ascriptive applicant characteristics, which indicates why people with a migration background (2010) are discriminated against, as well as because of age (2012). Information on age and migrant background is available for the recruiter in the written application materials. Because Imdorf emphasized the effects of easily accessible information, he remains rather vague on how recruiters detect information that is more hidden and which selection methods or techniques would apply in this case. The HR management literature speaks of positive experiences with methods such as personality tests, or work sample performance tests to achieve a person-to-company fit (Bowen, Ledford, and Nathan 1990). Similarly, trial work days or internships are well appreciated for the opportunities they provide to observe applicants in actual work settings and team constellations. They provide a meaningful opportunity, particularly for low-achieving young students (Solga and Kohlrausch 2013) or students with a migrant background (Krug von Nidda 2019) to prove their suitability for the company, even against the odds.

The sociological perspective in Imdorf's model makes it possible to capture the various considerations and decisions that recruitment involves in its operational reality, complexity and contradictions. The internal logic of the company, which becomes apparent when assessing applicants' suitability for the various functional dimensions, emphasises, on one hand, how their qualifications can be translated into productivity (for example, through training), but even more important is the significance of social and personal characteristics (that is, age, cultural background, social skills). It thus makes sense theoretically to stress the significance of different applicant criteria and not only one educational measure. Recruiters thus rely on several criteria which they evaluate in terms of the logic of the three 'worlds' and reach an assessment of the most suitable fit among all the candidates (see Table 2). As the focus is on education, Imdorf's approach highlights various several indicators related to education.

The corporate environment of recruitment

While labour market and personnel selection theories focus on mechanisms of graduate selection, Imdorf (2010; 2012) stresses that recruiting decisions are oriented towards the corporate sphere and its social relations. The role of the recruiter and the social relationships within the company have been investigated from a comprehensive theoretical perspective. Struck (2001), for example, supplements the theoretical considerations we have looked at so far with his concept of gatekeeping, which conceptualizes recruiters' position, role and characteristics. By considering recruiting as a gatekeeping process, it offers an opportunity to analyse the expectations formulated by companies with regard to their members, both internally and externally. Secondly, it offers the opportunity to specify the function and effects of recruiting, both at the corporate level and at the societal level as a process of social stratification. This is important when it comes to understanding why company characteristics or personal characteristics can turn out to have an impact on the recruiting process.

When companies align their recruiting strategies to resource-driven and strategic considerations (Wilz 2010), they transfer their decision-making authority to individual members of the company, mostly HR personnel, who act on their behalf. In this position, the individual stakeholder plays a particularly important role because recruiters are considered gatekeepers with regard to the vacant position. They thus determine who is granted membership of an organization. Struck (2001) is more concerned with the organizational responsibility and function attributed to these respective individual corporate members and describes their role as gatekeepers between individuals, organizations and institutions.

Gatekeeping, according to Struck, is defined as 'shaping, assessing, granting and non-granting of status continuity and transition' (ibid.: 3, author's translation). When individuals want to achieve a status change, for example, when students wish to enter the labour market and apply for a job, gatekeepers 'assess [their] claims' (ibid.: 2, author's translation). When addressing these claims, they represent specific schemes of internal organizational decision-making and perform the task of selecting from the various applicants. Their assessments are also subject to scarcity, in the sense that jobs are finite goods.

In conceptual terms, Struck therefore uses the term 'gatekeeper' to refer to situations in which a person has decision-making authority, mediating between individual and organizational responsibilities with regard to institutions and under conditions of scarcity. Corporate gatekeepers in today's differentiated societies perform a decisive function for their organizations by structuring transitions and closing 'growing gaps in uncertainty' (ibid: 6; author's translation). Following Struck, these gaps have emerged through social structuring in accordance with occupational status and access to labour market positions. In his opinion, this structuring principle has to some extent gone beyond structuring societal positions in accordance with social origin only. Therefore, selection at points of transition in such differentiated societies is functional and thus necessary.

In this context, gatekeepers are granted considerable 'scope of discretion' (ibid.: 12, author's translation), whereby they are supposed to apply the company's shared expectations with regard to objectives, profitmaking and values during the gatekeeping process. Moreover, they are supposed to consider economic, social and demographic organizational structures. Gatekeepers pursue these requirements in the interest of their company and need to comply with a number of requirements regarding their role at the intersection of individual, organization and society. They gain 'special knowledge and sensitivity' (ibid.: 17, author's translation) in handling existing uncertainties for the company. More importantly, they enable other organizational units to act on a safe basis. Consequently, their 'inner-organizational power increases with the level of relevance' (ibid.: 18, author's translation) of coping with uncertainty for the efficiency and effectiveness of the company. Hence, considerable decision-making freedoms are bound to a constant demand for legitimacy. Gatekeepers legitimize their decision-making criteria, which usually need to be accessible and transparent to other internal or external actors regarding their objective, procedural or equal distribution. In the case of recruitment decisions, open, unfilled positions are an economic risk for particular departments, as well as the company as a whole, with HR managers in particular being assigned an essential, responsible and influential position.

Summarizing, Struck (2001) emphasizes the function of gatekeeping in differentiated modern societies. He explains that HR personnel use their own criteria to assess applicants in reference to their organizational structures and constraints. They legitimize their decisions towards internal and external actors by applying these criteria. Nevertheless, normative rules influence gatekeepers' scope of discretion in a direct way, for example, in terms of laws on equal treatment with regard to personal characteristics or collective agreements, as well as indirectly, with ongoing changes in regulations.

The theoretical conception so far has engaged with the institutional context of skill formation, and this institutional environment as a framework for recruiting processes. The following section presented theories at the micro level that are related to the immediate (nearer) environment of action and motivation of the people involved. Recruitment is presented as a process based on applicant criteria and individual considerations. Moreover, we have seen that recruiting is strongly determined by organizational considerations or employment systems that structure individual action (meso-level theoretical concepts). In the next section we derive hypotheses and connect the practice and framework conditions of recruiting with aspects of digitalization.

3.3 Thematic integration and hypotheses

The preceding sections have provided an overview of the state of the art in terms of skill formation and demand, followed by theoretical considerations concerning employers' motives and recruitment criteria, as well as their corporate and institutional recruiting environments (Chapters 3.1 and 3.2). Skill shortages are closely interwoven with technological developments within the framework of the digital transformation. Therefore, the present project considers it particularly important to address the impact of digitalization in terms of the link between education and employment. The theoretical assumptions we have presented can now be integrated into a conceptualization that combines the digitalization literature with a sociological and multi-level perspective on skill formation and recruiting processes (Chapter 3.3). This section presents this conceptualization and introduces the derived hypothesis, which is approached empirically in what follows.

For the past few years, skills shortages have been a pronounced problem for recruitment in both Germany and Estonia. They affect mainly technical occupations, which are increasingly important with regard to digitalization processes (European Union Skills Panorama 2016; Eurofound and Cedefop 2020). Skills shortages mean that employers have difficulties finding talent with the right skills. Compared with other labour shortages, skills shortages mean that the substantive fit between applicant and job position is the main challenge facing candidate recruitment. This brings puts supply and demand for qualifications and skills to the fore (McGuinness, Pouliakas, and Redmond 2017).

This project aims to contribute to current research on skill shortages. The literature shows that the reasons behind skills shortages are manifold, but more attention is needed with regard to demand-side patterns. For example, recruiting difficulties or insufficient or inefficient personnel management and personnel planning are essential contributing factors. We thus have a better understanding of the skills dimension in recruiting situations, with more research diving deeper (Eurostat 2020). Also, technological change induces or amplifies structural shifts, which can result in skills shortages when development progresses faster than the skill profiles of (future) employees (Quintini 2011). On the other hand, the literature review has shown that particular skills receive greater attention in skill formation processes because digitalization requires that education systems adapt to change. It is evident from the recent literature on the causes and existence of skills shortages, however, that the digital transformation perspective has not been sufficiently studied. This highlights a significant research gap because the current transformative developments in terms of digitalization are important, irreversible and comprehensive.

Analysing digitalization as an essential contextual factor in skills shortages shows that the skill requirements for the future workforce and for firms are hard to determine. Besides the situation of employees, there is considerable uncertainty on the employers' side because they are unsure which skills they should look for in future hires. By focusing on formal and informal skills, the project aims to differentiate what employers mean when they talk of skill shortages. This is done from two perspectives because shortages concern both labour supply and demand. The project analyses different skills in relation to each other and in the context of digitalization, first, in terms of graduate skill supply (skill formation processes) and second with regard to skill demand (corporate recruiting processes).

3.3.1 Skill formation systems in the context of digitalization: hypotheses

Digitalization affects skill shortages within the framework of the shift towards a digital service economy. Task shifts in the workplace affect the skills needed to perform them. An increasing share of service tasks in occupations has accompanied this shift towards a digital service economy. It brings to the fore, on one hand, communications (via ICT tools), with consultancy services gaining importance or diversification of customer/colleague contacts and communications. On the other hand, human interaction integrates more digital technologies or human-technology interactions. It puts employees in situations in which they have to carry out more coordination and communication, participate actively, and handle process knowledge.

With changing tasks, occupational profiles are changing and directed towards digitalization developments. Because tasks and skills are closely related, this implies a new dynamic of skills application. Employees utilize both professional (formal) and increasingly informal skills (Eurofound 2018; Hirsch-Kreinsen 2014). The combination of both work-integrated and experience-based tacit knowledge and profound occupational skills gained through structural and formal education helps employees to improve their work capacities in the context of digitalization (Nies, Ritter, and Pfeiffer 2021). Such developments also concern education and, most profoundly, vocational education and training.

Within the framework of VET, clear occupational profiles are developed through regular training and curricula. Skill formation therefore establishes a particular mix of general formal skills, such as literacy, numeracy or languages, and formal occupation-specific skills, such as electronic technical skills. In addition, because VET is very practically organized and takes place in a real working context during work as a trainee or intern in the company, a range of informal skills are acquired, such as communication skills, problem-solving skills, and interpersonal skills. Informal skills are person-specific abilities and are crucial for the ability to respond to pressure for change in the current context of digital transformation and beyond. Furthermore, informal skills symbolize the adaptability of qualification systems to change. Teaching informal skills in connection with current job profiles has become important for VET in order to ensure its educational relevance for the future.

A comparison between Estonia and Germany is interesting because the two countries are recognized as prototypes for different VET systems. In accordance with the complementarity of labour market institutions and skill formation in terms of the varieties of capitalism approach, different skill systems favour the provision of different skills (Hall and Soskice 2001; Culpepper and Thelen 2004; Streeck 2011; Bol and van de Werfhorst 2011). Hypothesis H1 therefore aims to integrate what we know from the institutional architecture in which skill formation takes place with new developments with regard to digitalization. It indicates that answers are needed on the impact of digitalization on skills provision and skills use and whether the relevant country is geared up to respond to such change.

H1: Informal skills are a more significant part of vocational education and training in Germany than in Estonia.

The assumptions made in H1 are derived from the fact that the effects of digitalization are also observed within VET. VET provides skills that are directly related to the job. Skill formation takes place through highly practical learning and training. Depending on the country and its particular skill formation system, skills vary in how specialized they are. This is based on the differentiation of the VET structures in Estonia and Germany in terms of their vocational orientation and characteristics. The institutional framework in Germany incentivises companies to engage strongly in vocational training and in human capital development. As a coordinated market model (CME), strategic interaction in Germany takes place through the coordination of various nonmarket actors, such as interacting in close relationships with partners or clients or through coordinated collective bargaining within the framework of which firms are able to gain common advantages through coordination. Firms are therefore motivated to maintain social relations that foster mutual recognition and expectations. Their engagement in VET is seen in a long-term perspective as something that pays off for firms. Estonia reorganized its institutional structure after the fall of the Soviet Union and organization in terms of market mechanisms is governed by its status as a liberal market economy (LME). Its education system focuses on the provision of wide-ranging and high-quality general skills. With regard to its VET system, this is supported by its organization as a mainly school-based system. Estonia's past as member state of the Soviet Union is shown by historical legacies that remain to this day. But the active renunciation of this past is setting new standards by establishing new procedures in the field of education, which also include digitalization as a learning requirement within the VET study programmes.

However, digitalization-related change is more easily recognized in workplaces than in the education environment. Schools, in that case, often need to catch up (Cedefop 2016b). The German dual system is the predominant pattern for most vocational training schemes and is shaped by the fact that Germany is a coordinated market economy (CME). It encompasses in-house experience, and students are based at a particular company throughout their years of training. This supports the assumption that informal skills are recognized as crucial and in different working situations. Furthermore, the involvement of social partners, corporate representatives and members of relevant associations has a long tradition and is highly institutionalized. It is therefore reasonable to assume that informal skills are taught and applied through the more extensive focus on the work context in the dual system (Germany) than in school-based vocational education (Estonia) (H1).

When it comes to determining the importance of different skill categories, the analysis of skills within the framework of VET training is based on a selection of VET study programmes. Referring to selected occupations subject to vocational training, the analysis illustrates the skill training profiles of a range of informal and formal skills. Because VET is the main precondition and baseline for employees that defines what knowledge and skills must be acquired for a given occupation, it is also interesting to look at whether the learning objectives of an VET programme correspond to the skills employees really need to perform their jobs or whether there are recent signs of the impact of digitalization. We have seen that digitalization emerges in real workplace situations more quickly than it can be integrated into VET training modules or curricula. Comparing skill profiles in the same occupations between training and (self-reported) skill utilization at work might indicate further skill shifts. Therefore, the analysis of skill profiles among the workforce provides further insights into the state of skill shortages. Hypothesis H2 concerns the skills available among the workforce.

H2: When employees describe their skill profiles, informal skills are more pronounced in Germany than in Estonia.

H2 assumes the existence of country differences. Skill formation determines major components of work in terms of the type and content of occupationally relevant skills. As explained, skill formation systems differ by country, which gives grounds to assume that also the type and content of relevant skills differ by country. Because in Germany employees in these occupations are trained in the apprenticeship system, they are assumed to encounter a broad range of different skills, and also informal skills, during workplace training. Training in Estonia in a particular occupation takes place within a school-based system. Students participating in internships and studying in workplace situations experience whole years in real-work conditions. This can be assumed to generate different perceptions of informal skills. The assumption therefore connects country differences in skill formation with the prevalence of self-reported skills in the selected occupations.

3.3.2 Employers as decision-makers in digital transformation

Hypotheses on the relevance of different skills

Digital transformation, with its related task and skill shifts, represents a particularly demanding state of affairs and requires organizations to respond (OECD 2019). But employers express uncertainty about which skills and qualifications they should look for (Weitzel et al. 2020; Meyer 2019). The right skill mix among employees promises successful performance at work. The changes ushered in by digitalization mean that employers must reflect thoroughly on what activities are entailed by particular jobs, which tasks will be allocated to a job, and which skills are necessary to perform these tasks successfully. The challenge of defining a good skill mix for an open vacancy is particularly relevant in new hires because companies can more easily make workplace adjustments and try to achieve a possible match for the future and avoid any additional turnover costs (Holmstrom and Milgrom 2009; Kroszner and Putterman 2009; Warning and Weber 2018). These challenges are related to the content of recruitment requirements, which employers have to define.

Looking at the employers' perspective in the discussion of skills shortages the focus lies on their recruiting behaviour and their emphasis on particular skills in a time of digitalization. For this purpose, micro-level labour market theories (see Chapter 3.2) provide a generative framework because they capture issues of information asymmetry on the demand side and employers' reasons for acting as they do in candidate evaluation. These theories encompass a variety of explanations of how education becomes relevant during recruiting process.

The underlying assumption of the human capital theory is that students face equal starting positions and are supposed to be treated equally throughout their schooling. In this sense, progress in schooling, achieved education levels and certificates reflect individual efforts, motivation and investment. In this perspective, education functions in the recruiting process to provide productive capacities in the sense of formal and informal skills. In this context, educational signals (such as qualifications) are important market signals for recruiters because they reflect individual characteristics that are achieved rather than ascribed. It is worth noting with regard to equal educational opportunities that human capital–based theories identify a range of factors that determine educational outcomes, such as social and cultural background, structural and institutional conditions of schooling and learning, or different social status–based educational decisions. But when it comes to employers' conceptions of education the perception of education as a signal of (potential) productivity is a good starting point.

Moreover, due to the increasing complexity of jobs, the literature has found that job advertisements increasingly mention differentiated educational requirements (Dörfler and van de Werfhorst 2009). Empirical evidence shows that recruiters rely on formal and informal skills during applicant selection. This broader understanding of education encompasses the legitimacy conferred by institutions and such signals as the level and degree of general education, vocational education and training or field of study, but also skills that are not necessarily obtained through schooling but linked to it (informal skills) (Humburg and van der Velden 2015; Protsch and Solga 2015; Di Stasio and van de Werfhorst 2016; Piopiunik et al. 2018). The acquisition of informal skills is therefore particularly interesting because, according to the literature, recruitment uses informal skills as essential criteria for determining employability. However, it should be noted that informal skills are related to social origin (Dörfler and van de Werfhorst 2009) and also experiences and achievements in the education system (Solga 2005).

Clearly, employers use a broad range of educational signals when they recruit labour market entrants. If one wants to understand better what recruiters mean by job suitability or employability it is useful to differentiate between formal skills, which are strongly related to formal educational processes, such as literacy, numeracy or languages, and can easily be assessed in terms of qualifications and certificates, and informal skills, which are also related to processes of formal education but harder to identify on the basis of certificates – they include problem-solving, interpersonal skills or ICT skills. Expectations with regard to applicants on the demand side are often vague. A more detailed approach is needed to disentangle the signalling values of various skills in relation to productivity and suitability. The principles of HR management are observed to be applied equally in Estonia and Germany when it comes to basic procedures and steps in personnel selection. That's why it is assumed that recruiters in Estonia and Germany both refer to a particular range of skills within their recruiting processes. Therefore, it is assumed that such skills are market signals for education.

Hypothesis H3.1 states:

Hypothesis H3.1: Employers screen applicants using several available educational market signals during recruitment processes.

In the human capital tradition, Stiglitz (1975) argues that recruiters receive such information from applicants and rely on certain criteria to sort this information. This is important because they are subject to information asymmetries. In education, they obtain suitable market signals. Signals are a marker for changeable characteristics which are important in decision-making processes. According to screening theory, utilizing educational signals is a valuable strategy for employers because it reduces information asymmetry. Education is particularly interesting for recruiters because educational signals provide information from which they may derive a person's (potential) productivity. Education is, in this perspective, a positional good because education systems differentiate students in terms of performance and achievement, for example, through school grades or different school (set based) tracks (or streaming).

In this way, education has a sorting function. Through self-selection and external selection processes, individuals are differentiated by their educational achievements, meaning that hardworking and high-performing students also obtain high educational achievements. Moreover, education is widely recognized in its function as providing qualifications. Recruitment decisions made on the basis of such educational signals seem rational because they are meritocratic (Solga 2005). The range of these educational signals gives recruiters insights into the potential value of applicants in terms of their ability to acquire certain skills after hiring. This is likely to be increasingly important in the context of digitalization, but also provides indications of the applicant's (learning or working) commitment and motivation.

Because of the linear connection between education and expected productivity, it is rational for the employer to try to distinguish between the levels of these signals to determine which candidate is likely to be most productive. Basically, the higher the educational achievement, the greater the likelihood of future productivity (Stiglitz 1975). Because such readily available information can be categorized in terms of different levels (high, average, low, or insufficient), it is likely to be used as a group characteristic by which applicants can be sorted. Because the employer is looking for the most productive candidates, productivity is taken to be synonymous with suitability for the job position. The recruiting process therefore assesses skills as educational market signals:

Hypothesis H3.2: Recruiters rank applicants according to their educational market signals and prefer high levels over average or low levels.

Regarding educational signals that are closely related to formal schooling, we distinguish between general education (type, level, and certification) and vocational education and training (level, field of training, and certification). Especially in recruiting processes for labour market entry positions, school leaving certificates and their level are important because in most cases applicants lack work experience. In terms of VET graduates, this means that their school leaving certificates from compulsory secondary schooling and their vocational certifications from dual training (Germany) or the school-based type of training (Estonia) are key. Although in both countries, there are options for starting a vocational training programme without a prior general education certificate, the lack of an educational qualification is generally regarded as reflecting poorly on achievement, motivation, abilities, and hence (potential) productivity. With the same principle in mind (education as a positional good) and based on screening theory, an educational certificate therefore has predictive power for recruiters in relation to productivity and a candidate's suitability.

It is therefore assumed that the lack of an education certificate is a weak signal of productivity and suitability. This leads to Hypothesis H3.3:

Hypothesis H3.3: The lack of an education certificate is an exclusion criterion for recruiters because it is a weak signal of productivity.

Besides the logic of using education to predict potential productivity, the external conditions of the workplace also enter into consideration for recruiters. Depending on the labour market segment in which the job vacancy is placed, particular aspects of occupational qualifications become salient. Recruiters may reflect on the necessity and relevance of occupational qualifications (horizontal structuring of the employment system) and in terms of the qualification pattern prevalent among the workforce in this segment (vertical structuring of the employment system). This has particular relevance in professions with vocational education and training because job-specific skills are expected (Solga 2005). Education in this way functions as an occupational closure mechanism (Haupt and Ebner 2020; Damelang, Stops, and Abraham 2018). Consequently, holding a degree or qualification in the respective specialized occupational field can be considered an entry ticket to the labour market and a valuable signal of candidate suitability.

In addition, holding a qualification in the respective specialized occupational field can be considered to have symbolic character. For most VET programmes, there are no formal entry barriers or formal minimum requirements. Some training programmes can take place in different sectors, for example in the industrial sector or in craft businesses, which means that their content and certification are identical. However, the symbolic character of closure becomes apparent if recruiters orient themselves towards the vocational education certificates of other colleagues within the team.

Hypothesis H3.4: Recruiters evaluate applicants with a qualification in the corresponding occupational field as better suited than applicants with a degree in another occupational field.

So far, we have looked at education as a relevant educational signal for employers. Informal skills have received greater attention than formal education in relation to work in labour markets under digitalization. It is an aim of this project to systematically integrate digitalization processes into the empirical analysis of supply and demand for skills. We therefore focus on the importance of informal skills for recruiters. We differentiate between three kinds of informal skill: *interpersonal skills*, *problem-solving skills,* and *ICT skills*. These are seen as educational market signals that are obtained indirectly through formal VET education.

There is increasing demand for such informal skills in digitalized environments (see Chapter 2). The literature provides insights into changing workplace tasks that require a range of essential skills (Bowen, Ledford, and Nathan 1990; Gekara and Thanh Nguyen 2018; Janssen et al. 2018; Eurofound 2018, 2017b; Pfeiffer 2019; Pfeiffer and Suphan 2018). The growth in service tasks and related digital technologies is increasing the interaction and communication of previously separated working people and operational fields (Baethge-Kinsky 2020b). Employees need to gain 'overview-knowledge' (Hirsch-Kreinsen 2014: 424, author's translation) with regard to workflows and operations, in which the use of social skills is essential (ibid.). The changeability of work content and processes calls for work flexibility and, at the same time, deepened collaboration. This requires a command of problem-solving skills (Hirsch-Kreinsen 2014; Meyer 2019). Especially in relation to vocational education, informal skills are now regarded as an essential part of education. There is currently a debate about the extent to which informal skills can be made more visible and transparent in certification (Coles and Wequin 2009).

Employers' reliance on informal skills as educational signals can be explained in terms of Imdorf's organizational conception of multiple worlds (2010; 2012). His perspective enables us to understand current corporate reality, its social structure and the respective social interactions that characterize the workplace beyond an approach to recruitment that takes into account only the productivity aspect.

Utilizing informal skills is a key aspect of task performance. Although for employers informal skill capacities are important in relation to productivity in respect of coping with change in working conditions and procedures within the framework of digital transformation, productivity is not the only thing. Informal skills exist within the organization's social sphere. In this sense, education, in terms of the informal skills it passes on, constitutes a social closure mechanism.

Imdorf stresses that recruiters evaluate applicants' suitability in terms of three central dimensions within a company: industrial, domestic, and project-oriented. The requirements of each of these three spheres can contradict one another, although all applicants need to show is that they are the best possible match, not a perfect match in each dimension. For instance, it is not enough to have very good problem-solving skills but no command at all of interpersonal skills. According to Imdorf, the applicant's multiple characteristics must meet the logic and requirements of the workplace. For highly digital workplaces, indicators of the three informal skills – interpersonal, problem-solving and ICT – are assumed to be particularly useful in evaluating the applicant's fit into the three spheres.

Interpersonal skills are related to corporate structures as work organization is increasingly taking on a project-based form (Hirsch-Kreinsen 2014). The resulting flexibilization requires the negotiation and setting up (individually or team-wise) of work structures and arrangements. This ultimately requires communication and cooperation. Appropriate conduct towards other colleagues or superiors is essential to perform teamwork successfully or at least not to disturb workflows among other teams. Moreover, Meyer (2019) describes a potential for new lines of conflict within the corporate hierarchical structure when company interests are affected by digitalization, for example, with regard to more qualified employees and meeting personal needs. As for companies, they are most affected by technical or social developments, for example, conflict-free integration into the active community and loyalty to operational objectives (ibid.: 15). The digitalized work environment directs employees towards more autonomy and flexibility and gives rise to other interests and needs.

Imdorf (2010) describes a need for applicants to fit into the internal or domestic world of companies (which also affects the industrial world). Social behaviour is a matter of maintaining horizontal and vertical social relations within the company. In this vein, recruiters seek interpersonal and/or cultural skills because their aim is to fit employees into the team's social structure (domestic world) and the productive world in which management and corporate targets have to be met. This points to mechanisms of social closure. VET students have broad opportunities to intensify their interpersonal skills through compulsory internships or in-company training. Because these experiences are recognized through the issue of certificates, they represent a suitable reference for informal skills.

Problem-solving is relevant because digital transformation presents employees with work structures and processes with which they have yet to become familiar. In this context, they need to deal with new situations and, in the event of a problem, develop solutions that are targeted and, in some cases, achieved independently. Problem-solving skills improve (cooperative) learning (Strom, Strom, and Moore 1999), but also collaboration with colleagues and partners, clients, or other target groups external to the corporate structure. This represents a valuable asset for the company, as it affects the satisfaction of partners or clients and can ultimately affect the company's performance. Within the framework of Imdorf's approach, employers look at applicants' suitability with regard to the project-oriented world also in relation to people outside company structures, who they have to be able to work with. Problem-solving is a suitable measure for determining an applicant's fit into the project-oriented world, besides the other dimensions.

The third kind of informal skill, which is related to education in a broader sense, but related to digitalization in a very narrow sense, is *ICT*. Employee surveys show that over recent decades new technologies have been constantly emerging because of continuing digitalization (Eurofound 2012, 2017b). Complementary findings observe a gradual increase in basic ICT-related skills, although a considerable number of people have yet to acquire these skills, even though they are urgently necessary for work (European Commission 2019). ICT skills comprise the use and creation of digital content based on an ability to engage with software, technical devices, or robots (European Union 2019). Because ICT skills explicitly include media literacy and the critical understanding and application of ICT, it points towards the guided and structured learning (and examination) of digital and ICT-related programmes and content within the framework of vocational education. But it also includes students' interests beyond schooling. Therefore, a good command of ICT skills can be taken as a sign of productivity across a range of occupations, especially within STEM occupations, because the tasks associated with new technologies can be performed directly without any additional training, qualification, or instruction (which saves time and money). In this way, ICT skills are an indicator with reference to Imdorf's industrial world.

We can thus see that recruiters use multiple signals of interpersonal skills, problem-solving skills, and ICT skills in relation to each other. In terms of productivity and suitability, it is assumed that the more proficient someone is in these skills the better (see H3.2). Nevertheless, applicants have to prove that they have capacities in all three skills together, and not just one. The command of all informal skills is relevant to matching workplace requirements and to mastering future workplace developments. This results in hypothesis H3.5:

Hypothesis H3.5: The lack of an informal skill is an exclusion criterion for recruiters because it is a weak signal for suitability.

When it comes to the recruitment of VET graduates, it is assumed that recruiters utilize various educational credentials and skills. An empirical investigation of recruiters' utilization of these signals is carried out in Chapter 6.

Hypotheses on the importance of the corporate recruitment environment

Looking at recruiters as actors embedded in and strongly interwoven with the corporate environment requires a closer look at the company level. With his theoretical concept of gatekeeping, Struck (2001) provides insights into the function and elements of organizational structures and describes how and why certain corporate members exert decision-making power in organizations. Decision-making authority is given to people assigned explicitly for this purpose. These are defined as gatekeepers, as they act at the interface between the individual and the organization. HR managers are therefore the relevant group for organizations when they recruit new people.

Gatekeepers are responsible for allocating scarce goods (job positions) to candidates. Gatekeepers perform this function in differentiated ('*ausdifferenziert*') societies by making judgements and conducting decision-making processes. In the case of recruitment processes, a gatekeeper assesses to whom corporate membership is to be assigned and to whom it is not. Gatekeepers depend on and are integrated into the corporate environment. They consider the company's resources, values, and ideas, which they have to implement. From Struck's approach we can deduce that recruiters act on the basis of the respective and varying backgrounds of their corporate environment and expectations.

In this regard, enterprise size is considered to be relevant. The varying capacities that companies allocate to human resource management in general and to recruiting processes in particular, are related to company size and number of employees. It has been shown that large companies with many employees have extensive inhouse-departments dealing with HR. They devote resources to strategic personnel planning and assessing future skills needs, whereas smaller companies often cannot do so due to capacity and resource constraints (Jaspers and Westernik 2008). It is therefore assumed that the corporate environment, in particular with regard to company size, affects recruiting decisions. Hypothesis H4.1 states:

Hypothesis H4.1: Recruiting decisions differ in terms of the respective gatekeeper's corporate environment, in particular enterprise size.

At the same time, gatekeepers in a company have considerable discretionary power (Struck 2001). They occupy special roles within the company's organizational structure because they have special knowledge of strategic management and special expertise. The legitimization of decisions is crucial. As long as gatekeepers are able to provide grounds for their recruiting decisions, those decisions are accepted. Gatekeepers can draw on their expertise or their experiences. These experiences may be gained through their own work experience when performing recruiting tasks or they may have special knowledge related to a particular department or the working reality of the relevant vacant position. Therefore, personal characteristics are important in determining gatekeepers' recruiting activities. Work experience underpins a gatekeeper's legitimization strategies with regard to decision-making. Gatekeepers draw on their own work experience, on their own educational background and take these into account when assessing the characteristics of the open vacancy. Therefore, hypothesis H4.2 assumes:

Hypothesis H4.2: Recruiting decisions differ in terms of the respective gatekeeper's personal characteristics with regard to work experience and educational background.

In this context, we conclude that the aim of recruitment is not only to hire young graduates 'whose knowledge, skills, and abilities (KSAs) provide the greatest fit with clearly defined requirements of specific *jobs* (...) [but also to] take into account characteristics of the *organization* in which the jobs reside (...) [as well as] characteristics of the person' (Bowen, Ledford, and Nathan 1990: 1). By keeping the focus on skills because of the importance of digitalization, but also by targeting the role and demands of recruiters, the project addresses the demand for skills comprehensively. Within the framework of a variety of internal and external requirements for vacant positions, recruiters use a range of different criteria, as we have seen in this chapter in terms of theoretical foundations and empirical findings. Because of their diversity, it seems worth taking a closer look at the relations between them and to observe which criteria are more intensely focused on by (which) recruiters with regard to potential suitability.

After explaining the research design (see Chapter 4), we shall test the hypotheses. It has been shown that digitalization affects both the demand for and the supply of skills. The results (see Chapter 5 and Chapter 6) show that skills supply and skills demand are embedded into specific institutional conditions and vary by country.

4. Research design

In this chapter we review the study's conceptualization in terms of its multilevel, comparative and methodological approach. It presents the methods used for the empirical analysis of both skill supply and skill demand in relation to the problem of mismatches in Estonia and in Germany, and also in relation to each other.

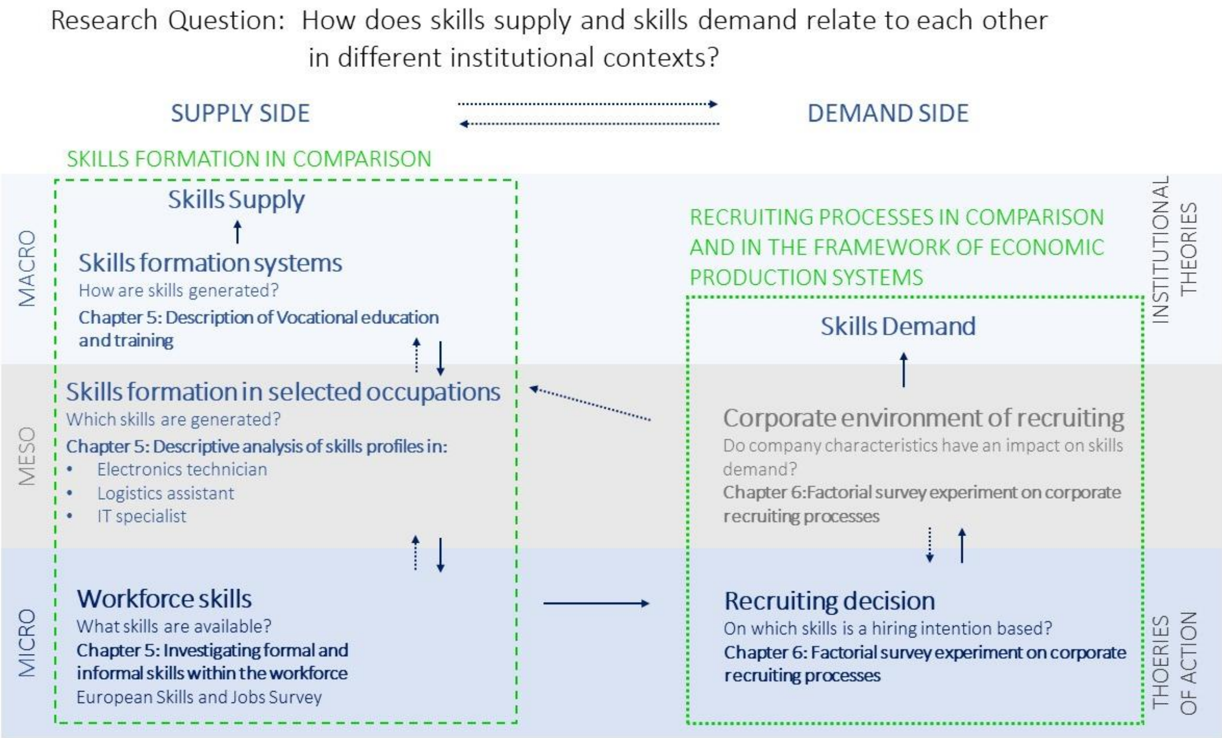
Within the framework of skill supply, the project looks at skill formation processes and highlights the establishment of skills among VET students with a view to developing the future labour force. Within the framework of skill demand, the project illustrates the employer side and approaches their strategies, structures and attitudes toward their potential employees. Applying such a research framework enables us to relate skill supply and demand to each other (research question) and to detect country-specific variations based on their institutional setup. Both sides coincide in the recruiting situation, making it meaningful as a potential step towards employment or unemployment for applicants, new personnel, or further vacancies for corporate actors. Thus, it is an essential and exemplary situation in which possible mismatches may occur.

Because the present project aims to better understand conditions and structures on both sides, we must here lay out the research methods. This is connected to our theoretical ideas. Sociological and economic micro-level theories consider corporate action and personnel selection strategies and explain strategies or motivations in theoretical terms (see Chapter 3.2). Corporate actors are discussed as gatekeepers. This perspective allows us to reflect on the multi-functionality of recruiting (individual-level, company-level) but further illustrates its societal impact and integration into country-specific institutional settings. To understand these interdependencies empirically, the undertaking takes a multi-level approach to analysis (Chapter 4.1 – Multilevel Approach). Institutional theories show that countries can be differentiated in terms of their implementation and the functions of educational and labour market institutions (see Chapter 3.1). Skill formation processes are included in a logic of complementarity between economic production and skills achievement and are connected to the supply side in that it illustrates how VET students acquire skills. This builds the general framework and context in which recruiting takes place. Estonia and Germany are observed to have created different systems of skills production. Chapter 4.2 (Comparative Perspective) illustrates the project's comparative dimensions, and Chapter 4.3 (Methodological Conception) explains how these comparisons are carried out.

4.1 Multilevel approach

A multilevel perspective implies that multiple levels of observation are considered. This is suitable for examining the influence of different attributes on individual action. Besides working with attributes that can be assigned to a single level of observation, such as individual characteristics, a multilevel approach offers the possibility to contemplate further contextual attributes of individual action. These contextual factors are drawn directly or separately from the individual level (Schnell, Hill, and Esser 2011). The project implements a multilevel approach by treating recruiting behaviour as individual action (micro-level) within the framework of corporate attributes (meso-level) and institutional context (macro-level). Figure 3 visualizes how these attributes are interrelated at the multiple levels of the project.

Figure 3: The multilevel research design



Source: Author's illustration.

The multilevel approach builds a framework for exploring micro–macro relations. In explaining individual action, causes or effects may vary between collective entities (Diaz-Bone 2006). Whether differences in skill demand emerge will be investigated by analysing different levels of explanation of action. In terms of our research interest, this requires that we analyse recruiting behaviour in order to establish the microfoundations of skills demand. This makes the multilevel approach an essential conceptual model for analysing skill formation and recruiting processes by country comparison.

Supply side: skill formation and workforce skills

The institutional context separates skill supply and skill demand likewise. Like companies themselves, corporate recruitment activities (supply) are part of an economic production system. When sourcing VET graduates, companies must rely on the skill sets provided by VET and training programmes. They are closely related to education systems, particularly skill formation. Moreover, companies are engaged in skills production processes, as the political economy literature has explained (see Chapter 2.3). In

Germany, many companies engage in VET training by offering training places within the dual system. In Estonia, companies provide training places for VET students through internships. Together with other actors and within the framework of educational regulations, they form the institutional context in which skills are produced. Therefore, a starting point of empirical investigation is the examination of different forms of skill formation in Estonia and Germany. This analysis seeks to answer the following questions: (i) how are skills generated (structures and forms of skill formation) (see Chapter 5.1)? (ii) Which skills are generated in the context of digital change and what kind of occupational profiles are there (see Chapter 5.2)? Occupations are an important point of reference in the operational context, on one hand, and a structuring principle, on the other. (iii) Which skills are available in the workforce with regard to occupations subject to training (see Chapter 5.3)? Skill formation is assigned to the supply side of skills. On the macro level, there is no direct link between skills supply and demand because the relevant actors are always located at the micro-level of analysis.

Demand side: recruiting processes

This framework, in institutional terms, provides the context for corporate action. The analysis of supply-side and country differences with regard to skills development is provided within the framework of the project's survey of corporate recruitment behaviour. In this way, the project starts to build micro-foundations. This leads to the micro-level of observation and the two groups of actors. On one hand, applicants are involved in recruiting processes as they try to find employment, and in this way, they make their capacities and skills available (skill supply). They have been studying within the context of a country's skill formation system, receiving education and training, and establishing an (occupational) skills profile which – among other things – they offer employers in the recruitment situation. Employers are involved in recruiting and evaluating those applicants who have graduated from a country's skill formation system. During the recruitment process, they express a demand for labour, including the requisite skills. Evaluation and decision-making on the merits of an applicant's profile represent individual actions within recruiting processes. Therefore, the factorial recruitment survey takes place at the micro-level. It contributes to the research question by surveying skill demand. A leading question for the analysis is which skills are essential to employers (see Chapter 6).

But recruiters aren't isolated actors. Responsible decision-makers are integrated into organizational, structural and, as explained above, institutional areas of action. For recruiters, this results in distinct roles that they need to combine and legitimize. They operate as mediators balancing 'individual aspirations, targets, attitudes and abilities, on the one hand with requirements, targets, values and/or functional constraints of organizations, as well as the social-structural and institutional framework conditions that affect them on the other hand' (Struck 2001: 26, author's translation). Therefore, it is of interest whether company characteristics at the meso-level impact skill demand (see Chapter 6).

Because recruiting decisions are highlighted in both countries, the comparative component is essential throughout the analysis on all levels of skill supply and demand. The following section outlines in greater detail how the comparative strategy is applied.

4.2 Comparative perspective

Comparative research takes the opportunity to identify (or test for) explanations or relationships which aren't studied in single-case endeavours. The project urges that we find explanations of corporate recruiting strategies (skill demand) against the background of the supply situation and the general societal environment. Moreover, the project is interested in comparing this situation in Estonia and in Germany. This requires a comparative perspective. Following Eisenstadt (1963 [in Morlino 2018: 16]), a 'comparison [involves paying] particular attention to the macro-dimensional, interdimensional and institutional aspects of society and of social analysis'. The comparative strategy adopted here includes several dimensions analogous to the multilevel approach. It is defined as a paired comparison concerning the country-specific set up of education and the labour market in Germany and Estonia.

Selection of observations

The two countries' education systems are very different. Within the framework of vocational education and training, the degree of vocational specificity is the central criterion for case selection. It is one of three often used characteristics used to describe VET systems in the comparative educational literature, besides standardization and stratification (Heisig and Solga 2015; Bol and van de Werfhorst 2011; Allmendinger 1989; Müller and Shavit 1998). Vocational specificity is a way of comparing VET systems in particular regarding their general or occupation-specific character with regard to skills and qualifications. Bol and van de Werfhorst (2011) state: 'While the prevalence of vocational education differs across education systems, there is as much variation in the specificity of the skills taught in educational programmes' (ibid.: 6). It determines the degree to which VET – and in consequence VET study programmes – are organized in terms of professions (Weil and Lauterbach 2011; Konietzka and Hensel 2017) and thus is related to how vocational education is linked to the employment system and to labour markets.

As a result, selection is based on a key explanatory variable of the research question: the institutional setting and distinctions between national skill formation systems. King, Keohane and Verba (1994) note that by selecting based on a key explanatory variable, no problems of inference are to be expected because 'our selection procedure does not predetermine the outcome of our study, since we have not restricted the degree of possible variation in the dependent variable. By limiting the range of our key causal variable, we may limit the generality of our conclusion or the certainty with which we can legitimately hold it, but we do not introduce bias' (ibid.: 137). Even though there is a relationship between the explanatory variable (skill formation) and the dependent variable (skill demand), negative design effects are avoided as selection is based on the values of the explanatory variable and 'we can control for that variable in our case selection. Bias is not introduced even if the causal variable is correlated with the dependent variable since we have already controlled for this explanatory variable' (ibid.: 137).

Furthermore, the criterion of vocational specificity highlights participating cooperation partners in terms of their involvement in and responsibility for VET students' learning outcomes (Culpepper and Thelen 2008). Comparative research emphasizes that systems of vocational education therefore need to be understood in close connection to the broader framework of political economy (Konietzka 2011), where cooperation partners for vocational education are located and in which VET systems are assigned a specific role in defining and sustaining its logic (Culpepper and Thelen 2008). Hall and Soskice (2001) explicate various connections between this institutional structure of vocational education and incentives for action – on one hand, for companies investing in training (and further education), and on the other hand, for individuals, also VET students, acquiring specific skills. However, the conditions of skill usage and opportunity structures of labour market access are also determined by these cooperation partners (Mayer and Solga 2008). With regard to evolution and implementation, it is apparent that countries have found different ways to establish (vocational) education and thus 'have developed historically quite different institutional settings for providing skills' (ibid.: 5). These differently developed structures are associated with specific advantages and disadvantages when it comes to institutional change.

Vocational specificity and its relevance for labour market entry and recruiting processes

The VET systems in both countries differ in their degree of vocational specificity. Germany provides high levels of job-specific skills within its apprenticeship system in contrast to Estonia, which follows training in vocational schools.[6] The degree of vocational specificity – measured by the number of students in the apprenticeship system (Bol and van de Werfhorst 2011), – is not intended to determine success or quality. Hence it indicates certain advantages and disadvantages for one or the other system, as elaborated below. What connects these different systems is the involvement of corporate actors to varying degrees. In the apprenticeship system, students are pupils in school and employees simultaneously. They experience learning through work to a considerable extent. Joint responsibility for education on both the public and private sides marks the strong relationship between education and the employment system. Estonia concentrates on VET schools, in which an extensive range of VET study programmes are offered. Theory is taught in the form of school-based learning, supplemented by in-school training comprising practical elements at companies or practical units at school (Cedefop and Ministry of Education and Research 2019). Vocational specificity of skills in school-based VET is regarded as lower than in other VET types because it establishes profession-related but generic kinds of vocational qualifications (Bol and van de Werfhorst 2011). Employers in Estonia often do not require specific qualifications but rather use their own criteria for hiring, as the labour market is seen as flexible (Kaldma et al. 2019). This points to a weak association between qualifications and the labour market

[6] Allmendinger (1989) distinguishes between four types of vocational education and training. Training in general schools and on-the-job training complete the typology.

and illustrates that these different skill formation systems imply a different logic of employer strategies to source employees.

Consequently, vocational education serves different functions in Germany and Estonia regarding educational allocation to the employment system. The respective historical roots and legacies of countries define how education systems are formed, what educational outcomes are achieved and how the allocation of people to employment positions takes place. Generally, Meyer stresses that schools have power as institutions that can select and allocate because 'educational allocation rules (…) give to schools the social charter to define people as graduates and therefore as possessing distinctive rights and capacities in society' (1977: 59). Moreover, he adds that it is important to reflect on allocation in the broader sense of legitimization in the sense that institutionalized education accepts the established structure of society. This relates to education systems because they classify and categorize people according to level and specialty, and thus are embedded in a process of institutionalization, as these classifications are often enforced by rules or state control (ibid.). Students are classified by attending specialized VET study programmes, which can be distinguished from other VET study programmes according to orientation and level. Overall, they can be distinguished from other school types, such as general upper secondary schools. VET study programmes thus sort students into vocational educational tracks and levels. However, the role of vocational education and educational qualifications in allocating professional positions takes on different meanings in different labour markets (Kurz et al. 2008).

This varying vertical structuring of employment opportunities must be seen in connection with specific forms of vocational training and underlines the importance of VET study programmes. In countries with an independent cross-sectoral dual vocational training system, the 'access, selection and allocation processes on the labour market are essentially regulated by occupationally structured and standardized certificates' issued by VET study programmes (Georg and Sattel 2006: 128). In addition, the ties between vocationally trained students in dual VET study programmes and the world of work are regarded as more likely to result in direct employment, with a smooth transition to jobs (Germany), than is the case in more flexible systems (Estonia) (Müller, Gangl, and Scherer 2002). The loose relationship between education and employment in post-Soviet Estonia indicates that qualifications do not necessarily secure smooth school-to-work transitions. Estonia's tremendous upheavals during the 1990s also impacted young people's labour market entry. After experiencing rather good and immediate opportunities, while being exposed to risks and instabilities, in the early 1990s, transitions may now be more extended and young people may end up in lower positions than other cohorts, thus experiencing greater vulnerability during early career stages (Täht, Saar, and Unt 2008).

Besides the vertical dimension of allocation to employment positions, VET study programmes may also be understood in terms of occupational structuring. The different economic and sociological approaches to segmentation are rooted in the assumption that the labour market overall can be broken down into several sub-markets, each of which is characterized by its own functional and control logic (internal/external), on one hand, and employment risks (primary/secondary), on the other. This duality was extended by Sengenberger and Lutz (1974). Their aim was to apply the labour market segmentation approach to occupational structures in which standardized occupational qualifications correspond to such structured job profiles (Köhler and Krause 2010). 'According to Sengenberger (1987), this type of occupational labour market (…) which recruits its future young employees via the (dual) training system, can be differentiated once again in terms of more or less closed profession-specific segments' (Protsch 2014: 83, author's translation). Applied to the VET system, this would mean that the chances of VET students being placed in accordance with their VET study programme in one of these more or less closed profession-specific sub-segments is determined by the kind of labour market segmentation predominant within a country. Estonia's labour market is structured in terms of general skills and hence externally. In occupationally segmented markets, as in Germany, occupational expertise is emphasized, achieved primarily by completing vocational education and the required VET study programme.

As described above, in dual training systems, occupations act as a structuring principle. Stronger segmentation by occupational skills is maintained than in school-based vocational training systems. This principle within dual training promises smooth transitions into employment and a good chance of inter-firm mobility at the same qualification level without loss of income within employment (Köhler and Loudovici 2008), but only if the professional specialization is appropriate. Thus, it hinders mobility between occupational fields and might disadvantage those whose vocational skills have become less relevant or even obsolete. The dual system is seen to react more slowly to rapid influxes of technology, whereas for school-based vocational training, due to a broader understanding of tasks and skills in jobs, greater adaptability is observed, which in the end enables young employees to switch occupational segments more easily (Bukodi et al. 2008).

Within the framework of training and recruiting, we observe a need to respond to incoming challenges. Skill mismatches indicate that the relationship between education and employers' needs is in tension. In terms of possible adaptability with regard to vocational education and training, the Estonian system, which is relatively dynamic, is a useful counterpart to the highly stable and solidly institutionalized state of affairs in Germany. VET study programmes play an essential role in structuring access to professional and thus societal jobs. Estonia is an even more interesting comparative case when one wishes to study skills and skills demand in the context of technological change.

The explanatory power of the comparative strategy

Our case selection criterion, namely the distinctiveness of the skill formation systems in Germany and Estonia with regard to vocational specificity, enabled us to take an international comparative perspective in this research. Accordingly, it compares maximum differences (Della Porta 2008). The choice of very different systems is very useful when it comes to developing explanations of the dependent variable, skill demand. We were able to examine countries with very different institutional environments and test equally plausible hypotheses concerning their country-specific environments. This made it possible to evaluate explanatory factors that could not have been achieved by single-case studies (Morlino 2018).

Several research projects on labour market entry processes have utilized the explanatory strength of a comparative design, but fewer have looked at the related recruitment processes. There is an extensive literature on institutional variation and its impact on labour market entry processes in a comparative perspective (most prominently, Müller and Shavit 1998; Allmendinger 1989), although their focus was mainly on western and southern European countries. However, a growing number of studies have also looked at Estonia and other recently transformed Central and Eastern European countries. These studies compared either EU countries as a whole or focused on the group of more recently joined EU Member States (Kogan and Unt 2008; Kogan, Unt, and Saar 2007; Saar et al. 2014; Fregin, Levels, and van der Velden 2020).

However, the main emphasis in the present research is the differentiation of skills (non-formal, formal) as signals of suitability for labour market entry. In this regard, there have been attempts to perform comparative studies, but again they often emphasize Western countries (see, for example Di Stasio and van de Werfhorst 2016; Piopiunik et al. 2018; Humburg and van der Velden 2015). They rarely compare country groups of western with Central and Eastern European states with a view to examining the role of institutional and educational settings that impact labour market entry and employers' recruitment processes. Saar, Unt, and Kogan (2008) called for further investigations to fill the research gap in which the focus would be on the skill dimension. Taking a recently transformed and highly dynamic country such as Estonia as an extreme counterpart to Germany, a lot can be learned about the potential for innovative societal developments that may have future viability.

Limitations

There are limitations that should be further elaborated here, however. Commonly, small-scale comparative projects look at from three to six countries rather than only two (Morlino 2018). Moreover, institutional arrangements and their development over time are very country-specific. In an attempt to assess country-specific dimensions the institutional conditions of the two countries need to be examined in detail, in theory and by empirical research. The chosen strategy of using extreme cases of the different modes of skill production may weaken the transferability of insights as the observations are exemplary of this or the other system. Despite this substantial restriction regarding generalization to other countries, however, comparing such different cases does make sense precisely to uncover how different VET systems deal with new challenges. It allows us to explore the reality of skill supply and skill demand in different skill formation systems.

The comparative analyses are carried out cross-sectionally, examining the cases at a specific moment. Data collection and analysis timeframe refer to the same periods, facilitating a synchronic comparison (Morlino 2018). The study's cross-sectional design is suitable for taking stock of the actual situation of skills supply and demand and their relations to each other. What cannot be shown are the direct effects that the technologization and digitalization of labour may have on employees' skills or employers' recruitment criteria, nor how each of these dimensions – the kinds of supply, the recruiting requirements of demand, or their relations – may have changed over time.

4.3 Methodological conception

The methodological concept establishes a framework for comparative analysis. The logic of analysis is deductive, meaning that hypotheses are derived from existing theories (Baur and Blasius 2014). In the stated research question – 'How do skills and skill demand relate to each other in different institutional contexts?' – the dependent variable (relation) is multi-dimensional. Therefore, the relationship to be researched is first broken down into its components, skills and skill demand. Necessarily, however, any project's results are gathered at the end of the project. This entails an evaluation of how skills and skill supply relate to each other in Germany and in Estonia. Once the research question has been answered for each country separately, a country comparison follows.

The relations between skill supply and skill demand are in line with the structure of the study, which, based on a multilevel design and the establishment of micro-foundations, makes use of different levels and actors for observation and comparison. In each of these analyses, the leading sub-question and objective are defined. They address the project's analytical dimensions and similarities and differences between Germany and Estonia (see Table 3). The skills supply component is targeted at its macro-, meso- and micro-levels and analysed in Chapter 5. The issue of skills supply integrates elements of the micro- and meso-levels and is explored in Chapter 6.

Table 3: Overview of the comparative dimensions and methodological conception

Observations	Estonia, Germany
Selection criterion	Skill formation system (vocational specificity)
Strategy	Comparison of very different systems

System level	**Dimension**	**Unit**	**Analysis**
Macro-level	Skill formation systems	VET systems in Estonia and Germany	Descriptive analysis
Macro-level and meso-level	Skill formation systems	VET study programmes: electronics technician, logistics assistant, IT specialist	Document analysis: criteria-based qualitative analysis Chapter 5
Micro-level	Workforce skills	Skill levels of people who graduated from selected VET study programmes	European Skills and Jobs Survey: quantitative analysis Chapter 5
Micro-level and meso-level	Skill demand: recruiting processes	Recruiting decisions on graduates from selected VET study programmes	Factorial Survey Experiment: quantitative analysis Chapter 6

Source: Author's elaboration.

4.3.1 Approach to the analysis of skill supply

In pursuit of a better understanding of skill supply in Estonia and Germany, all related levels of skill supply are targeted (macro-level, macro-meso-level, micro-level), and are analysed step by step. Descriptive methods are used to introduce systems of national skill formation and their differences (macro-level) (Chapter 5.1). Such a description provides concrete insights into structures and procedures of general skill formation in Estonia and Germany. This is based on three central indicators of education systems frequently used in comparative studies. The relevant criteria are standardization, stratification and vocational specificity. Information on their structure and outcomes is available via indicator-based educational reporting by the European Union, and the Estonian and German authorities. These are used as primary sources.

To concretize the process of skill formation, a closer look at three specific VET study programmes is beneficial. This helps us to understand more directly the different logics of the apprenticeship system in Germany, and school-based VET in Estonia. VET study programmes are the operational level at which vocational educational processes occur and where the already noted vocational specificity manifests itself. Based on the example of VET study programmes, it becomes clearer which skills are targeted in which learning structures. Out of the great variety of VET study programmes, those for electronics technicians, logistics assistants, and IT specialists were selected because of their importance in contributing to digital transformation. They make up the units of analysis of skill formation processes (Chapter 5.2). The descriptive analysis is based on theory-deduced criteria regarding relevant skills in digitalization and utilizes official educational regulations and documents on VET for the study programmes. This analysis concretizes specific skill profiles for each occupation.

With regard to the structures and content of skill production, the last analytical step in the section on skill supply is to uncover relations between formal targets for skills to be acquired via VET and skills utilized by the workforce. The analysis therefore concentrates first on identifying the workforce's occupational skills profiles (micro-level) (Chapter 5.3). The quantitative analysis targets those employees who have undergone training in the selected VET study programmes (unit of analysis). In this respect, the analysis covers different skills (formal and informal) and levels. It reflects on these to establish specific occupational skill profiles within the workforce in order to compare them with what training is supposed to achieve.

With this approach, we may illuminate how knowledge transfer in educational learning processes translates into individual skills (macro–micro link). It represents a micro-foundation on the supply side of skills. The comparative element shared by these two chapters, Chapter 5.2 and Chapter 5.3, therefore considers how skills are generated, which skills are predominantly being taught, and which skills are needed in the world of work in Estonia and Germany. The relationship between educational requirements and skill application in the workplace is discussed in Chapter 5.4. The project defines a reference period for the comparison of figures and indicators with regard to skill formation. Structurally speaking, the Covid-19 pandemic did not affect the formal structure of skill formation. The description of institutional conditions and varieties is thus still valid. However, the data on workforce skills were cross-sectionally collected and published in 2016, which means that they are a little behind the newest developments. The more recent wave of the data source for workforce skills, the ESJS, has been collected but, unfortunately, it has not yet been made accessible for scholarly purposes (see the discussion in Chapter 5.3).

Because individual skills acquisition processes are subject to a variety of formative influences, values, aspirations and preconditions, it is not the aim here to assess the effectiveness of vocational programmes in terms of individual assessment but rather to portray what employees say about the skills they use and the need for them in their current job tasks. Therefore, it aims to provide a detailed picture of the skills that predominate in the various professional fields in each country. Furthermore, it seeks to obtain more knowledge about working reality. The analyses in Chapter 5 enable us to anticipate the conditions that might be assumed necessary by employers and in working practice with regard to the demand for skills.

4.3.2 Approach to the analysis of skill demand: factorial survey experiment

Skill demand is studied in Chapter 6. The sub-question concerning which skills companies are looking for is addressed by means of a factorial survey experiment. The unit of analysis is corporate recruiting processes, specifically, their decision-making regarding different educational criteria. As in the previous chapters, it targets the recruitment behaviour that takes place in the three selected occupations. Because job matching isn't completely detached from corporate and personal experiences, the overall corporate environment and the demographic and institutional context are considered in this chapter (micro-level, meso-level). Given that skill formation is bound to other institutions by institutional complementarities, firms engage in skill production in different ways. This influences their recruiting strategies. It builds the central precondition of why it is relevant to relate skill supply to skill demand. In addition to the project aim of identifying and laying out the differences between the institutional context of digitalization in Estonia and in Germany, it makes sense to investigate differences – or alignment – between skill demand in those two countries.

The analysis of recruiting decisions in both countries focuses on employer preferences with regard to several formal and informal skills related to applicants' education, but observable in varying degrees. Usually, corporate recruitment strategies formulate expectations based on certain criteria. The analysis seeks to understand recruiters' focus on informal or formal skills when considering VET graduates' suitability. In light of the diversity of companies, recruiting takes place against the background of the 'size and skills of their workforce' (Eurofound 2015: 59), the recruiter's position in the corporate sphere, work experience, and own occupational and educational background. Therefore, it takes corporate characteristics into account (meso-level). With this approach, the project aims to study the situation of skill demand in its interrelations with decision-making and the corporate environment.

Therefore, the prevailing aim of the methodological approach is to identify skill demand patterns within the framework of an experimental set-up because data on employer recruiting behaviour, especially in the comparative dimension, are rare. Factorial surveys are a quasi-experimental method. Here, the survey is designed mainly to pursue the project's focus on skills. The approach and its application are outlined in greater detail below.

The factorial survey approach

Factorial survey experiments model situations that are familiar to the respondents but susceptible to distortions. The situation created for this analysis is a classic recruiting situation with a view to gathering cross-sectional data on hiring intentions by evaluating several applicant profiles. The strategy involves approaching corporate actors with a common task, while at the same time heeding business sensitivities. In a multilevel perspective such as this, the cross-sectional design of current recruiting behaviour makes a comprehensive study possible, thus reflecting budgetary and time constraints.

The factorial survey approach involves a method aimed at exploring social and individual judgements (Wallander 2009). Its proliferation is a response to criticisms that questionnaires and direct survey questions are often not well suited to studying human behaviour and attitudes because the requisite judgements remain rather abstract and vague to the respondents. The stimulus of concrete situations seeks to remedy this. They are designed to be 'presented to the respondents [in] as concrete and detailed [a way] as possible (…) and would more closely approximate real-life decision-making' (Alexander and Becker 1978: 93). After presenting such a situation, the respondents are asked to evaluate the conditions or express their intentions as regards action and decision-making in that regard.

A core element within a factorial survey is the 'vignette', a description of the stimulus, which might take the form of an object, situation or person. The description resembles reality but remains hypothetical, provides information on several attributes (*dimensions* as variables with different *levels* as values), and specifically characterizes the object, situation or person under study. For example, Emerson, Yancey, and Chai (2001) study the effects of race on residential living patterns. They designed the vignette, which in this case is a certain neighbourhood, and used descriptions of five different attributes: 'Checking on the neighbourhood, you find that property values are stable, the other homes in the neighbourhood are of equal value to the home you are considering, the crime rate is low, the neighbourhood is 20 percent Asian, and the public schools are of high quality.' After the vignette is presented, the respondent is asked: 'How likely or unlikely do you think [it is that] you would buy this home?' (ibid.: 925). In this way, the required judgement is operationalized within the framework of a rating task.

This strategy is advantageous as the information is given by the researcher and the respondent does not have to impute it. Together with the condition that the application of the stimulus situation is held constant over the respondent group, a certain degree of standardization is gained (Alexander and Becker 1978). Moreover, compared with purely item-based surveys, factorial surveys are more robust against distortions that might be caused by social desirability (Auspurg, Hinz, and Liebig 2009). Against these advantages, however, the hypothetical character might be problematic. The respondents' answers are based on situations in which they might feel emotionally and/or physically detached and thus depend on the respondents' imagination or experience. This involves uncertainties concerning how response patterns overlap with realistic responses (Aviram 2012). Generalizability is assumed to be limited as the given evaluations of the vignettes, especially of combinations of unrealistic or rarely occurring dimensions, cannot be translated one by one into evaluations in real situations. Although Rossi and Alves (1980), early proponents of factorial survey applications, argued in response that 'it is the judgments made of statistically infrequent combinations of characteristics that most clearly reveal the respondents' true principles of judgment' (in Wallander 2009: 507) more recent studies pay close attention to the issue of realism and exclude unrealistic combinations (Auspurg and Hinz 2015).

Despite or precisely because of the hypothetical character, social science research has utilized the possibilities arising from this method when studying subjects related to crime, law, and deviance, studying health and medical issues, or beliefs about welfare and fairness (Wallander 2009; Sauer et al. 2011; Auspurg et al. 2009; Jasso 2006; Auspurg, Hinz, and Sauer 2017; Liebig and Mau 2005). When it comes to work and employment topics, factorial surveys have been used to gain insights into organizational commitment (Porter 2001), willingness to accept job offers (Abraham et al. 2013), or employers' selection strategies (Di Stasio and Gërxhani 2015; Di Stasio and van de Werfhorst 2016;

Protsch and Solga 2015; Humburg, van der Velden, and Verhagen 2013; Humburg and van der Velden 2015; Liechti et al. 2017; Gutfleisch and Robin 2019; Fossati, Wilson, and Bonoli 2020; Imdorf et al. 2019; Maier, Mergener, and Steeg 2020). Furthermore, factorial surveys find application in studies exploring partnership behaviour, (gendered) household decisions, and mobility (Auspurg, Iacovou, and Nicoletti 2017; Schönholzer 2011; Nisic and Auspurg 2009; Abraham and Nisic 2012).

Factorial surveys are an experimental technique because the features of vignettes presented to respondents are simultaneously manipulated and vary systematically. This procedure makes it possible 'to identify how each dimension affects these evaluations or decisions and to assess the relative impact of the single dimensions' (Sauer et al. 2011: 89). Because respondents might not always be aware of which factors drive their judgment or evaluation, factorial surveys are seen as specifically appropriate to 'study the *actual* determinants – or combinations of determinants – of human judgments' (Wallander 2009: 506). The 'vignette universe' – all possible combinations of dimension levels – is defined in terms of the number of dimensions and levels. Returning to the example of a neighbourhood, which is described, for example, using four different attributes – such as quality of schools (low, medium, high), property values (declining, increasing), crime rate (low, average, high) and inhabitants (heterogeneous, homogeneous) – in this case, the vignette universe would consist of 3*2*3*2 = 36 different vignettes. If the vignette universe is too large to be fully applied, it is quite common to draw random or systematic samples. These fractionalized subsamples can be applied to a possibly small respondent sample which corresponds to several vignettes (Wallander 2009).

Using a factorial experimental design is seen to be especially suited to projects that investigate social phenomena that are otherwise hard to explore due to the sensitivity of the issues or their complexity. Asking corporate actors about their hiring practices can be a sensitive matter. Because corporate recruiting contains sensitive business information, and thus might entail the disclosure of otherwise hidden practices, 'it might be an advantage that the measured response is not a respondent's statement about past behaviour or the prevalence rate' (Dickel and Graeff 2016: 209), which might make it easier for respondents to reveal their decision-making intentions. In Armacost et al.'s (1991) empirical investigation of the comparative advantage of the scenario technique over direct questioning and the randomized response approach, the scenario method was highly rated in relation to sensitive business behaviour. It turned out to be particularly valuable on questions that address individual actions and rare events (Armacost et al. 1991). To avoid social desirability, the factorial survey approach seems a useful strategy for avoiding the strong censoring of results. In terms of external validity, deviations may emerge when looking at the answers to a factorial survey. They are related to intended and observed behaviour (Groß and Börensen 2009). With regard to employers' hiring intentions, Pager and Quillian (2005) found that certain limitations exist in predicting corporate hiring with regard to employee groups of racially stigmatized and discriminated people. This calls into question whether this method can develop suitable proxies for discriminatory behaviour. In response to these results attention should be paid to the gap between intended actions and real-world behaviour when factorial surveys are performed.

Taking these limitations into account, the procedure thus allows us to undertake measurements of multiple factors simultaneously. More precisely, it is possible to detect and isolate the effects of several independent variables on assessing a specific situation (Diekmann 2004). Within the vignettes, the random assignment of the levels of the independent variables further ensures that the factors are independent, creating internal validity. However, data collected through a factorial survey are designed very specifically for the respective experimental treatment and aren't that suitable for secondary analyses. This requires setting up a factorial survey highlighting corporate recruiting behaviour toward VET graduates in Germany and Estonia. The project serves as a further example applying a factorial survey in education and social stratification research and contributes to the further dissemination of this method.

Construction of a factorial survey experiment

The designed factorial survey is integrated into an online questionnaire. Because the project follows a quantitative approach, it tests the hypothesis derived from the theoretical background in Chapter 3 (for more details see Chapter 3.2). It derives central independent variables from screening theory (Stiglitz 1975) and employers' efforts to overcome the challenges of incomplete information. They utilize market signals to assess the applicant's potential productivity in the future. Educational signals are especially suitable for this purpose because, in the human-capital tradition, education points towards individual efforts and investment and offers predictions about a person's ability to acquire specific skills after hiring, and about their (learning or working) commitment and motivation, and provides hints about processes of self-selection and external selection.

The other mechanisms of education are also tested. The factorial survey contains information on education as an 'entry ticket' and makes use of Imdorf's notion of multiple suitability (2012) in order to obtain the results needed to test the hypotheses. This educational information is incorporated into the factorial survey by means of a set of educational variables. This is embodied in a fictitious applicant profile within the framework of a factorial survey experiment. This is operationalized by using common information provided in written applications in formal recruiting processes. Taken altogether, the information on the fictious applicant is given in six dimensions: general education, vocational education, VET study area, interpersonal skills, problem-solving skills, and ICT skills. All dimensions have a variety of levels. This gives the respondents options to differentiate between applicant profiles in terms of levels of education. After the respondents have seen the applicant presentation, they are asked for their evaluation. The recruitment decision at the first stage of the process is therefore measured by the respondent's hiring intentions (for more details on the construction of the factorial survey see Chapter 6.1).

The factorial survey is integrated in the online questionnaire, which contains standardized before and after questions to answer. Before the factorial survey module, respondents are asked a few questions about the graduate labour market. After the factorial survey module, the follow-up questionnaire inquires about characteristics of the respondents and their working environment, thus opening up important control questions. It covers the respondents' professional careers, current positions, and personal biographical and corporate characteristics. These questions are important prerequisites for the hypotheses on the corporate environment and the role of respondents as gatekeepers (see Chapter 3.2.2)

Research ethics

The factorial survey approach is an experimental method of data collection. The data obtained in this way are project-specific and designed to answer project-related research questions. This makes the collected data unavailable for secondary data analysis for other research projects. As for all data collection procedures, ethical considerations are important.

The ethical aspects of the interaction with survey participants and the survey design are especially important in experimental treatments (Oldendick 2012). The international research community is generally agreed on the importance of protecting personal rights, which not only includes protection from unethical treatment for scholarly purposes, but also the right to adequate information on the research topic and procedure. The latter is a fundamental precondition to enable the relevant experiment participants to decide independently whether they wish to participate or not. These two common principles of research ethics, protection and voluntariness, come into play at the preparatory phase of data collection. In line with the recent EU General Data Protection Regulation (GDPR) of May 2018, interested participants will be redirected to the survey only when they have read the requisite information and have given consent that their information may be used for scholarly purposes only (see Appendix B-2).

A third aspect thus refers to security precautions during and after data collection: anonymity criteria and data protection (Döring and Bortz 2016). To protect the identity of the respondents, anonymization procedures are used. Additionally, careful precautions are taken to prevent unauthorized access to data (Deutsche Gesellschaft für Soziologie 2017). After being briefed about the general outline of the study, the participants receive contact details for requests and information, as well as an opportunity to obtain an expense allowance at the end of the survey (debriefing).

Summary

This chapter has laid out how it approaches the stated research question and formulated hypotheses empirically. Taking a multilevel perspective, it approximates the relations between skill supply and demand and performs comparisons at each level and dimension relevant to both sides. Regarding the methodological approach, it has been shown that the analyses are based on sources from different backgrounds and timeframes. The primary reference points for analysis and comparison concern the situation before the Covid-19 crisis hit the whole of Europe. However, the data collection period for corporate recruiting processes (Chapter 6) had to be delayed because of the pandemic and the accompanying uncertainties for companies. It took place in Q3/2020 after the initial stabilization of the economic situation, after the so-called 'first wave' became apparent. The invitation to participate made it clear that the questionnaire is not intended to study recent changes resulting from the Covid-19 crisis, but the kind of recruitment processes that usually take place. The hypothetical situation of the factorial survey design supports this.

Given that the years 2020 and 2021 represented crisis years in many respects, and this study deals with recruitment processes under the kind of conditions that tend to prevail regardless of any crisis scenario, under normal conditions, we argue that data collection during a relatively early stage of the Covid-19 pandemic still provides useful and general impressions. Its references to statistics and documents mainly from before the crisis are considered to provide sufficient independence of any outliers caused by the crisis. Further details on the methodological procedures and data basis are provided in each analytical chapter (Chapters 5 and 6).

5. Skill supply: skill formation

What defines an occupation? In the case of occupations subject to vocational training, the core components of tasks, skills and important knowledge are discussed with the participation of educational authorities and social partners (for example, trade unions, employer organizations, or counselling boards) and are stipulated through elaborate procedures aimed at producing a particular occupational profile. This chapter illustrates how this is achieved.

Chapter 5 explicates the formation of skills within vocationally trained occupations by outlining the framework conditions, actors and structures. To that end it describes skill formation processes at the country level in Chapter 5.1 in the form of skill formation systems in Estonia and Germany. The following two chapters continue with skill formation in selected occupations. They highlight how distinctive occupational profiles are established and which skills priorities are set out in training programmes (Chapter 5.2) and in the workplace (Chapter 5.3). The occupations under study are electronics technician, logistics assistant, and IT specialist.

This has two major results with regard to the project's research question: How do the supply and demand for skills relate to each other in Estonia and Germany in the context of digital transformation? It has been explained that in both countries this relationship is marked by skills shortages and mismatches. The first contribution of this chapter is in the understanding of why and when employers speak of skills shortages. This requires an examination of the skills level of analysis. Chapter 5 contributes to the explanation of skill shortages by analysing the supply side of labour and by illustrating skill formation processes. It specifically outlines the levels and types of skills in skill formation via vocational education and training. This enhances knowledge of the preconditions of formal occupational skills profiles and levels in different countries – and is important for the evaluation of skill shortages.

Secondly, looking at different skill formation processes helps to clarify whether the reasons for skill shortages lie in the institutional structure of skill formation. Taking the supply side perspective, education systems formulate, form and express specific skills throughout their structures and procedures of education and training. In the context of digitalization, however, education often lags behind technological developments in the work context. The examination of country differences helps to clarify skill shortages because advantages or disadvantages can be identified based on country-specific institutional structures and legacies.

5.1 Skill formation systems in comparison: Estonia and Germany

European vocational education and training systems are diverse. They exhibit national traditions and pathways. Germany and Estonia represent two notably different ways in which skill formation and teaching are organized. This concerns the structure of vocational learning (dual places of learning), and responsibilities for learning outcomes (school or training company), as well as the institutional context and whatever special incentives it may provide for engaging in skill formation. Skill formation is a central means by which companies may obtain a workforce with the skills they need for their activities. Given the institutional complementarities involved in skill formation, firms engage in skill production in a variety of ways (Bills, Di Stasio, and Gërxhani 2017).

A structural and qualitative approach is taken to the comparison of the German and Estonian skill formation systems, looking at elements that are similar or different in kind (King, Keohane, and Verba 1994). To capture institutional diversities, the description of vocational education and training in Estonia and Germany is based on three main criteria: the comparative educational literature focuses on standardization, stratification and vocational orientation when classifying a country’s education system (Müller and Shavit 1998; Allmendinger 1989).

The dimensions of standardization and stratification allow us to describe critical features of the VET system within the general education system. *Standardization* reflects the provision of equal educational standards. It encompasses ‘the degree to which the quality of education meets the same standards nationwide’ (Allmendinger 1989: 233). It can be found in nationwide curricula and educational regulations, the provision of teacher training, or the uniformity of school-leaving examinations. *Stratification* describes ‘the proportion of a cohort that attains the maximum number of school years provided by the education system, coupled with the degree of differentiation within given educational levels (tracking)’ (Allmendinger 1989: 233). This dimension explains selection procedures and mobility patterns within and throughout education systems and can be observed in different school tracks or by enrolment and graduation figures and their attrition rate.

The dimension of *vocational orientation* (relevance of VET, skills specificity) in an education system allows us to reflect on the system's institutional complementarities with the labour market. Because the arrangement of and responsibility for vocational learning determine the character of skills supplied, vocational orientation is a prominent feature of skill formation processes. Vocational orientation is determined by, first, the prevalence and amount of student participation in any vocational education programme in general. This gives an impression of the provision of vocational skills (vocational orientation). Secondly, vocational specificity is measured by the number of students enrolled in a vocational training programme within the dual system. The dual system encompasses dual places of learning: students combine working in a firm and learning in school. This is said to provide students with more specific and work-relevant skills than would be the case in other forms of vocational training (Bol and van de Werfhorst 2011; Breen 2005).

5.1.1 Estonia

Education is highly valued in Estonia. Its importance can be traced back historically and Estonia may be characterized in terms of constantly high educational achievements. During Soviet rule, the Estonian education system was incorporated into the Soviet education system. In socialist Estonia in the 1970s, a coordinated vocational training system was implemented. It offered VET together with upper-secondary education or as part of post-secondary studies (Saar 2008). With the collapse of the Soviet Union and the regaining of independence in 1991, the country underwent a long series of frequent and substantial VET reforms. The former VET system was marked by inflexibility due to centralized rule. Long debates then started about providing opportunities for a larger group of VET interests. The application and negotiation process involved in accession to the European Union had a significant impact. In 2006 and 2013, the institutions of the VET system were fundamentally reformed, with substantial changes. The latest reform ended with the VET Institutions Act of 2013 (Ümarik 2015; Ministry of Education and Research 2017).

Standardization

It is worth characterizing the provision of equal educational standards, nationwide educational reforms and regulations. The VET Institutions Act of 2013 laid down new regulations regarding VET in Estonia and in conjunction with the general Estonian education system. Its outstanding achievement was to restructure the organization of VET towards a learning outcome–based system. This includes a new credit system, predefined study volumes and VET curricula, which now define learning objectives and outcomes to be achieved. These outcomes within a VET study programme are noted in two documents on vocational education and occupational standards. Occupational standards for the respective fields are to be created, approved and renewed at least every four years by an occupational council. This council consists of representatives from the employer side, the employee side, occupational associations, and the government. There are occupational standards for each of the several VET study levels. Moreover, the Institutions Act newly regulated VET training at different points in time to make up an educational journey: initial VET qualifies people for labour market entry and another (higher) level, also within the general schooling track. The continued acquisition of VET qualifications marks the (additional, job-relevant) competencies achieved so far (Cedefop and Ministry of Education and Research 2019).

The occupational standards (*Kutsestandard*) form the basis for compiling national curricula, school curricula and other training programmes in Estonia. They are also the basis for assessing students when awarding occupational qualifications. The national curricula represent the framework of the learning structure and are designed by a commission of social partners. Finally, they are approved by the Ministry of Education and Research. Schools with a training interest in a specific occupation must therefore first develop a school curriculum based on the national curriculum and then apply to the Ministry of

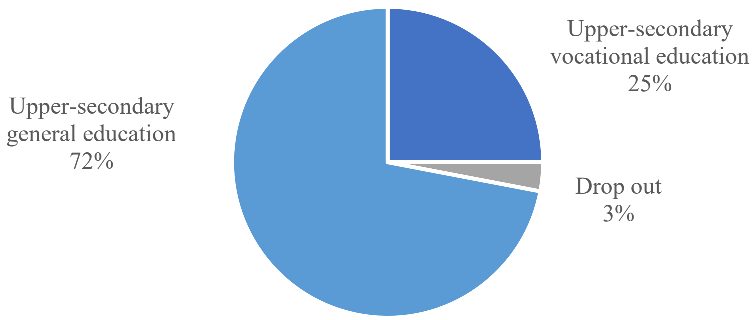
Education and Research for the right to offer training. After obtaining the relevant permission the school may offer a VET training programme, although such permission is granted mainly for a whole curriculum group rather than a single curriculum. This procedure of licensing VET curricula makes it possible to react to labour market changes and skills needs, and to assess school capacities and VET demand as curricula are valid for three years and there are annual evaluations of the placement of students in training places (Ministry of Education and Research 2017). The state owns most VET schools (2021: 81%), but the right to train is also granted to municipal (2021: 8%) and private VET institutions (2021: 11%) (Ministry of Education and Research Estonia 2021b).

The processes of curricula design and the relevant framework conditions show that in Estonia, responsibility for the overall design and funding of VET lies in large part with the state. In terms of standardization, legislative acts clearly set the structure of school-based VET and lay down the rules on how occupational standards and curricula are established. They give an idea of the kind and the number of exams, as well as defining the involvement of other labour market actors. Besides that, however, VET institutions have significant autonomy. Schools decide for themselves which VET programme they will teach and at which level. By designing their school curricula, schools also decide about the content and structure of learning, the content of learning (in accordance with the national framework curricula), and the number and timing of admissions. The given examples clearly demonstrate that standardization within the Estonian school-based VET is low. Because there is even less legislative regulation on these VET programmes that are taught within the apprenticeship system than in programmes taught within the school-based system, standardization is considered even lower (see below for more details).

Stratification

The following description of selection processes to different school tracks, attainment rates and mobility patterns illustrates the degree to which the Estonian education system is stratified. In Estonia, vocational education and training becomes an option after a long period of common schooling. Students in Estonia are educated in general schools from grades 1 to 9 for basic education (*põhikool*) (primary and lower secondary education). After grade 9, upper-secondary education continues for a further three years in grades 10 to 12. It contains a general track (*gümnaasium*) and a vocational track (*kutseõppeasutus*). Students make their first educational decision at this intersection between primary and upper-secondary education. Students are aged 16 at this point in line with the European norm (European Commission 2022b). Although it is not compulsory, nearly all students continue to upper-secondary education (see Figure 4). Dropping out of education at this stage is very rare in Estonia compared with other countries. The majority of students opt for the general track, while a quarter choose the vocational upper-secondary track (Musset et al. 2019a).

Figure 4: Educational choices after primary schooling in Estonia, 2017



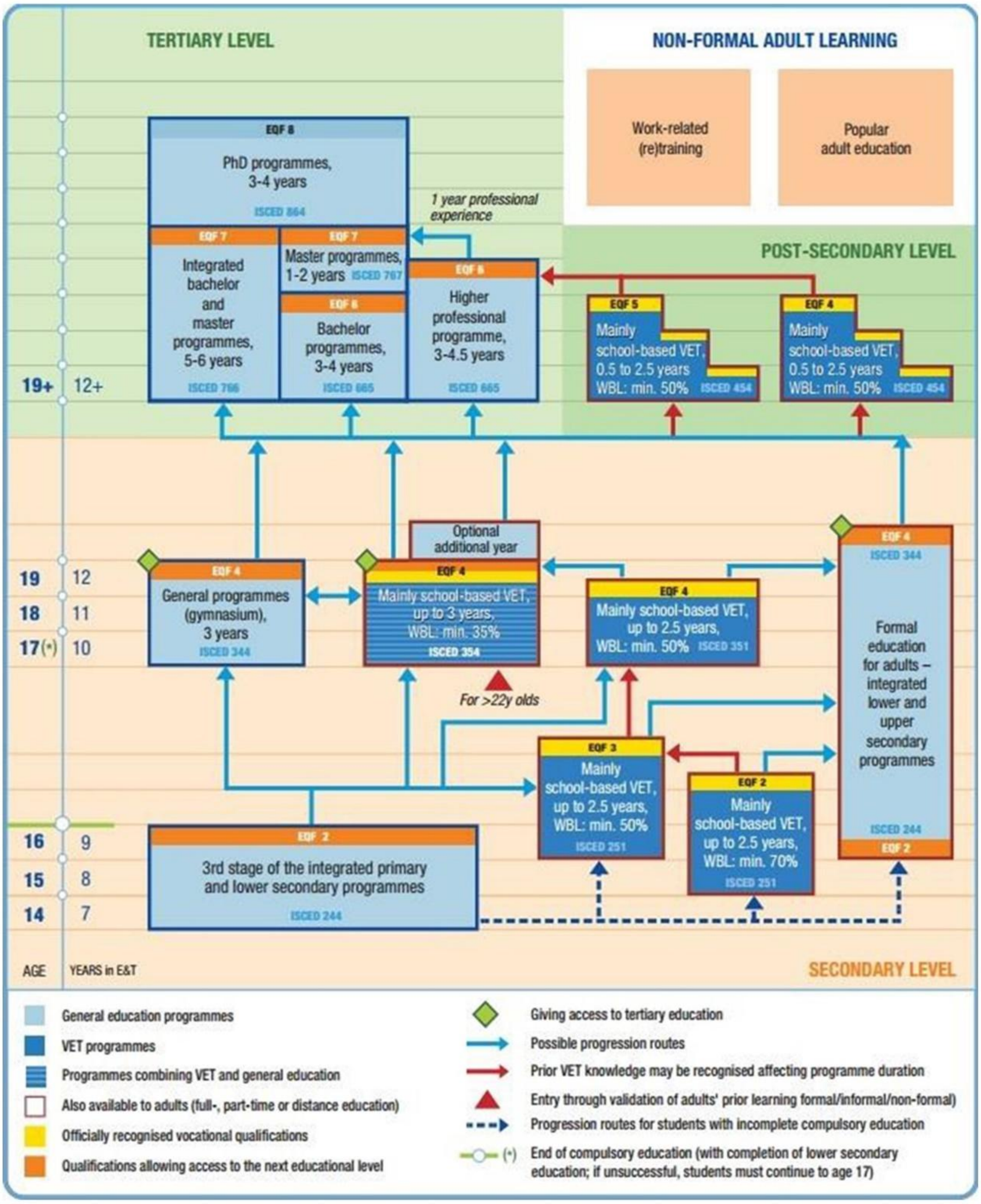
Source: Musset et al. 2019.

These educational choices lead to a comparable picture of educational attainment. There is stable high educational attainment in the country, manifested in a large proportion of people with tertiary-level certificates. Since 2011, this share has increased continuously to reach 42 percent in 2020. Graduates from upper-secondary education (general and vocational), as well as post-secondary continued programmes make up 49 percent of this. The percentage of Estonians who achieve the highest degree after compulsory schooling is very low (9%) by EU comparison (see Appendix A.1) (Eurostat 2021a).

On the vocational track (initial VET), two forms of upper-secondary vocational education are offered. School-based upper-secondary VET (*kutsekeskharidusõpe*) and company-based upper-secondary VET (apprenticeships, *töökohapõhine õpe*). School-based VET combines vocational training with an upper-secondary general education. The share of work-based learning constitutes at least 35 percent (and up to 50%) of the VET programme. Practical workshops at schools are combined with work practice at enterprises within the framework of apprenticeships. Learning within the workplace environment at the enterprise has a larger training component and makes up around two-thirds of the curriculum (see Figure 5 for more details) (European Commission 2022b).

Upper-secondary vocational students receive two qualifications on graduation: a formal educational qualification and a professional qualification that certifies the learning outcomes achieved for a particular occupation. To obtain these certificates, students have to pass a school examination and perform a research or practical project. State examinations (general graduation exams, comparable to *matura*) are not obligatory. However, VET students may want to take such exams because they may be required for higher educational institutions. After completing upper-secondary education, students enter the labour market or have several choices for continuing their educational journey. They are eligible to continue studies at higher educational levels at any institution. Their options range from further post-secondary vocational programmes (EQF level 4 or 5) to professional higher education in vocational schools or in institutions of professional higher education or training in institutions belonging to universities, as well as academic higher education after passing the state examination (EQF 6 to 8) (Ministry of Education and Research 2017).

Figure 5: VET in the Estonian education system, 2018



Source: Cedefop and ReferNet Estonia in Kaldma, Kiilo, and Siilivask 2019.

A closer look at the distribution among these educational pathways at the level of secondary education shows that most VET learners take the upper-secondary vocational schooling track (77% of VET learners in 2021). The importance of this form of VET has been steadily increasing since 2011. Other forms of VET include further options of initial and continued VET. For example, the VET programme leading towards EQF level 2 encompasses students lacking basic education or having special needs. At the moment, training content is taught mainly in a strongly practical way. Another VET programme leads to EQF level 3. It has no entry requirements and combines practical workshops at school with practical experience in enterprises. Graduates can enter the labour market or attend upper secondary school for adults to obtain educational certificates of this level. This accounts for 7% of VET learners, and their number has risen over recent years. Continued post-secondary non-tertiary VET programmes (EQF 4 and 5) offer specializations for graduates from the general or the vocational upper-secondary tracks. In 2021, this form of VET accounted for 17% of VET learners, whose significance has continuously decreased in recent years (Statistics Estonia 2021b).

The mobility patterns for VET students to the labour market or further educational pathways reveal the following: around 10% of upper-secondary vocational graduates (2016) continue studies in (professional) higher education, while 90% of graduates leave education altogether (Kaldma, Kiilo, and Siilivask 2019). Hereby it becomes clear that the VET track determines lifelong-learning mobility, which is lower than other educational tracks because admission to academic higher education institutions is based on state examinations. Hence, opportunities to continue studies are distributed unequally between VET and general upper-secondary schooling (Täht, Saar, and Kazjulija 2016). The employment rate for recent VET graduates has made good progress, increasing constantly. However, with the Covid-19 pandemic, the situation worsened: unemployment rates of VET graduates (aged 15–24) rose from 8.5% in 2019 to 15.9% in 2020 (see Appendix A.1) (Eurostat 2021c). Generally, vocational education determines the employment situation of VET students, whereby they gain lower-status employment positions than academic students (Martma 2016).

Despite this, a positive development may be observed in Estonia's problematic issue of VET dropouts. As statistics reveal, VET dropout rates have been a significant concern over recent years. The dropout risk is highest during the first year of training. This may reflect poor career counselling in basic schools (Beilmann and Espenberg 2016). Lately, the dropout rates, in particular at the level of upper-secondary VET, have decreased and the situation is improving (Statistics Estonia 2021b). This allows an overall positive picture in terms of stratification. Estonia performs well in a Europe-wide comparison of its education system, with high levels of educational attainment, student performance and available options to continue from the vocational track to general higher education. The long period of common schooling is generally considered beneficial for educational opportunities independent of family and educational or financial backgrounds.

Vocational orientation

The last dimension characterizing VET within the education system is related to the vocational orientation of the education system. In Estonia, vocational orientation remains relatively stable. As suggested by Bol and van de Werfhorst (2011), vocational orientation is characterized by student participation in any kind of VET. A helpful indicator is the number of students in VET tracks.

After compulsory basic schooling, most Estonian students continue on the general track with the prospect of attainment in academic higher education. Over recent years, a stable proportion of students – around 25% – have opted for the vocational upper-secondary track (2017; see Figure 5) (Kaldma, Kiilo, and Siilivask 2019). After upper-secondary education, around 10% of graduates change from general to vocational education and start a programme in continued VET, while the majority (52%) continue in (academic) higher education (2016). A share of 38% do not continue studies at this educational intersection (Ministry of Education and Research 2017; Kaldma, Kiilo, and Siilivask 2019). This distribution of students emphasizes that the provision of vocational skills in Estonian is at a lower level than the provision of general skills (vocational orientation).

Beyond the vocational orientation of the education system, its vocational specificity indicates a specificity of trained skills. This is measured by the number of students enrolled in the country's dual system. In Estonia, apprenticeships are possible in initial or in continued vocational education. As for every VET programme, the relevant school develops and implements a curriculum for apprenticeships in the respective training programme. During this process, an expert opinion on the programme's feasibility has to be obtained. Reasonably, a significant difference from the school-based form is the amount of training time within enterprises. This makes up at least two-thirds of the curriculum. The remaining third of the curriculum involves mainly training at the VET school. Students receive a training contract that regulates the obligations of the parties involved (enterprise, school, student), details learning and working conditions, supervision during the apprenticeship, and wages (Kaldma, Kiilo, and Siilivask 2019).

The number of apprenticeship students is a valuable indicator of vocational specificity because learning in dual places of instruction provides opportunities to experience real working situations (Bol and van de Werfhorst 2011). In Estonia, the dual system plays a minor role in the VET system. Among VET learners, the number of apprenticeship students is low (around 8% in 2020), but it has increased considerably since 2015. The vast majority of these apprentices study in programmes leading to an upper-secondary vocational qualification (EQF 4) (Ministry of Education and Research Estonia 2020). One reason for this lack of demand is that apprenticeships within the framework of this form of training have been in place since 2006.

A further reason lies in the generally low supply of apprenticeship places. Enterprises have scaled this down since the education system began to be restructured from the 1990s onwards. In the aftermath of the Soviet collapse, some sectors became obsolete. Major economic reorganizations and sectoral changes affected mainly economic sectors in which VET took place (Kogan and Unt 2008). Meanwhile, several policies were aimed at increasing the number of training places and there were attempts to increase the involvement of enterprises in training again. Such policies, for example, support the creation of additional training places. Moreover, enterprises receive transfers from the VET school offering apprenticeships (which apply for funds to the Ministry of Education and Research, again based on the school curriculum), but the details depend on the respective contract drawn up on an individual basis between the school and enterprise (Ministry of Education and Research 2017).

Within the particular form of cooperation between schools and participating enterprises in Estonia, also in the case of apprenticeships, schools are granted a wide scope of flexibility and responsibility. Standardization of training and forms of cooperation remains low. The VET schools design the apprenticeship curriculum, define the content of exams and organize collaboration with the enterprises themselves. One area of cooperation between labour market actors is the occupational qualification committee, which confers occupational titles after the exam. Besides that, cooperation, especially within the curriculum process, is 'multifaceted' in the sense that Estonia 'lacks a uniform organizational model for apprenticeship' (Kaldma, Kiilo, and Siilivask 2019: 10). Schools are free to initiate apprenticeship curricula and set the number of students they will accept. As a result, establishing an apprenticeship place also depends on the school's network with local enterprises. In the so-called company-based model, the enterprise initiates and organizes these processes. In general, enterprises lack information about their options regarding how to get involved in VET in terms of apprenticeships (ibid.).

Because the amount and form of apprenticeship training makes it possible to determine the character of skills within the country the Estonian education system provides specialized skills and strongly work-related skills at a rather low level. Flexibility in the involvement of coordination partners and training companies leads to the assessment that occupation-specific skills are not highly standardized and equally distributed within the country. Schools' flexibility means that the provision of vocational training and its quality tend to vary.

The Estonian education system thus seems to put more emphasis on the provision of general education. Moreover, in political economy terms and in terms of institutional complementarity, this means that Estonia has moved closer to a liberal market system and values rather general skills in the labour market after reorganizing from a planned to a capitalist economic system (Lane 2016). Although student VET participation rates seem to be stable, the vocational specificity of the Estonian VET system is relatively low. The figures show that Estonia values higher educational aspirations and attainment.

VET in Estonia has long been stigmatized because of its association with Soviet times. Additionally, VET was long an option for low-achieving young people and signalled poor educational achievement (Kogan and Unt 2008). However, the reputation of vocational education has been rising considerably (Eamets and Humal 2015; Kaldma, Kiilo, and Siilivask 2019). Because of the challenging demographic situation, labour migration and digitalization, the Estonian government strongly emphasizes vocational training to uphold and develop skill supply for the economy. The government has therefore launched several programmes and policies in response to the challenges concerning VET. For example, in 2015, it founded OSKA, a labour market needs monitoring and skill assessment center. The Estonian Lifelong Learning Strategy of 2020 provided a basis for further development. The New Education Strategy 2021–2035 is a subsequent education policy that considers the impact of digitalization on the labour market (Ruul and Kuuk 2020).

5.1.2 Germany

In 2000, Germany faced an education crisis, the so-called 'PISA shock'. In contrast to public perceptions, German student performance in the first international comparative survey was below average. The PISA results manifested prevalent but unaddressed gaps within the country's education system. This concerned, for example, the internationally comparatively low spending on education, missing national educational standards, or the unequal educational opportunities that strongly depend on a person's socio-economic or migrant background. Despite the introduction of education reforms and further developments in student performance, education in Germany remains in the middle, not reaching the top level like Estonia or Finland. Among other problematic aspects, the educational attainments of students with a migrant background still differ considerably from the rest of the student body. There also continue to exist gender inequalities in terms of aspirations and attainment, as well as regional disparities in accessibility and participation (OECD 2021a).

However, the longstanding tradition of vocational education in Germany contributes to the favourable reputation of German education. It also structures educational attainment. For decades now, a majority of the population have attained the highest vocational qualification (ISCED 3 and 4) (54%). The aspiration to enter higher education (ISCED 5-8) has increased over recent years (31%), but Germany still doesn't come close to the EU average. A stable share of 14% leave education at most with a lower secondary qualification (see Appendix A.1) (Eurostat 2021a). The following section describes the structure and impact of vocational education in the German education system more closely. As in the case of Estonia, the description follows the dimensions of standardization, stratification and vocational orientation.

Standardization

In Germany, the structure of institutionalized education differs not only from other countries but also within the country itself. The responsibility for education is shared among several authorities and hierarchies, most decision-making power being located in the 16 federal states (*Länder*). The 16 different education systems in these federal states have in common at least that education is hierarchically structured in terms of certificates that can be obtained in different types of school (for more details see below under 'Stratification'). In VET, the states regulate the training of the school-based parts of the system, which take place mainly in vocational schools.

National government has responsibility for the in-company training parts of study programmes. The Vocational Training Act (*Berufsbildungsgesetz*, BBiG) applies here. It contains training regulations (*Ausbildungsordnungen*) for each training programme. These training regulations specify the skills, knowledge and abilities to be acquired and set out binding conditions for training. They lead to vocational qualifications that are recognized throughout Germany. Moreover, the Vocational Training Act regulates, for example, students' wages or the suitability of out-of-school training facilities (Bundesministerium für Bildung und Forschung 2022). Accordingly, all occupations in the dual system fall under the regulations of the Vocational Training Act, with exceptions in manual vocations in accordance with the Crafts Code (*Handwerksordnung*) and also with regard to training in health care professions (Greinert 2013). In coordination with these training regulations, the federal states develop their framework curricula for the school-based parts of training, as mentioned above.

Because Germany is well known for its longstanding tradition of training within the dual system, one would assume a uniform and long established legal basis. However, such a prerequisite of standardized regulation and guidance for reasonable practicability wasn't available in Germany for decades. The first law was negotiated for over 50 years and came into force only in 1969. Since then, the Training Act has been further developed and fundamentally modernized in 2005. The current amendment came into force in 2020. Recent changes concern, for example, the introduction of a minimum wage for apprentices and three new vocational training levels. Also new is the integration of further regulations in the area of examinations, the conception of training regulations and the possibility of part-time vocational training. The context of digitalization entered the definition of training programmes within the framework of new occupational standards and the framework of aligned vocational training statistics (Bundesministerium für Bildung und Forschung 2020b). Looking at past steps in the state regulation of VET, skill formation structures have become more and more consolidated (Herkner 2009, 2018).

Regulations on additional qualifications supplement the state-recognized training regulations for initial VET programmes. These qualifications can be achieved during initial vocational training and supplement it. They are either cross-occupational or occupation-specific. In contrast to a large number of possible additional qualifications, the additional qualifications assigned and certified by the chambers offer VET trainees, in particular, attractive opportunities for upgrading their vocational training. An example of a cross-occupational qualification is the so-called 'European assistant'. It covers European commodity and business law and contains an internship abroad that lasts several weeks. 'Electrical Engineering - Industry' is an example of an occupation-specific form of this. It offers trainees the opportunity to acquire in-depth knowledge and skills in electrical engineering and networking in view of the increasingly networked working environment (Hofmann, Hemkes, and Martin 2020). Obtaining such additional qualifications might expand employment chances by widening the employment field and enhancing employability (Euler and Severing 2020). Moreover, the national employment agency offers suggestions for upskilling or entire continued training programmes for each VET programme (Bundesagentur für Arbeit 2019a).

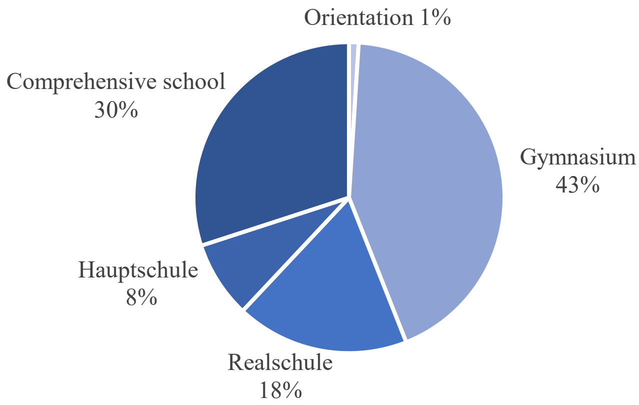
Overall, VET in Germany is marked by comparatively strong standardization of in-company training (by state regulation). The in-school parts of training are highly comparable throughout the country. Training is possible only in state-recognized occupations for which occupational training standards are provided. The support of collaboration partners is needed for such recognition. In addition, collaboration is also prevalent in further aspects of VET provision. Regulated by the BBiG, 'competent bodies' (*zuständige Stellen*) ensure the monitoring of in-company training and include members delegated from federal authorities, central state authorities and chambers. Their crucial task is to support and advise training companies, to organize and hold examinations, and to establish lists of training contracts. Each competent body has a tripartite committee comprising representatives of vocational educational institutions, trade unions and employer associations. Cooperation in the form of responsible committees and in the area of the dual system has grown over the years (Hippach-Schneider and Huismann 2019).

This is why the German dual system of cooperation is also referred to as a corporatist governance model. On one hand, the training market grants (generally) open accessibility for every interested person. On the other, training companies decide whether they will take part in training and whom they accept as trainees. However, if they train, the (state) regulations on training content apply (Greinert 2013). Although vocational schools are equally involved in VET for the school-based training parts, aspiring trainees sign a work contract only with the company providing the traineeship and thus acquire the status of an employee at the company (Granato and Ulrich 2014b). As a result, the VET system in Germany facilitates comprehensive stakeholder collaboration in many respects, as shown in curricula design, training implementation and examinations.

Stratification

Students make two educational choices before entering the German VET system. After a period of four years of common schooling in primary education (*Grundschule*), students have to decide mainly among four tracks for lower-secondary general education (*Hauptschule/Mittelschule*, *Gesamtschule*, *Realschule*, *Gymnasium*). However, it must be noted that the available school types vary between federal states. The Germany-wide overview in Figure 6 shows that the highest-level of schooling, the Gymnasium, was the most preferred in 2018/2019 with a share of 43% of all students. This number could even be higher because 'comprehensive schools' (chosen by 30%) include several types of school. This also applies to the number of Realschule pupils (18% of the total), which could be higher as the intermediate school leaving certificate (between the Abitur and the lowest level of Hauptschule) is widespread (see Figure 6). A relatively low number of students at the intersection between primary and lower secondary schooling opt for the Hauptschule (8%). The educational expansion and related higher educational aspirations after the Second World War have changed the number of students in Hauptschule. In addition, it has been observed that the increased and different selection within the education system stigmatizes lower secondary school (Hauptschule) pupils as a negative selection effect (Solga 2002).

Figure 6: Educational choices after primary schooling in Germany, 2018/2019



Source: Autorengruppe Bildungsberichterstattung 2020.

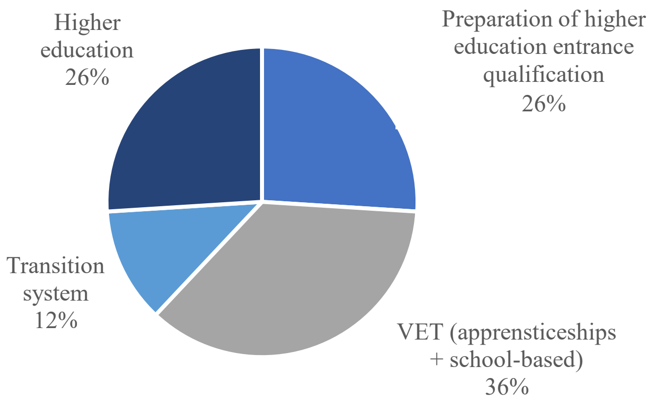
Common to all federal states is that each track contains separate curricula and prepares students for different school-leaving exams. The German education system is often called an ‘early tracking model’ (Triventi et al. 2016b: 386). Once students are distributed among these tracks, transitioning between them isn’t that common. But if transitions do occur, they tend to be characterized by ‘downward’ mobility, meaning that students change, for example, from Gymnasium to Realschule. As a counterpart to this early support, the comprehensive school is increasingly being promoted as a more integrative form of school alongside the previous three-tier school types (ibid.). Compulsory schooling at the lower secondary track ends after grade 9, when students are, on average 16 years old.

However, a characteristic of the rigidly tracked system is that general schooling ends at different stages in the educational course, depending on the track chosen. This leads to different transition periods for young people in Germany, at different ages. Students at Gymnasiums can receive their first school-leaving qualification automatically without taking any exams after passing grade 9. But most continue their upper-secondary education studies for another two to three years and take an ‘A-level’ exam (Abitur). Students enrolled in Realschule can take exams at grade 9 and leave education or take a further – and higher level – exam at grade 10. At this stage, schooling at Realschule ends. For students at Hauptschule/Mittelschule, their only option to complete their education is to take final exams at grade 9. The distribution of qualifications for 2018 shows that the preliminary trend of higher qualifications didn’t continue. Some 40% of students gained an Abitur (A-levels) which grants access to academic education, and 11% of students received a qualification that gives them access to universities of applied sciences. More than half of the students, 51%, obtained a middle level qualification, whereas 23% left with the lowest qualification (*Hauptschulabschluss*). A rise may be observed in the number of students leaving school without any lower-secondary qualification (7%) (Autorengruppe Bildungsberichterstattung 2020).

A central characteristic of this early stratification is that the school type chosen for lower secondary education strongly predicts further educational choices, chances and careers. As a result, social inequality is very pronounced in the distribution of pupils at the first educational transition. Moreover, students' educational decisions are still highly dependent on their parents' educational attainment (Solga and Dombrowski 2009; Buchholz et al. 2016).

After lower secondary education, students are confronted with their second educational decision. Figure 7 overviews the distribution of students among several educational sectors within one year. This gives an impression of the options available and chosen after secondary education (Bundesinstitut für Berufsbildung 2021a). As in previous years, the VET sector was also the most frequently preferred option in 2020 (36%). In the middle of the Covid-19 pandemic, however, VET showed an overall decline in new trainees. The shares of students in tertiary education (26%) and students preparing for their Abiturs (26%) are distributed almost equally. Students in transition make up around 12% (ibid.). Students who enter the VET system for upper-secondary education might have different educational qualifications and are of different ages. We find that it is predominantly graduates from Hauptschule/Mittelschule and Realschule aged 16 or 17 who transfer to a VET programme. However, more and more students with an Abitur also opt for a VET programme, although their qualification would permit them to enter tertiary education. The decision at this educational conjunction is again strongly connected with future educational and labour market opportunities, also because of Germany's high occupationally segmented labour market. Because students opt for specific and distinctly structured vocational training programmes or study subjects, this transition makes labour market entry strongly institutionalized. Education and the labour market are closely linked.

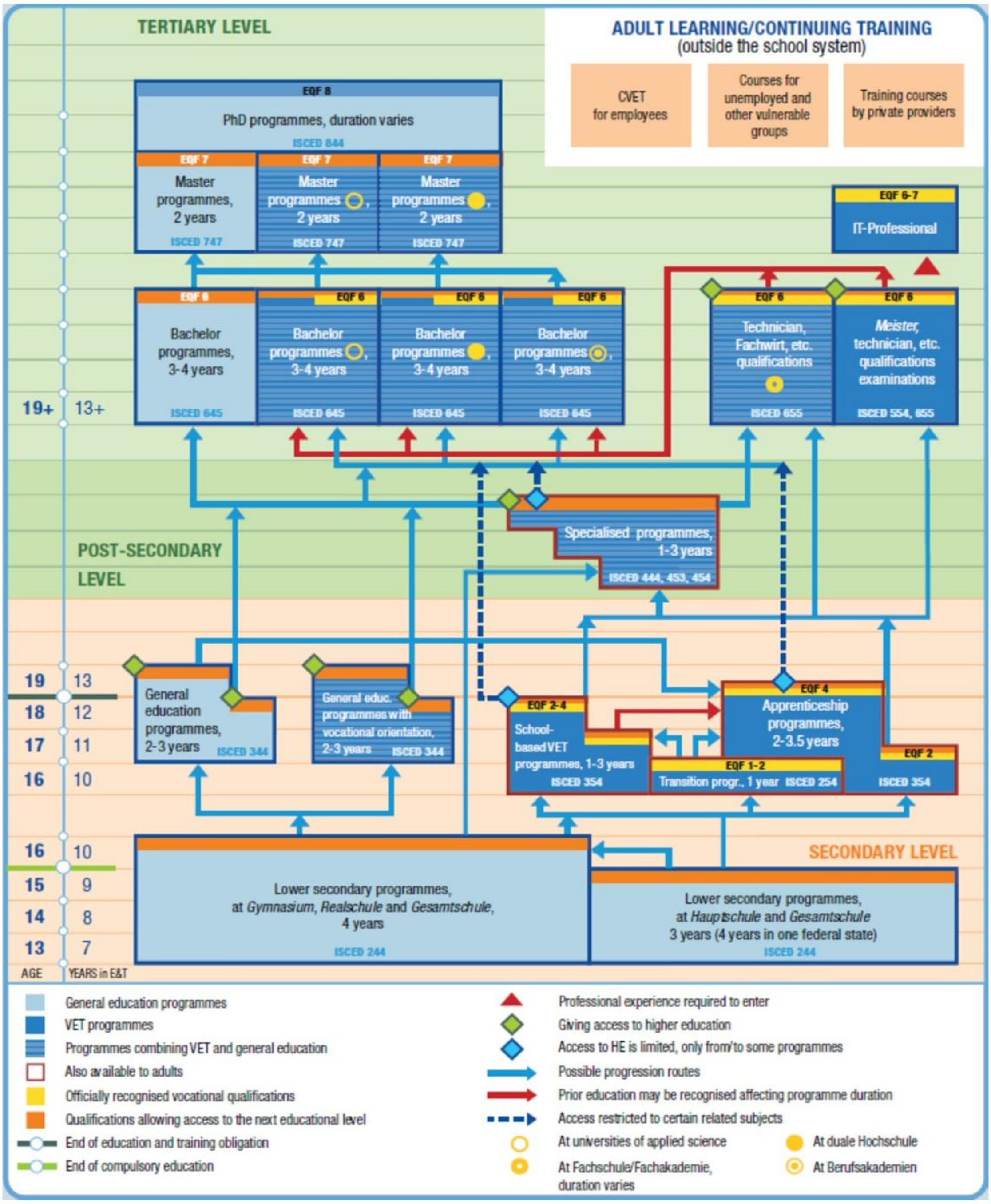
Figure 7: Students' educational choices after lower secondary education in Germany, 2020



Note: These figures provide a cross-sectoral impression of students within the education system in 2020 in different branches. Source: Bundesinstitut für Berufsbildung 2021a.

The VET system is generally divided into three parts: a school-based vocational system, apprenticeships, and the so-called transition system. The form of VET training depends on the occupational profile of training. Most vocationally trained occupations are taught as apprenticeships (64% of all trainees in 2020), whereby training in occupations in health and social work takes the form of school-based VET (28% of all trainees in 2020). A small number of other occupations are also taught in a school-based manner (8% of all trainees in 2020) (Bundesministerium für Bildung und Forschung 2021). The transition system is a preparatory segment, including several (workplace-based) training courses. Despite strong criticism of poor learning outcomes, poor student transition rates into a structured fully-qualifying vocational programme, and stigmatization due to adverse selection, the German government continues to offer these intermediate policy measures (Bundesministerium für Bildung und Forschung 2021; Kohlrausch 2012). Figure 8 details the vocational programmes and the education system in Germany.

Figure 8: VET in the German education system, 2016



Source: Cedefop and ReferNet Germany in Hippach-Schneider and Huismann 2016.

Opting for vocational training in the dual system involves the challenge of finding a training place in a company. At this first transition from school to working life, most people interested in vocational training then go through their first application and recruitment procedures, which are based on market logic and the applicant's level of certification. Observation of these first labour market transitions reveals that especially students with a migrant background and students with a Hauptschule qualification have more difficulty being accepted as an in-company trainee than others in their peer group (Diehl, Friedrich, and Hall 2009; Beicht and Gei 2015; Beicht and Walden 2014; Heisig, Gesthuizen, and Solga 2019; Kohlrausch and Solga 2012; Krug von Nidda and Söhn 2022).

The market mechanism operates primarily at the first threshold of taking up vocational training and subsequent placement in the labour market after training. With regard to the second threshold towards an employment position after the completion of VET, recent figures show that a high share of training companies take on their VET trainees (Statista 2021; Bundesinstitut für Berufsbildung 2020b). The take-up rate in 2020 was 71% and has increased in recent decades, as the company-based survey data show. This becomes clear when compared with the unemployment figures: most VET graduates have direct prospects of follow-up employment (Bundesinstitut für Berufsbildung 2020b). Around 25% of VET trainees are unemployed right after graduation but find employment opportunities with other enterprises or take different educational paths because, generally speaking, the youth unemployment rate is relatively low (4.9% in 2021, Statistisches Bundesamt 2023).

This impression belies the fact that there are persistent difficulties in Germany's vocational training system. As already explained, it is comparatively difficult for young people without a school-leaving certificate or in transition to start in-company training or to find follow-up opportunities after being trained in short-term (state-provided) qualification measures. In addition, the situation on the training market is made more difficult by matching problems among companies interested in providing training and by a declining training rate, particularly among SMEs. A further important aspect in this regard is the integration of young people with non-straightforward educational paths or of foreign origin because these young people are still found more frequently in the transitional sector or remain without a vocational training qualification (Bundesinstitut für Berufsbildung 2021a). Policy measures target precisely these aspects. One of the most prominent and widespread measures is the 'Educational Chains' initiative, which aims to promote seamless and smooth connections between school and training. The Work of Tomorrow Act (Arbeit-von-Morgen Act) is also dedicated to promoting further education in the context of structural change and providing additional support for VET. The law provides more significant support for people who have not completed vocational training, for example, by integrating a legal entitlement to funding for qualification-oriented continuing education (Bundesministerium für Bildung und Forschung 2021).

In addition to the transition to employment, there are many opportunities for vocational training graduates to continue their education. Post-secondary courses at Berufsoberschule (higher vocational college) and Fachoberschule (technical college) can lead to both a subject-specific higher education entrance qualification and the general Abitur. This opens up further opportunities to study at tertiary level, for example at universities of applied sciences, dual universities or vocational academies. Besides higher education, it is very common to achieve a tertiary-level vocational qualification (*Meister*, *Techniker*, *Fachwirt*). Because initial vocational training is highly regulated, the continuing education programmes cited here do not include specific programmes and are regulated and certified by the federal government (Hippach-Schneider and Huismann 2019).

Overall, this underlines the importance of the transition at the first threshold. A comparison with other countries shows that the German education system has high levels of stratification, as labour market placement in Germany is based on unequal opportunity structures. Access to the vocational training system depends heavily on the type of school chosen and the first educational decision is made at a very early age (Dietrich and Abraham 2018; Kohlrausch and Solga 2012).

Vocational orientation

Vocational orientation refers to the extent to which vocational skills are emphasized in comparison with general skills in the education system. The vocational orientation in Germany is strong. Compared with other forms of upper secondary education, vocational training is still a popular option among students: 36% of students registered for vocational training across all sectors in 2020 (see Figure 8). Within the VET system, the dual system is popular among vocationally oriented students: 64% of VET students were part of the dual system in 2020. Enrolment in training occupations is much higher than in school-based states. Only 36% of those interested in vocational training are trained within the school system (Bundesinstitut für Berufsbildung 2021a). Germany has high values for both indicators: firstly, the level of vocational training in contrast to general education (vocational orientation), and secondly, the level of dual training in contrast to school-based training (occupational specificity).

The basically stable spread of dual training, as in Germany, enables vocational students with special skills. In principle, students may translate such specific skills directly into labour market chances. The link between education and the labour market is close in this type of qualification system (Bol and van de Werfhorst 2011; Breen 2005). Moreover, it is linked to the structure of the labour market in general and integrates institutional complementarities. For labour market actors such as firms, participation in skill formation can be crucial – depending on the nature of the capitalist system – as it can help solve their coordination problem in securing suitable future workers. As already mentioned, companies in Germany follow this logic in that in many cases the hiring of their trained apprentices goes hand in hand with their participation in training as employees.

A closer look at the development of VET in Germany over time reveals that, particularly since 2015, the interest in VET among young people has increased, seeming to stabilize at around 35–36% by 2020 (Bundesinstitut für Berufsbildung 2020b). But the Covid-19 pandemic appears to have caused significant uncertainties and turbulence on the apprenticeship market, which will become evident in a longitudinal view over the next few years (Bundesinstitut für Berufsbildung 2022). Despite its importance, the VET system has been facing problems over the past few years that haven't been resolved. The figures presented and their development over time are often the subject of discussion. The viability of the VET system is contested by the existing lack of occupationally skilled labour, demographic change, and comparatively low interconnectivity between vocational and academic education in the context of a consolidated trend toward higher qualifications.

One central aspect is that for vocational training in the dual system, the only possibility of obtaining a training place depends on companies' decisions on whether or not they will engage in training, combined with the transition challenges for certain groups of school leavers mentioned above. Companies also make decisions concerning their capacities (number of training places). Overall, the number of companies involved was again decreasing in 2020, particularly the participation of SMEs (–2.5%). In addition, the number of training places was reduced. Explanations of these figures include the weak economy in 2020, labour market insecurities because of the Covid-19 pandemic, and the fact that in recent years companies have not been able to fill training places with young people they consider suitable. A similar pattern can be seen in the supply of qualified workers. Due to negative demographic trends, smaller age groups are entering the training and labour markets. There were fewer entries to the dual system, at –9.2% in 2020 compared with 2019. Due to negative demographic trends, smaller age cohorts are entering the apprenticeship and labour markets (Bundesinstitut für Berufsbildung 2021a). Interest in health care, education and social professions has therefore increased. The number of beginners in these professions, which are taught within the school-based vocational training system, increased (+2.7% in 2020) (ibid.). In retrospect, however, the declining number of training contracts and the increasing matching problems are nothing new. As a result, more and more people interested in vocational training are facing a lack of prospects, while training companies are left with unfilled training places.

Comparison and summary

The Estonian and German VET systems differ in many respects. The German system is more highly *stratified* than the Estonian one, and also exhibits higher levels of *standardization*. It grants VET schools more flexibility regarding VET provision, content and assessment. The *vocational orientation* is higher in Germany than in Estonia: more students in Germany than in Estonia opt for the vocational track within the education system. Table 4 summarizes this latter aspect, providing an overview of educational attainment in the two countries. In Germany, the majority undergo an upper-secondary or post-secondary non-tertiary education, but vocational education is still important. With regard to the tertiary level, academization has progressed more steadily in Estonia than in Germany.

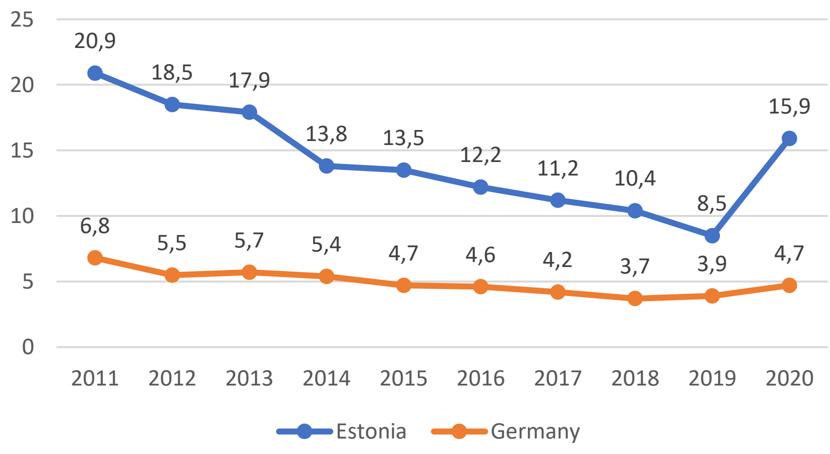
Table 4: Educational attainment in Estonia and Germany, 2011–2020 (%)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Maximum lower-secondary education (ISCED 0-2)										
EE	10.9	10	9.4	11.8	11.3	10.9	11.2	10.8	9.8	9.3
DE	13.4	13.4	13.3	13.1	13.2	13.5	13.5	13.4	13.4	14.3
Upper-secondary, post-secondary non-tertiary education (ISCED 3-4)										
EE	52.1	52.3	53.2	50.6	50.5	50.2	49.1	48.1	48.7	48.5
DE	59	58.4	58.1	59.8	59.1	58.2	57.9	57.5	56.8	54.4
Tertiary education (ISCED 5-8)										
EE	36.9	37.6	37.4	37.6	38.1	38.9	39.7	41.2	41.4	42.3
DE	27.7	28.2	28.6	27.1	27.6	28.3	28.6	29.1	29.9	31.3

Source: Eurostat 2021, Labour Force Survey lfsa_edat. Population by educational attainment aged 25–64 (%) and in ISCED-11 groups.

There are other differences in relation to the stability of vocational education in Germany as compared with Estonia. As regards the transition from school to work, the link between the VET system and other labour market institutions is important. Looking at Figure 9 and unemployment rates after graduation, we see that students in Germany find their way into employment faster than those in Estonia. Beyond economic explanations, this indicates the connectivity of the education and labour market systems. Thus institutional factors and the way different countries structure their VET systems also matter, as VET is the focus of this study.

Figure 9: Unemployment rate of VET graduates in Estonia and Germany, 2011–2020 (%)



Source: Eurostat 2021, Labour Force Survey lfsa_urgead. Unemployment rate of 15 to 24-year-olds who graduated from upper secondary and post-secondary nontertiary VET (ISCED levels 3–4).

Bol and van de Werfhorst (2011) outlined theoretically that where vocational learning takes place determines the character of the skills provided. Countries can be differentiated in terms of their institutional settings, which furnish students with skills varying in their *vocational specificity*. In Estonia, there are significantly fewer programmes with company-based learning places and the importance of apprenticeship is significantly lower than in Germany (Bundesministerium für Bildung und Forschung 2020a; Ministry of Education and Research Estonia 2020). This highlights another key aspect of vocational education and training: the role of labour market actors differs significantly between Estonia and Germany.

This difference is based on the broader institutional framework in which education is embedded. Companies acting in coordinated market economies (CME), as in Germany, become deeply involved in VET through their participation as training sites for apprenticeships. As a result, this institutional arrangement creates a framework particularly well suited to establishing specialized skills. In coordinated market economies the institutional settings introduce labour market imperfections that reduce labour turnover or compress wages and/or reduce poaching and free riding – all of these factors that make it 'safe' and profitable for firms to invest in human capital development (Culpepper and Thelen 2008: 24). For many young people in Germany, VET is a good option after graduation from school to start their further educational journey. The importance of the apprenticeship system stands out because 64% of all VET learners in 2020 were in the dual system. Students interested in dual system occupations also target technical occupations (STEM and IT professions) (Bundesministerium für Bildung und Forschung 2020a).

In contrast, institutions associated with liberal market economies (LME) discourage employers from participating significantly in skill formation. Because they coordinate around market mechanisms, the (future) workforce is incentivized to acquire rather general skills transferable to other firms or industries. VET graduates are not expected to have very specialized firm-specific skills, and companies are prepared to provide in-house preparatory job-related training (Eamets and Humal 2015; Lane and Myant 2007; Lane 2016). In addition, the involvement of companies in vocational education and training in Estonia requires more information and more precise and dependent forms of organization. Cooperation between schools and companies has been strengthened by initiatives aimed at homogenizing the organization of in-company practical training, but it remains challenging in some sectors. Due to the considerable autonomy of VET schools, however, the quality of practical training tends to vary (Ümarik 2015). As we have seen, Estonia offers mainly school-based vocational training, which combines school-based learning of theory and practical work. The most popular VET option in Estonia is part of upper-secondary education, as in Germany: 77% of VET students in Estonia chose the vocational upper-secondary track (EQF 4) and opted for the school-based version rather than an apprenticeship at this level.

From the enormous differences in the number of trainees, it can be deduced that the specificity of qualifications differs significantly between Estonia and Germany. Skills acquired from training in dual learning places are considered more specific than skills taught in general vocational programmes (Breen 2005; Bol and van de Werfhorst 2011). This distinction between specialized and general skills refers to the portability of skills among work positions or even economic sectors. Therefore, the specificity of qualifications and the way in which they are acquired is of great importance for entry into the labour market and recruitment.

Streeck (2001) has theorized about the differences between skills and their character as specific or general. They are dealt with in Chapter 3.1.2 (see above). In short, he characterizes skills in terms of the dichotomy between general skills as transferable skills and specialized skills as less transferable skills (Hall and Soskice 2001; Estevez-Abe, Iversen, and Soskice 2001; Streeck 2011). He states that skills tend to vary not only in terms of their economic portability but also their levels and nature. This additional category is connected to the generation of skills: different forms of learning and workplace interactions provide occupation-related (specialized) skills or general, occupational skills. In terms of portability to other occupations or industry sectors, these formal (occupational) skills vary according to the form of training. In this way, a difference may be identified between apprenticeships and school-based training. Moreover, workplace experiences (as in apprenticeships) intensively and comprehensively train less formalized, but at the same time highly portable skills of an extra-functional character. Examples are experiential learning, tacit knowledge and work habits subsumed as informal skills (ibid.). In Streeck's view, the portability of such specialized skills resides in the institutional conditions of skill formation. Linked to this are the trust, value and acceptance they enjoy both from the students who acquire these skills and from the employers who demand them. In addition, education and training is largely standardized. It gains credibility and trust through certificates.

This theoretical consideration of the provision of different skills within processes of skill formation is our next focus (Chapter 5.2 and Chapter 5.3). Based on the descriptions of VET systems in terms of the criteria of standardization, stratification and vocational orientation, the main target in the following chapters is to find examples of the establishment of such different skills, skill levels and their potential for portability as suggested by Streeck (2011). This is achieved by a closer look at vocationally trained occupations and an analysis of the variety of skills in these occupations in Estonia and Germany (Chapter 5.2).

5.2 Skill formation in selected training programmes

In Section 5.1 we saw the differences between vocational education and training in Estonia and Germany, which are based on the countries' institutional conditions, structural requirements and organizational responsibilities. Section 5.2 expands the understanding of different skill formation systems by detailing the generation of skills within three occupations. With regard to the research question of how different countries shape and demand education in the context of digitalization, the investigation of skill formation in certain occupations may deepen our knowledge of the range of skills on offer. This is achieved because the generation of skills is shown in terms of its practical implementation in occupational and operational terms. The chosen occupations are VET programmes in electronics, logistics and IT. The following descriptive analytical review of these occupations looks at training targets, training structures and regulations (Chapter 5.2.1), and describes the relevant occupational skills profiles (Chapter 5.2.2) comparatively in Estonia and Germany.

5.2.1 VET in the spotlight: training programmes for electronics technicians, logistics assistants and IT specialists

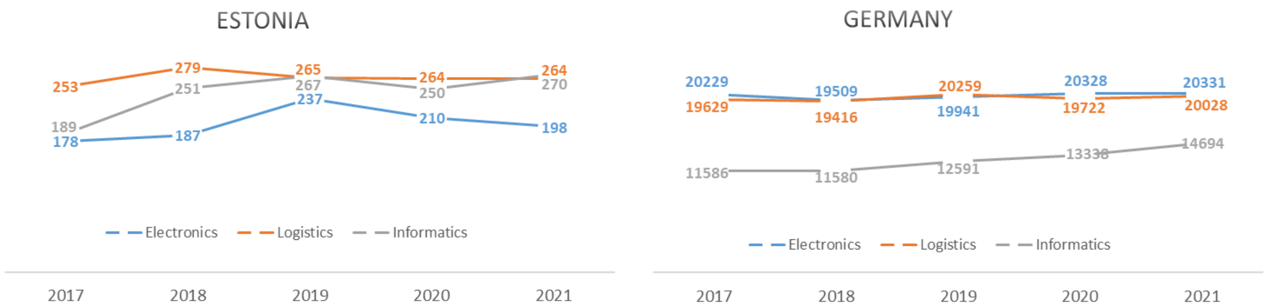
Selection of training programmes

Young people are spoiled for choice in relation to the vocational education track in Germany. It offers 325 different options. The vast majority are taught as vocational training programmes within the dual system (Bundesinstitut für Berufsbildung 2020c). In Estonia, there are no fewer than 359 occupations to choose from, most of which are offered as part of school-based training and at several qualification levels (Estonian Qualifications Authority 2020a). From this broad range, the three occupations of IT specialist, logistics assistant and electronics technician stand out because they are of great importance for both countries' future development. Vocational training in these occupations requires preparation for highly digital and innovative work settings. VET curricula and educational regulations are established in collaboration with representatives from employers' associations and relevant experts, and new and changing circumstances for training, particularly digital transformation, are commonly considered (Janssen et al. 2018).

Hence, the three occupations in the electronics, logistics and informatics training fields were selected on the grounds of their relevance for future developments and their importance within the digital transformation. Logistics workers are key to global trade; without IT programmers, pioneering new means of production wouldn't exist; IT support solves technical problems; and without electronics engineers, networked or power-saving applications in buildings would not be possible. Digital technologies strongly shape work in these occupations with an impact on workplace settings, cooperation and task content. Moreover, they contribute significantly to digital structural change in the economy (Eurofound 2020b). For both countries, these professions are equally important for shaping the digital transformation and for a future-oriented understanding of the economy (Estonian Qualifications Authority 2020; Bundesinstitut für Berufsbildung 2020a).

Training in these areas secures a skilled workforce for the future. Vocational courses in particular can make a key contribution to these developments by enhancing students' employability. In both countries, students often choose these occupations (see Figure 10). Once a student has qualified, these occupations offer good and immediate prospects of employment. The demand for a skilled workforce in these occupations remains stable because of the developments already mentioned (European Union Skills Panorama 2014b; 2016).

Figure 10: Number of VET graduates in the training areas of electronics, logistics and informatics in Estonia and Germany, 2017–2021



Source: Haridus- ja Teadusministeerium, 2021; Bundesinstitut für Berufsbildung, 2021.

Furthermore, the importance of these occupations also means that there is a wide range of regional training and employment opportunities in both countries. Because the analysis aims to study processes observed throughout the country and not particularly prevalent in single economic clusters or geographic regions, it is essential to consider widely known and widely available educational programmes. This aspect is reinforced by the fact that the trainees are young and therefore vocational training takes place mainly on local labour markets and is linked to regional economic requirements where they live (Jost, Seibert, and Wiethölter 2019).

Students study for their chosen occupations in vocational sub-specialized training programmes. In order to compare occupations in similar specializations, we selected VET study programmes for electronics technicians, logistics assistants and IT specialists. They involve core tasks related to the use of technology or technical applications or the performance of (technical or IT-related) engineering tasks. But they also encompass different economic branches. The VET study programmes for electronics technicians and IT specialists lead to STEM (Science, Technology, Engineering, and Mathematics) occupations.[7] Table 5 provides an overview of the vocational courses of study and their allocation to the various training areas and the training occupations for which the courses of study provide training

Table 5: Selected VET study programmes in terms of fields of training and occupation

VET study programme	Estonian field of training	German field of training	Classification of Occupation (ISCO-08)
Electronics technician	Engineering, manufacturing and construction	Manufacturing	Electrical equipment installers and repairers
Logistic assistant	Business administration and law	Industry and trade	Material recording and transport clerks
IT specialist	Information and communication technologies	Industry and trade (and manufacturing)	Information and communications technology, operations and user support technicians

Source: Information on fields of training is taken from official educational statistics reports (Statistics Estonia 2019b; Bundesinstitut für Berufsbildung 2019d). Study programmes lead to occupations categorized by the ISCO-08 scheme[8] (International Labour Office 2012; Bundesagentur für Arbeit 2011; Estonian Qualifications Authority 2021b).

In both countries, training in the three VET programmes takes place in different areas of learning, which are defined by the competent bodies for training and/or examination. In Estonia, training fields are categorized according to the ISCED-F classification scheme (Unesco 2015), while in Germany seven different areas of responsibility have been defined for training. These are industry and commerce, manufacturing, agriculture, public administration, home economics, liberal professions, and maritime transport. VET programmes can be categorized according to their area of responsibility. These areas do not necessarily correspond to the relevant economic sectors in Germany. Furthermore, the occupation of IT specialist, for example, can be trained either in the area of responsibility of industry and commerce or in that of skilled crafts (Bundesministerium für Bildung und Forschung 2019). Looking at training activities by study field, a similar picture in Germany and Estonia emerges: manufacturing has stable demand and trained 27% (Germany) and 37% (Estonia) of all newly entered VET students in 2019. Industry and trade in Germany and the Estonian study fields of business administration and law, as well

[7] So far, there is no universally applied definition for the exact assignment of occupations to STEM. The ILO groups together a set of occupations into 'thematic views' but they do not comprise the STEM category. The classification introduced by the OECD and Eurostat (Eurostat 2016), which was further specified by UNESCO (2017), differentiates between STEM with regard to education and qualifications, and with regard to professions. The latter comprises STEM in the sense of employees working as scientists or engineers in a wider understanding. This conceptualization allows us not only to capture employees but also includes training in VET study programmes that lead to STEM occupations. Following this logic, both VET study programmes, IT specialist and electronics technician, are defined as STEM-related occupations (Kroll and Uhly 2017).

[8] While the Estonian Occupational Qualifications Standard (*Kutsestandard*) directly assigns the respective ISCO-08 codes, the German Federal Institute for Vocational Education and Training (BIBB) refers to the respective professions within the country-specific KldB 2010 system (*Klassifikation der Berufe*) (Bundesinstitut für Berufsbildung 2019d). Looking at the national labour statistics conversion tables, the KldB 2010 codes are cross checked with those of ISCO-08 (Bundesagentur für Arbeit 2011). As a result, both systems are synchronized at an ISCO-08 3-digit level.

as information and communication technologies also attract a large number of trainees (DE 58% and EE 21% of VET students) (Bundesministerium für Bildung und Forschung 2019; Statistics Estonia 2020; Bundesministerium für Bildung und Forschung 2020a).

All three VET study programmes are officially recognized as three-year VET training courses,[9] leading to an EQF (European Qualifications Framework) level 4. The level indicates that vocational students have achieved an upper secondary vocational qualification (which aligns with ISCED-2011 category level 354). The EQF is a reference framework within the EU that specifies the relevant knowledge, skills, responsibilities and autonomy requirements at a total of eight educational and qualification levels. It provides more insight into shared key elements than the institutional education structure alone. In this way, the EQF makes it possible to easily compare qualifications from different education systems (European Commission 2020c). After completing a vocational training programme, graduates qualify to use professional titles. An electronics assistant course, when completed, leads in both countries to the occupation of 'electrical equipment installers and repairers' (ISCO-08 code 741). The logistics assistant programme comes under ISCO-08 group 4, 'clerical support workers' and is defined by the minor group 432, 'Material recording and transport clerks'. Finally, IT specialist leads to occupations grouped under ISCO-08 category 3, 'Technicians and associate professionals', more concretely in group 351, 'Information and communications technology operations and user support technicians'.

Limitations

Although the VET study programmes selected here are related to innovative training areas and occupations that contribute significantly to making digitalization happen, they are clearly gender-specific and thus male dominated. To date, there has been no sign of a trend reversal of the gender proportions in the related sectors (Eurofound 2017a). This picture is confirmed when looking at participation in vocational training in all three chosen study programmes by gender (Bundesinstitut für Berufsbildung 2019d; Statistics Estonia 2020). This gap in gender-equal economic participation is not unrelated to general economic development (Mitra, Bang, and Biswas 2015) and moreover to possibilities for self-development (Barbieri et al. 2019). Several global and European-level, as well as national policies are seeking to eradicate gender stereotypes, especially in STEM subjects (Zacharia et al. 2020).

In view of the unequal gender distribution in the participation rates of the selected vocational training courses, companies avoid highlighting gender-specific differences in terms of supply and demand with regard to skills. This selection of training courses means that the training situation and the transition from school to work are dominated by male students, but the training situation of women is largely unaffected. Taking this limitation into account – also for reasons of time and resources – three occupational profiles with different specializations and significance for digitalized labour markets were

[9] Becoming an electronics technician in Germany takes around 3.5 years.

selected rather than attempting to ensure a representative composition of the entire vocational training on offer in both countries.

Electronics technician: VET training and occupational profile

Electronics technicians plan, install, commission and, when required, repair in-house electrical installations and energy systems. They introduce new developments and technical enhancements in electrical installations and equipment on site. Keeping up with the latest trends and products on the market is thus part of the job. For example, smart home solutions are increasingly being used in households because they promise an easy and comfortable way of handling heating, lighting or blinds via smartphone. In this way, home and security technologies are combined with communication tools via touchpanels, mobile phones or end-user apps. Moreover, solutions to climate change will also require resource-efficient and sustainable transportation systems, as well as energy consumption. But most importantly, new technological developments enable new and even more robust resource-efficient solutions. Smart grids are used for households, for example, but are also an important factor in electromobility infrastructures. Smart meters are a technical solution that improves the efficiency of energy use and provides the information required to manage energy demand in an environmentally friendly and economical way.

All this will inevitably have a substantial effect on electronics technicians, who are reporting a higher level of complexity in their work. When asked whether their working tasks have gained in complexity over the past 15 years, electronics technicians are more likely to agree compared with the average for all occupations in the EU (EU 69%, DE 78%, EE 75% in 2015). This also applies in Germany and Estonia (EU 58%, DE 64%, EE 62% in 2015) (European Foundation for the Improvement of Living and Working Conditions 2007a, 2007b, 2012, 2017). The digital transformation is giving rise to dynamic developments that impact training. In Estonia and Germany, VET training profiles have been updated in recent years and now integrate new trends such as connected living, smart grids or smart meters (for more details see below) (Roth 2018; Bundesagentur für Arbeit 2019a; Estonian Qualifications Authority 2017b).

Vocational training for electronics technicians includes the choice of several specializations. In Germany, the VET study programme 'Elektroniker/in Energie- und Gebäudetechnik' is a sub-specialization that focuses on the abovementioned tasks for electrical and energetic installations in housing. It has experienced constantly rising student enrolment numbers over the past few years (Bundesinstitut für Berufsbildung 2019a). A comparable study programme in Estonia is the 'Sisetööde elektrik'. It also shows stable participation rates over recent years. Within the curriculum area of technical studies (*Technikaalad*), it has been the second strongest programme after car technician since 2016 (Ministry of Education and Research Estonia 2019c).

These two VET study programmes are widely available in both countries and in equally stable demand, among students and in the labour market (Ministry of Education and Research Estonia 2019c;

Bundesinstitut für Berufsbildung 2019a). VET graduate electronics technicians predominantly find employment in manufacturing (Section C) (International Labour Office 2012). In Estonia, the proportion of open vacancies is highest in manufacturing (18% of all vacant posts, 2018), which confirms the need for qualified labour here (Maasoo 2019). Employees working in manufacturing make up around one-fifth of Estonia's working population, which makes it one of the country's biggest economic sectors (Eurostat 2019). In Germany, statistics on the labour market entry of VET students show that graduates cope successfully with this transition, predominantly without interruptions (Seibert and Wydra-Somaggio 2017). Employment also appears to be secure later on: the occupation-specific unemployment figures for electrical specialists are at a very low level (2.6% in 2019, Bundesagentur für Arbeit 2020b), which underlines the constant need for skilled labour.

Changes in the context of digitalization at the workplace are bringing about shifts in terms of tasks and skill use, with effects on VET training. In order to keep up with the latest work needs, VET study programmes in Estonia and Germany are regularly updated. The following section unravels the processes of updating training and compares the situation in the two countries, as they have introduced different types of training. Impressions and experiences in the workplace help to ensure that training profiles are kept up to date. This descriptive analysis therefore deals with the occupational profiles (primarily occupational standards) of electronics technicians and describes changes in learning objectives and learning outcomes.

In Estonia, the occupational standards for electronics technicians (*sisetööde elekter*) were updated and validated in 2006, 2008 and 2012. The current programme became valid in 2017. Since 2022, an updated version of this occupational profile has been followed. Since 2012, the programme *Sisetööde Elekter* has been offered at level 4 of the European Qualifications Framework (EQF). Level 4 means that students hold an upper secondary vocational qualification after compulsory general education. Before 2012, the preceding training programme *Elektrik III* was established in 2006 and renewed in 2008. It led to the same occupational profile of mechanics and installers of electrical equipment (ISCO code 7412) at this qualification level (Estonian Qualifications Authority 2021a). Generally, Estonia updates the occupational standards (*Kutsestandard*) regularly and routinely adapts profiles to meet job requirements. Estonian legislation clearly defines the structure of school-based vocational education and the setting of occupational standards and curricula and their duration. The formulation of occupational standards is an area that is relatively standardized in Estonia. In addition, however, VET institutions operate with greater autonomy (as explained in chapter 5.1).

The following section reviews changes in occupational standards in 2017 compared with 2012 in Estonia. The occupational standards adapt to a digital working environment by integrating new tools (information technology hardware, professional software), and by emphasizing safety issues in regard to the working environment. The job description at the beginning of the occupational profile marks the critical outline of the occupation. The 2017 profile prominently stresses that 'electronic technicians work independently and as a member of a team, performing duties in changing situations'. This shows that, other than in 2012, the requirement for teamwork to adapt to changes is seen as very important (Estonian Qualifications Authority 2017a).

Furthermore, the occupational standards describe the key skills required to pass professional examinations. Because this study is interested in understanding the relations between skill supply and demand – and mismatches in this regard known as skills shortages – it is worth looking at the targeted skills in VET training. Comparing the 2012 and 2017 occupational profiles, the changes are as follows. The 2012 profile contains two main references to informal skills: first, sharing experiences with team members or supervisors (Section B2.1 Work planning and organization); and second, applying a basic knowledge of communication when carrying out installations (section B2.7 Optional skills).

In contrast, the 2017 version cites a full range of informal skills. It contains key requirements with regard to professional competences (section B2.1-B2.8), as well as key central transversal skills (section B2.9) for examination purposes. Six are particularly important:

- communicates politely and correctly with co-workers and clients, and provides information in a clear and understandable way;
- participates in teamwork, can react quickly to a changed situation;
- uses opportunities for self-improvement, is aware of technological changes;
- uses ICT hardware and professional application software;
- is able to use at least one foreign language;
- is proficient in basic online security.

Because these transversal skills are central requirements of attaining professional certification, they are part of student assessment (Estonian Qualifications Authority 2012, 2017a). In general, the electronics technician programme in Estonia addresses technological change in three main regards: first, by describing the need to maintain awareness of changing conditions; second, by addressing technological change specifically in the programme; and third, by listing detailed requirements regarding how to deal with it in terms of communication skills, interpersonal skills (teamwork, self-improvement) as well as ICT skills.

In Germany, updates of VET training regulations and apprenticeship curricula are performed on demand and are not legally prescribed. Key reasons such as the digital transformation and the energy transition make it urgently necessary to update electronics training in Germany (Bundesinstitut für Berufsbildung 2021b). In 2021, the entire training system in the wider field of electronic work and e-commerce was comprehensively reorganized. The previous training regulations were reorganized in 2004.

The new 2021 training regulations for electronics technicians restructured specializations in the company. From 2004 to 2021, the occupational standards (*Ausbildungsverordnung*) applying to electronics technicians (*Elektroniker*) had three specializations: energy and building technology (*Energie- und Gebäudetechnik*), automation and system technology (*Automatisierungstechnik*), and information and telecommunications technology (*Informations- und Telekommunikationstechnik*).

From 2021 on, electronics technicians only included the first two specializations (energy and building technology, automation, and system technology), while the ICT specialization was merged into another occupational profile. Another stand-alone training programme was added to the two electronics specializations, 'Electronics technician for building systems integration' (Bundesinstitut für Berufsbildung 2020e, 2021).

In addition to structural changes in vocational training for electronics technicians, the training regulations there have also been changed due to changing work requirements and tasks in light of the digital transformation. Looking at the structure of training in 2004 and 2021, the changes mainly concern the general job description of electronics technicians and not sub-area specialization. There are now a total of 12 content areas with regard to training (Article 4, § 4). The description of what constitutes an electronics technician in general was supplemented with two additional content areas in 2021.

- review and maintain compliance with data protection and information security concepts, including informing customers about legal rules and integrating technical solutions to achieve (data) security; and
- analyse technical systems, which includes understanding, analysing and evaluating systems in terms of their components, limits and interfaces with other technical systems.

Also new with regard to occupational standards within the framework of standardized training elements (*Standardberufsbildposition*) is the notion of 'digitalized work' (see 5.1 for more details). Digitalized work defines relevant and fundamental skills required for catching up with digital change beyond the occupation of electronics and is integrated into all newly regulated VET training regulations. In the digital work section, training aims to teach data processing, communications and information retrieval from digital networks. It also includes training in new working methods and self-directed learning (Bundesinstitut für Berufsbildung 2021d). Together with digitalization, the standardized work description has four fields of training:

1. organization of the enterprise, vocational training, labour, and collective bargaining law;
2. security and health at the workplace;
3. environmental protection and sustainability;
4. digitalized work.

Beyond changes with regard to digitalization, it is interesting to note that the weighting of the examination modules shifted from 2004 to 2021. The number of examination blocks remained the same (5 examination blocks). But the weighting of examination blocks changed and greater attention was paid to checking customer and sales orders (from 25% of the total exam in 2004 to 36% in 2021). This has been at the expense of the examination of how students perform electronic operations (from 40% in 2004 to 30% in 2021) (Article 15) (Bundesgesetzblatt 2008, 2021).

Overall, a comparison of the two countries' occupational training standards for electronics technicians shows that skill formation in the Estonian VET system is adapted to new working demands more regularly than the German VET system. This difference is due to the different institutional conditions (see Chapter 5.1). The situation of electronics technicians illustrates clearly that both countries have made significant updates. The main changes include a stronger focus on safety aspects and the teaching of technical (networked) systems with new work equipment and (software) applications. Estonia has also tried to raise awareness of the fact that training takes place under changed working conditions and prepares trainees for teamwork, improved communications and self-improvement. In contrast, Germany places greater emphasis on customer orientation in both training and examinations.

Logistics assistant: VET training and occupational profile

Logistics assistants perform loading and unloading operations and inspect and control goods both quantitatively and qualitatively. Their tasks range from transportation, warehousing, stock and flow planning and optimizing, while communications and commercial activities are gaining in importance. VET training in logistics is possible in both countries in a small variety of VET study programmes. The logistics assistant was selected as a comparable occupation in both countries. Besides logistics assistants (*Logistiku abi*), Estonia also trains warehouse workers and transport organizers. Germany trains logistics assistants *(Fachkraft für Lagerlogistik)*. They work in warehouses or load various means of transport such as lorries, containers or railway wagons. Harbor logistics is another training occupation and differs from that of logistics assistant.

The demand for this VET study programme us stable in both countries. In Estonia, enrolment is regular, but training participation numbers are lower than in Germany. The programme in Estonia is offered at six vocational schools spread across all regions (Ministry of Education and Research Estonia 2019a). Training places are also offered throughout Germany, particularly in large federal states such as Baden-Württemberg, Bavaria, North Rhine-Westphalia and Lower Saxony (Bundesinstitut für Berufsbildung 2019b). In terms of study choices, logistics assistant was one of the 10 most popular courses chosen by men in 2019 (8th place) (Federal Institute for Vocational Education and Training 2019f).

Occupational opportunities for logistics assistants open up in all kinds of enterprises in several economic sectors – logistics is known as a cross-cutting profession (International Labour Office 2012). In both countries, employment prospects are positive. In Estonia, there is an obvious need for more skilled workers in the transportation and logistics sector, especially given the convenient location of Estonia's Baltic Sea ports (Estonian Qualifications Authority 2017c). Logistics and trade are one of the sectors with the highest employment in Estonia, and the number of vacancies has risen slightly in recent years (Statistics Estonia 2019a; Eurostat 2019). In Germany, there is overall stable demand for skilled workers because of the increasing movement of goods and demographic change (Bundesvereinigung Logistik 2019). However, graduates of vocational training such as warehouse logistics specialists initially face a short-term risk of unemployment (17%) immediately after completing their training. As this decreases over time (8%), it is assumed that graduates here are more frequently being trained in SMEs (in which turnover rates are lower than in larger companies and a larger number of vocational training graduates are trained and not hired immediately after training (Seibert and Wydra-Somaggio 2017).

In the field of logistics, current developments in digitalization are often described as disruptive. The digital transformation is finding its way into logistics with new (consumer) trends and technical tools. These are used by employees in almost all operational activities and work levels, which indicates the scope of development (Estonian Qualifications Authority 2016a; Bundesagentur für Arbeit 2019b). Current global trends in logistics point to support for warehouse workers in parcel picking. Such support involves wearables. These are mini-computers that are intended to be worn on the body. Smart gloves, for example, transmit information and can scan barcodes, which gives employees the advantage of having their hands free for order picking (Bundesagentur für Arbeit 2019b). In addition to manual support, 'vision picking' uses smart glasses, augmented reality (AR) and corresponding software to provide information about a product and its location in the warehouse. This information is displayed directly on the glasses. This process has now become standard in some large logistics companies (DHL International GmbH 2020). In addition, the development and implementation of autonomous and intelligent vehicles, such as cobots, drones and forklift trucks, as well as the programming of e-service/e-sales solutions in the field of intelligent transportation systems is gaining momentum (Nikolova-Jahn, Demirova and Entchev 2014; Flämig 2016).

The impact of digitalization at the workplace level can be tracked in employee surveys. Compared with other occupations, logistics assistants across Europe report that their tasks and duties have increased over the past year. This is above average for all occupations in Europe (European Foundation for the Improvement of Living and Working Conditions 2017). Although the increased automation on the factory floor described above is changing the task structure by replacing manual work with automated operations, digitalization is bringing to the fore tasks that previously did not exist or existed only to a limited extent, such as monitoring tasks, control activities or data maintenance and recording.

These outlined trends are gaining considerable influence in the training sectors of both countries. Estonia and Germany recognize the need for up-to-date training programmes as the sector grows and the occupational profile changes. However, adjustments in VET are not (yet) fully embedded in apprenticeships and job profiles (Estonian Qualifications Authority 2017c; Kock and Schad-Dankwart 2019). The following sections take a closer look at the training regulations and occupational standards for logistics assistants in Estonia and Germany.

In Estonia, the current job profile for level 4 logistics assistant training, '*logistiku abi*', was regulated in 2016. This was valid until 2021. Prior to that, earlier occupational standards from 2011 and 2014 applied. A very similar occupational profile to the logistics assistant is the transport organizer, '*veokorraldaja*', which has been offered since 2005. Both training courses have been combined in a new training course called 'Transport Organizer – Logistician', '*Veokorraldaja-logistik*'. It integrates the road transport aspect of 'veokorraldaja' and (among other things) the management of transportation, warehousing and flow of goods aspect of 'logistiku abi' and puts a stronger emphasis on customer service (Estonian Qualifications Authority 2021b). Looking at the occupational standards from 2011 to 2016, only minor developments can be seen with regard to logistics assistants. They concern mainly the description of skills, knowledge and tasks. For example, the 2011 version provides more information on relevant knowledge (for example, specific regulations, waste legislation, customs legislation or agreements) and on the assessment method than the 2016 version. The structure of training areas and the main defining content of training remain the same (Estonian Qualifications Authority 2016a).

In Germany, the current description of 'warehouse logistics specialist' dates back to 2004. No adjustments were made in the period 2001–2021 (Bundesinstitut für Berufsbildung 2020e). Compared with the previous occupational profile and training structure from 1991, the current regulation has updated the qualification requirements to include more teamwork, information and communication, customer orientation and use of foreign languages (Bundesinstitut für Berufsbildung 2021c). However, training managers assume that in future a warehouse logistics specialist should have a good understanding of processes relating to data, the flow of goods and control of the flow of goods. Process knowledge inevitably goes hand in hand with system knowledge and also with an understanding of which system controls which processes or goods in terms of which function (which goes hand in hand with the use of digital technologies). This requires that logisticians quickly familiarize themselves with new applications, as digital technologies are used in many areas. In order to master the various systems, logical, analytical thinking is a core skill that is becoming increasingly important (Kock and Schad-Dankwart 2019). To date, these aspects have been part of on-site and in-company training, but are not anchored in the vocational training regulations.

A comparison of vocational training in logistics shows that the two differ in terms of the integration of new content into qualification processes. Germany is sticking to an occupational profile from 2004 and has not yet made any adjustments. Estonia has been offering a slightly updated training programme since 2016. But here, too, there have been no significant (content-related) changes to the programme. However, Estonia is trying to keep the job profiles up to date by merging two related logistics programmes into one. It now integrates the main tasks of current transportation and logistics work.

IT specialist: VET training and occupational profile

The IT specialist was selected as the third VET study programme because a digital world of work is imaginable only with trained IT personnel. IT specialists are considered to be integral to economic functioning and decisive drivers of innovation in modern economies. Their main tasks – development, testing and administrative support – are also essential in many other areas of the economy.

The general portfolio of a trained IT specialist is comparable in both countries and includes the planning, implementation and administration of customer-specific information and communication technology (ICT) solutions. Despite the high level of interest in studying computer science at universities, a considerable number of students opt for vocational training in the ICT sector (Estonian Qualifications Authority 2019; Bundesagentur für Arbeit 2020a). Interest is increasing among young male students in both countries, as this opens up excellent employment opportunities, including highly dynamic jobs. In Germany, the part-time degree course 'Fachinformatiker/-in Systemintegration' has been very popular for several years (Bundesinstitut für Berufsbildung 2019f). In Estonia, the ‘IT-süstemiide nooremspetsialist’ was the most frequently chosen course within the curriculum group in the 2018/2019 academic year, followed by software developer (Ministry of Education and Research Estonia 2019b; Federal Institute for Vocational Education and Training 2017b).

As further adjustments of digital technologies are taking place in almost all economic sectors, IT specialists are an important occupational group. For those with vocational training, future employment opportunities are envisaged in the information and communication sector (Section J), in various companies in other sectors, and in public administration. Both Estonia and Germany state that they urgently need skilled workers in computer science, particularly to maintain and strengthen the competitiveness of their economies. In Estonia, IT has developed into an important economic sector as the country strives to become an information society. It is emphasized that ICT not only enables a ‘mature and secure environment for widespread use’ in the economic sector, but also aims to ‘increase people's well-being and improve the effectiveness of public administration’. There is also a demand for IT specialists in Germany, although the focus here is on STEM education in general. Despite the low unemployment rate among those employed in the IT sector, transitions to employment after training are characterized by considerable mobility. More than 40% of those completing vocational training find employment in companies other than the one in which they were trained, and a further 15% take this step after a short period of unemployment (up to three months) (Seibert and Wydra-Somaggio 2017).

Current innovation paths are related to so-called ‘artificial intelligence’ (‘AI’), which supposedly represents a step from machine-readable data to machine-‘understandable’ data, based on machine or deep learning processes. When it comes to AI, many people conjure up ‘visions of the future’ or in some more or less abstract way ‘robots’, but employees often work with digital systems based on AI without really knowing it. New AI-based technologies and platforms are also being established for computer science and are designed to support and relieve the burden on IT staff. Further developments can be seen in the importance of IT security because of the enhanced connectivity of devices and the use of services in apps through cloud computing, online trading or edge computing. In addition, the integration of cyber-physical systems in various companies shows that the role of computer science in the corporate environment and in corporate collaboration is changing (Brenner, Broy, and Leimeister 2017; Bundesagentur für Arbeit 2020a).

In view of these trends, IT specialists must remain flexible. They report more frequently than average among all professional groups that they have had to take on more responsibility in the past year. Among computer scientists the EU average is 41%, while it is 51% in Germany and 50% in Estonia (2015) compared with an EU average of 32% for all professional groups, 36% in Germany and 38% in Estonia (2015). Furthermore, increasing complexity and a higher demand for further training are also reported. The trends and impressions in the IT sector underline the fact that education and training programmes require modernization of learning content. In both countries, the updating of vocational training programmes has been completed. The other developments are outlined below.

In Estonia, the occupational profile (*Kutsestandard*) of the 'IT-süstemiide nooremspetsialist' was updated in 2019. This new incarnation of the IT system specialist includes three sub-professions: help desk technician, IT technician and IT administration technician. It was valid until 2024 and ties in with earlier versions of the occupational standard from 2000, 2004, 2008, 2011 and 2014. The programme has frequently been adapted to integrate new trends in vocational training (Estonian Qualifications Authority 2021b).

The main differences in the 2019 occupational standard compared with 2014 are related, first, to the amended training structure and, second, to the adapted description of the occupation. First of all, vocational students must reach these performance indicators. In the earlier versions, the occupational standard specified the core knowledge and skills to be acquired. Secondly, several restructurings in the training description refer to changed work priorities and division of labour. It is worth mentioning that the job description in the 2019 version now states that the work requires 'the ability to work in a team and manage conflict situations. (...) The field is developing rapidly, so continuous self-improvement is important' (Estonian Qualifications Authority). Therefore, the training parts have changed significantly. They reflect a shift towards an increased application of interpersonal skills. In addition, the number of training parts in the 2019 standard was reduced from 22 to 12 and content priorities shifted. In 2014, there were several preparation and implementation steps for training (for example, design, development, system integration and implementation). These steps are now combined into three components and form the central training parts of IT infrastructure and solution development, implementation and testing. In addition, training modules covering commercial and business knowledge (such as procurement, making sales offers, contract management) have been removed.

The shift in training priorities towards planning and implementing IT solutions, on one hand, and risk, project, problem and security management on the other, reflects the fact that there is high demand for best practices in a variety of interpersonal tasks, such as service tasks, the need for collaboration and communication with colleagues, customers or suppliers. This impression is further supported by the fact that the 2019 version highlights aspects such as monitoring installations, monitoring within the helpdesk, providing services and maintaining customer relations (ibid. 2014, 2019). Comparing the key competencies between 2014 and 2019 shows the following.

Key skills in the 2014 version of the occupational standard:

- Identify project risks and draw up action plans.
- Define project plans, including single-project tasks.
- Report on progress, providing information about compliance with the project plan, transmit information with regard to organizational risks or the risk management process.
- Delegate tasks and organize assistance if necessary.
- Participate in risk analysis, management, and documentation.
- Implement mitigation measures.

In 2019, the relevant indicators stressed teamwork and communication:

- Participate in the project team as a team member.
- Assess the current situation according to the project plan.
- Assess the timeframe for carrying out the project.
- Inform the project leader of any circumstances that may affect the progress of the project or the achievement of its objectives.
- Assess risks associated with work components and their impact, make proposals for mitigation.
- Participate as a team member in the development and updating of risk management plans.

Although the 2014 version lays out five transversal skills at the end of the occupational profile – communication, written expression, ethics, collaboration, and problem-solving – the 2019 version links them systematically and concretely with regard to their application within the respective parts of training, as shown above (ibid. 2014, 2019).

In Germany, training for IT specialists, 'Fachinformatiker/-in' was last updated in 2020. Before that, the training regulation from 1997 applied. In the current version from 2020, two sub-specializations have been added. VET students can choose whether they study to be an IT specialist in the form of an IT system specialist (*Systemintegration*, in focus here), or specialize in application development (*Anwendungsentwicklung*), or – and this is new – in data and process analysis (*Daten und Prozessanalyse*) or digital networking (*Digitale Vernetzung*). With one update in all these years, a new training regulation was introduced after 23 years (Bundesinstitut für Berufsbildung 2020c).

As for the significant changes between 1997 and 2020, there was a clear expansion of the subjects of IT security and data protection. At the same time, copyright aspects and recent (European) instruments, such as the General Data Protection Regulation (GDPR), have become more important. Social and interpersonal skills are also becoming more of a focus. These are seen as crucial prerequisites for interdisciplinary cooperation and digital communication when computer scientists work in the areas of project management, quality management and sustainability and have to take ethical aspects into account. The Training Regulation (*Ausbildungsverordnung*) therefore adds 'collaborative work using digital technology' (§4). This complements the four areas of the standardized training elements (*Standardberufsbildposition*) (see explanation in Chapter 5.1). The occupation of electronics technician also includes the newer version of the standardized training elements (Bundesinstitut für Berufsbildung 2021d). These are:

1. Vocational education and training, labour and collective bargaining law.
2. Organization of the training enterprise.
3. Security and health at the workplace.
4. Environmental protection.

In addition to new topics emerging because of progressive digitalization, the structure of the final examination has changed. Students are now tested in two separate exams. The first part tests the structure of an IT-supported workplace. The second part focuses on knowledge and practical work in the specialized sub-areas. An essential part of the old examination plan was the preparation and completion of a company-related project. The importance of this has been retained (it accounts for 50% of the final mark), but the time allotted for it has been increased, from 35 hours in 1997 to 40 hours in 2020 (Bundesgesetzblatt 2020; Bundesinstitut für Berufsbildung 2020c).

The comparison of Estonia and Germany in the field of computer science shows a clear picture: Estonia's monitoring of training regulations goes beyond Germany's efforts in this regard. However, both countries find common ground in the higher priority given to IT security and data protection. In Estonia, the importance of conflict management, teamwork, communication and self-improvement is also increasingly being recognized. This is generally shared in Germany, but even more emphasis is placed on performance in customer contact and practical experience.

Summary

Although the training regulations in Estonia and Germany are updated regularly, there are significant differences. While the frequency of updates to occupational standards in Estonia is more evenly distributed across training occupations and more regulated, Germany adapts its occupational profiles as needed and independently, depending on occupation. These differences are related to each country's regulatory requirements. As explained in Chapter 5.1, Estonia implemented a series of institutional reforms following Soviet rule. As part of a comprehensive reform programme, an evaluation and monitoring structure was set up that can quickly track structural, economic or social changes. Digitalization is being welcomed very positively by the educational authorities in Estonia, so it is not surprising that VET programmes also include new tasks and newly required skills. Germany also has a strong capacity to quickly identify new skills needs because of the close links between VET and the work environment and the high priority of work-based learning for students.

The updating of training regulations has created a situation in which new and relevant training content must be considered and common ground agreed. In the case of training regulations drawn up by committees consideration is taken of whether digitalization has produced new knowledge and skills that need to be taught as part of the respective programme, or whether knowledge and skills are up to date. The procedure reflects a standard and widespread opinion in the respective professional field of the country, and not only tried and tested practice in companies. Table 6 summarizes the activities of both countries in the selected training areas.

Table 6: Training regulations in Estonia and Germany

	Estonia	Germany
Electronics technician	Current programme: 2017 (until 2022) Previous programmes: 2006, 2008, 2012	Current programme: 2021 Previous programme: 2004
Logistics assistant	Current programme: 2016 (until 2021) Previous programmes: 2011, 2014	Current programme: 2004 Previous programme: 1991
IT specialist	Current programme: 2019 (until 2024) Previous programmes: 2000, 2004, 2008, 2011, 2014	Current programme: 2020 Previous programme: 1997

Sources: Electronics technician: Bundesanzeiger 2008, 2021; Estonian Qualifications Authority 2012, 2017; Logistics assistant: Bundesanzeiger 2004; Kutsestandard 2016; IT specialist: Bundesanzeiger 2020; Kutsestandard 2014, 2019.

A second aspect of the digitalization of work in all training programmes is that both countries define specific informal skills as relevant parts of each training programme. The Estonian profiles are quite clear in their definition of informal skills and in terms of which parts of training have become more important. In Germany, the more recent training regulations for IT specialists in 2020 and for electricians in 2021 also address the requirements of digitalization more specifically than previous training regulations. These adjustments are manifested in a modified training structure or the explicit integration of the training area 'networked collaboration using digital technology', as in the case of IT specialists, or through the integration of 'digitized work' as a new standard training element (*Standardberufsbildposition*) in the tasks of electronics technicians.

This new part of the standard job description reflects the fact that there is a high level of awareness in Germany of the changing skills requirements resulting from digitalization. As 'digitized work' will be part of every new or updated training programme from 2020, it has been possible to define essential skills that should be taught throughout the entire vocational training programme in workplaces and in vocational schools. Germany is thus pursuing an approach that is more general than in the more recent training regulations in Estonia (for example, in IT), where informal skills are more clearly assigned to several parts of the training (Estonian Qualifications Authority 2021b) (Bundesinstitut für Berufsbildung 2020d).

5.2.2 VET in focus: the content of training for electronics technicians, logistics assistants and IT specialists

In Chapter 5.2.1, the three selected VET programmes were presented in terms of their training structures and regulations. The chapter described the processes of skill formation in more detail from the perspective of institutional regularities and differences. In order to delve more deeply into the level of skills, these three VET programmes will be examined analytically in terms of the content of training profiles and skills specificity.

Method and data

The analysis of the occupational skills profiles acquired in vocational training programmes focuses on the content of training for electronics technicians, logistics assistants and IT specialists. A closer look at the skills profiles in VET programmes broadens our knowledge of the supply side of the labour market. Formal processes of skill formation set the conditions and content of the skills and knowledge of VET graduates as an available and future labour force. Efforts to resolve skills shortages therefore require a better understanding of the supply dimension of the labour market.

The country-specific perspective is also of interest for this analysis because Germany and Estonia have established different forms of training. In Chapters 5.1 and 5.2.1, it was shown that the prevailing type of skill formation system in a country influences the production of types of skills. The types of skills trained within the framework of dual learning are more specific than those taught in school-based vocational programmes. In the comparative education literature, this difference is captured by the terms 'vocational orientation' and 'vocational specificity' (Breen 2005; Bol and van de Werfhorst 2011). In these categories, Germany meets all the criteria of a strong vocational orientation. It has established an extensive dual training system with a high number of apprentices. Time spent in the workplace and training in the immediate workplace environment is therefore an essential part of the dual system in Germany. It is generally observed that in dual systems informal skills in particular are applied and trained more extensively in the workplace than in school-based systems. This is presumably because apprentices in company-based training regularly and extensively gain company-related work experience and have close connections to their occupational area. This seems to be more extensive in Germany than in Estonia. H1 therefore states:

H1: Informal skills are a more significant part of vocational education and training in Germany than in Estonia.

This theoretical assumption of the difference in the specificity of skills due to institutional conditions is now tested by analysing skills in the selected occupations. This seems to make sense because digitalization creates a further need for informal skills in the work context. As already shown in the regulations governing VET programmes (chapter 5.2.1) and their updating, informal skills have gained more and more importance in training in both countries over time. In addition to the influence of digitalization, trainees are increasingly being prepared for changing work contents and framework conditions of their occupation with an emphasis on the ability to change or the need for further training. In terms of digitalization, it is therefore interesting to see how these types of skills and the relationship between informal and formal skills are structured in the two countries.

For the analysis of skill types and profiles, official VET documents are used and analysed on the basis of a set of criteria. The criteria are derived from the theoretical educational concept of the VET system (see Chapter 5.1) (Morlino 2018). The criteria-based document analysis integrates a qualitative method to illustrate and evaluate the training contents of the VET programme in relation to their training modules. This is done to identify different types of abilities. The analysis also includes a qualitative-quantitative part that takes into account informal and formal skills in these parts of the training curriculum. The two criteria are: (i) the main training parts within the overall curriculum structure and (ii) informal and formal skills in these parts of the training curricula.

The method is based on official VET documents and is considered a secondary data analysis. The curricula in the two countries provide information on the importance of different modules and training content in the form of time specifications (weeks spent training in the modules or allocated credit points). In addition, the curricula provide clear information on the types of learning modules and their scope. The curricula thus provide a precise idea of the skills that are taught. On the basis of this documentation, the skills are recorded, grouped and related to each other. This procedure is carried out for three VET programmes and in a cross-country comparison. It provides a picture of the various formal and informal skills that should be acquired through vocational training.

The compilation of documents includes state regulations, mainly ordinances, laws, occupational standards and curricula from the past 21 years (2000–2021) (see Table 7). In particular, the professional standards and the corresponding framework curricula provide a suitable basis for this purpose, because these documents, on one hand, manifest the institutionalized process of skill formation. On the other hand, they express a mutual agreement of many stakeholders on the main work activities, specifications, competence and skill requirements of a profession (Eamets and Humal 2015; Bundesinstitut für Berufsbildung 2017a).

Table 7: Compilation of VET regulations and curricula, 2000–2021

VET study field	Documents
Electronics technician	Occupational Standards Estonia: 2012, 2017; Germany: 2003/2008, 2021 VET Curriculum Estonia (Tartu): 2019; Germany: 2021
Logistics assistant	Occupational Standards Estonia: 2011, 2014, 2016; Germany: 2004 VET Curriculum Estonia (Rakvere): 2017; Germany: 2004
IT specialist	Occupational Standards Estonia: 2014, 2019; Germany: 2020 VET Curriculum Estonia (Pärnu): 2020; Germany: 2020

Sources: Estonian Qualifications Authority 2011, 2012, 2016a, 2017a, 2019; Tartu Kutsehariduskeskus 2019; Rakvere Ametikool 2017; Pärnumaa Kutsehariduskeskus 2020; KMK 2003, 2004, 2020, 2021; Bundesgesetzblatt 2008, 2021, 2004, 2020.

This includes the legally binding regulations on vocational education and training (Vocational Training Act, Kutseõppeasutuse seadus), occupational standards (Training Regulations, Kutseseadus, Kutseharidusstandard) and the corresponding curricula (Training Framework, Framework Curriculum, Kutsestandardid, Õppekava) (Ministry of Education and Research Estonia 2018; Bundesministerium für Bildung und Forschung 2020b). In Estonia, curricula for training programmes are based on a national curriculum, but they are prepared by vocational schools under their own responsibility. Once registered using a curriculum code, they are available in the Estonian Education Information System (EHIS, Eesti hariduse infosüsteem) (Ministry of Education and Research Estonia 2021a). The compiled database therefore contains Estonian curricula from various vocational schools.

Electronics technician: skills profiles in Estonia and Germany

Electronics technicians specializing in energy and building technology work primarily with communication technology, household appliances, energy technology and lighting technology. Their main tasks include the planning, installation, monitoring and repair of electronic equipment and system components in compliance with occupational safety, security, electrical and environmental regulations. This also includes advising and working with customers and clients.

To become an electronics engineer, the curriculum in Estonia provides for compulsory modules in five main areas. These account for two-thirds of the course content (67%; see Table 8). In addition, the curriculum structure provides an elective module in which students can choose from 16 subjects (in the Tartu curriculum) and a wide range of subjects from the more general (for example, physics, foreign languages) to the profession-specific (for example, electronic measuring and cutting tools) (17%). The general education module deepens at least the knowledge of natural sciences, mathematics, (foreign) languages, social studies and personal development, and art (17%). These subjects are part of every training structure in vocational education in Estonia (Tartu Kutsehariduskeskus 2019). In Germany, the training structure consists of two main sections: one part is taught in a group of training programmes in electronics occupations (56%), the other part contains modules specifically designed for the sub-specialization of electronics in energy and building installations (44%). These vocational training contents are complemented by the acquisition of foreign language skills, which are integrated into various learning stages. Fundamental standards and principles in the work context are taught in an integrated way throughout the entire training period. They discuss sustainability, labour rights and collective bargaining or the context of digitalized labour markets (KMK Ständige Konferenz der Kultusminister der Länder 2021).

Table 8: Structure and main content of the training of electronics technicians

Estonia	Scope	Germany	Scope
Training structure:			
Occupation-related training	67%	Occupation-related training: general electronics	56%
General study subjects	17%	Occupation-related training: sub-specialization	44%
Elective subjects	17%	Standards in the working context: throughout VET	/
The main content of occupation-related training:			
Construction of the electrical building installations		Implementation of systems, networks and devices[1]	
Implementation of electrical building installations		Analysis, testing and maintenance of parameters and systems[2]	
Basic knowledge of electrical and energy systems		Evaluation of quality and security concepts[3]	
Building automation		Construction of energy- and electrical building installations[4]	
Business environment and career planning		Customer contact and communication[5]	
Practical experience: integrated into all fields			

Notes: The Estonian curriculum lists modules and ECTS points. In Germany, time schedules are given, and training fields are summarized accordingly: 1: Training regulation §4 Abs. 2 (10),(11) and §4 Abs. 3 (2), (3), (4), (5). 2: Training regulation §4 Abs. 2 (7), (8), (9), (12) and §4 Abs. 3 (3), (6). 3: Training regulation §4 Abs. 2 (3), (5), (6). 4: Training regulation §4 Abs. 2 (2) and §4 Abs. 3 (1). 5: Training regulation §4 Abs. 2 (1), (4). Bundesgesetzblatt 2021.

Sources: Tartu Kutsehariduskeskus 2019; KMK 2021; Bundesgesetzblatt 2021.

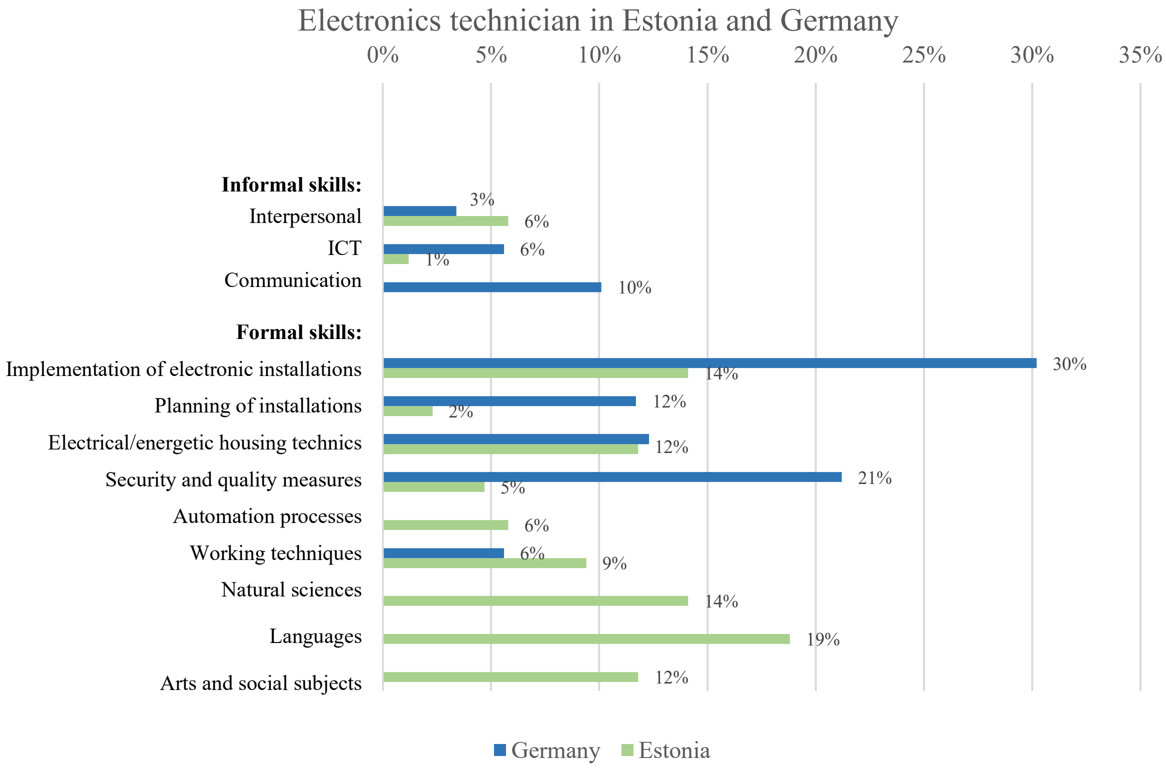
Reflecting the main tasks of an electrician today, electrical building installations make up the most important part of the training content in Estonia. The focus is on the construction and implementation of electrical installations in houses and buildings. In terms of scope, this is followed by learning how to operate and maintain existing systems. Equally important is an understanding of Estonian energy and electronic systems, their components and how they interact. Another module covers the installation, connection and testing of building automation and low-voltage devices. Electronics technicians are prepared for everyday working in companies and the needs of the contemporary economy. Training includes reflecting on one's own role in this environment and understanding the importance and requirements of reliability and cooperation. These modules are taught in a school context and supplemented by practical experience (Tartu Kutsehariduskeskus 2019).

In Germany, the situation is very similar. But there, there is also a focus on the installation of a variety of things, such as electrical and electronic devices, building systems, communication systems or networks. Unlike in Estonia, however, less time is spent on the conceptual part of planning, construction and preparation, and more on the actual installations themselves. In addition, there is a stronger focus on analysis, testing and maintenance, as well as on the implementation of quality assurance and safety measures. Customer service tasks take on special significance; the training plan includes a module on advising and supporting customers. But customer needs are taken into account not only here; they are also mentioned repeatedly in other training areas, for example when it comes to advising on data security or when the customer already has energy systems at home (Bundesgesetzblatt 2021).

The aim of including these training topics in the curriculum is to develop a specific skills profile for the occupation of electrician. A closer look at the individual skills and knowledge that are the focus of training in the two countries reveals that a range of occupation-specific skills are taught (see Figure 11). Not only can differences be observed in the emphases on certain skills, but the two countries differ in terms of the relationship between formal and informal skills.

Figure 11 illustrates the skills profile of the electronics technician. It provides an overview of the skills to be acquired within the framework of training in Estonia and Germany. When it comes to a content analysis of skills in the curriculum the various informal and formal skills add up to 100% for the profile overall (see Appendix Table A.2-1 and Table A.2-1 for the assignment of skills to the skill categories in the curriculum).

Figure 11: Skills profile of electronics technicians in Estonia and Germany (%)



Sources: Tartu Kutsehariduskeskus 2019; Bundesgesetzblatt 2021.

The Estonian training programme strengthens the formal skills that are taught in general studies (45%; natural sciences, languages, art and social studies). In addition, a range of job-specific skills (48%) are taught, with a focus on acquiring knowledge of technical devices and processes (for example, understanding the principles of electrical engineering, an overview of buildings and their electrical systems, understanding technical drawings). Furthermore, skills required for the implementation of installations and automation processes are important, including basic working techniques. These formal skills make up the bulk of an electronics technician's profile. In addition, the Estonian programme takes into account the requirements for informal skills by defining interpersonal skills and ICT skills (7%). Students acquire interpersonal skills. For example, the programme aims for them to 'work independently and as a team member' and that they be 'open to collaboration and participate in teamwork, develop social and intrapersonal skills, and interact supportively with others' (Tartu Kutsehariduskeskus 2019).

In Germany, the ratio between job-specific formal skills and informal skills required for the job is slightly different: job-specific skills make up 81% of the profile, while 19% of acquired skills are informal. Particular emphasis is placed on communication skills (10%), as the work of an electrician involves performing a range of service tasks. The application of digital skills is part of the training plan and is required when an electrician goes out into the world of work, as outlined in the job descriptions. In addition, shorter innovation cycles require students to have a good knowledge of self-organization, learning ability and cooperative working habits (interpersonal skills) (KMK Ständige Konferenz der

Kultusminister der Länder 2021). In terms of formal skills, students must know and practice how to implement and install electronic systems and networks (for example, connecting communication devices to broadband networks, setting up functional features, installing and putting devices and equipment into operation). In addition, there are important skills related to quality measures, for example, controlling the effectiveness and efficiency of implemented security measures. Planning skills for installations and learning the basics of electrical and power engineering are acquired in a similar way.

As it turns out, the proportion of informal skills in Germany is higher and more diverse than in the Estonian training plan. Although the Estonian curriculum provides a large amount of training in specific work-related skills, it also describes very detailed skills in the ‘General Studies’ section, thus placing a particular emphasis on general skills and knowledge. This is in contrast to the German programme, in which general studies (mathematics, language) are also part of the programme. Nevertheless, the main description of the learning outcomes in the curriculum mainly refers to job-specific skills.

Logistics assistant: skills profiles in Estonia and Germany

A trained logistics assistant takes care of transportation and logistical processes. This includes loading and unloading tasks for transport or storage, warehouse planning, quality control, and information processing and documentation of processes and services. It is also important to carry out commercial activities and communicate with customers or clients, as logistical processes take place within supply chains and contact with previous and subsequent operating units is necessary.

In Estonia, there is a substantial practical component in the acquisition of expertise in logistical processes (work-based training makes up 68%; see Table 9). In addition, students receive training in general subjects (17%) and can choose from a range of specializations in the elective part of the course (15%). The structure of the curriculum is similar to that of the electronics technician (Rakvere Ametikool 2017). In the German training plan, unlike in Estonia, training in general subjects such as mathematics or English is also widespread, but it is not as visible in the curriculum structure because these subjects are integrated into vocational learning fields and are taught in an integrated way. This also applies to work standards, which are addressed throughout the programme (as in the electronics technician programme) (Bundesgesetzblatt 2004).

Table 9: Structure and main occupational content of training for logistics assistants, Estonia and Germany

Estonia	Scope	Germany	Scope
Training structure:			
Occupation-related training	68%	Occupation-related training: logistics assistant	100%
General study subjects	17%	Standards in the working context: throughout VET	/
Elective subjects	15%		
The main content of occupation-related training:			
Management of warehousing, transportation and inventory		Management of loading/unloading and warehousing[1]	
Sales services in logistics		Quality measures in logistics	
Basic knowledge of logistic operations		Work organization, communication	
Customer service		Working techniques	
Business environment and career planning			
Internship			

Notes: 1: The training field consists of § 11 (8),(9),(10),(11). The Estonian curriculum lists modules and ECTS points. In contrast to Estonia, the German training plan gives only broadly stated references in months.

Sources: Rakvere Ametikool 2017; Bundesgesetzblatt 2004.

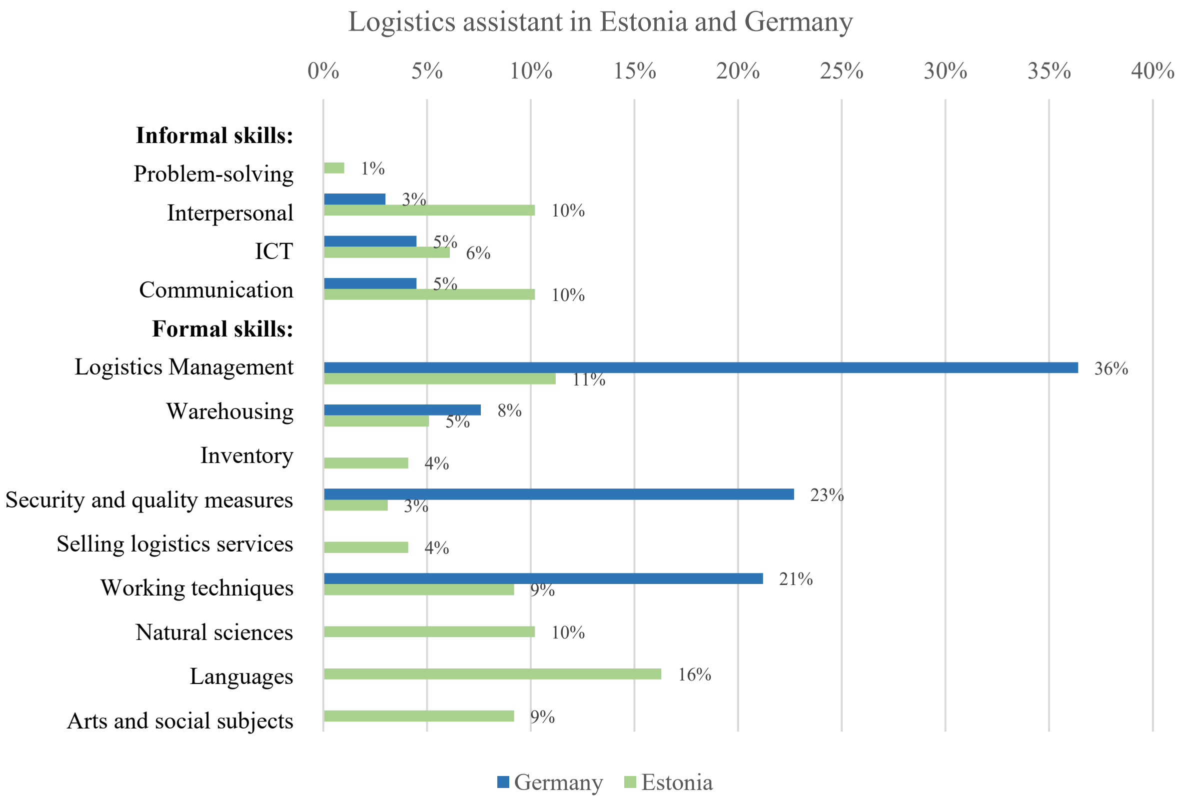
In terms of content, Estonia focuses on providing an overview and imparting a good knowledge of how to carry out management tasks in logistical processes, such as warehousing, inventory and transportation. This includes structured and planned procedures, as well as the evaluation and determination of risk factors. Students gain insights into the framework conditions under which the processes take place and how they are linked to other processes in the global supply chain. The increasing importance of commercial activities in Estonia is reflected in the existence of two modules: the module 'Sales Services in Logistics' trains students to buy and sell logistics services to customers, while the module 'Customer Service' emphasizes the importance of consulting and communicating with internal or external customers. Practical experience is therefore not negligible and helps students to act in a supportive and responsible manner in line with company values and to further their professional development (Rakvere Ametikool 2017).

In Germany, the training programme also focuses heavily on managing operational logistics processes. These processes not only emphasize the operational side, but also include working with regulations, filling out documentation and creating lists. In all these steps of logistics management and operations, quality control is an important part of training in Germany. Another part consists of work organization and communication tasks, similar to Estonia. Here students learn to integrate their own workplace and work tasks into the operational processes of the company, to coordinate with colleagues and to carry these out using current media, technical logistics terms (in foreign languages) and modern office communication. The working techniques taught in another module are relevant for students to acquire knowledge in specific measurement and control techniques, as well as in transport systems, for example (Bundesgesetzblatt 2004).

Large parts of the content of training are taught equally in both countries: the administration and operation of warehousing and transport in theory and practice. However, the Estonian programme places a strong emphasis on commercial activities, unlike in Germany, where these parts are not the focus. On the other hand, the aspect of quality control is taught more intensively in Germany than in the Estonian programme.

This is confirmed on closer inspection of the formal skills that define the occupational skills profile (see Figure 12). The general focus on skills for logistics management and operations is equally important in both countries. In addition, warehousing skills are essential. In Estonia, although warehousing and sales are less important, they are still widespread, which is not the case in Germany. Here, however, knowledge and skills in the area of quality assurance are much more important (23%) than in Estonia (3%). However, both curricula emphasize business-related skills and knowledge about the business environment (Estonia 9%; Germany 21%), such as the ability to analyse oneself professionally, undertake responsibility for making informed decisions about one's career, or understand the nature of the economy (see Appendix Table A.2-3 and Table A.2-4 for the assignment of skills categories in the curriculum).

Figure 12: Skills profile of logistics assistants in Estonia and Germany (%)



Sources: Rakvere Ametikool 2017; Bundesgesetzblatt 2004.

In addition to these job-related skills, informal skills are also fostered as part of the training plan. They include mainly communication skills and foreign language skills. Because logistics employees act as an interface to other departments or other customers in the global market, it makes sense to know job-specific terms in other languages, such as English. Communication skills therefore include not only the ability to interact constructively with others, but also to be attentive to collaboration and the value of shared information about operational processes (Bundesgesetzblatt 2004; KMK Ständige Konferenz der Kultusminister der Länder 2004). In Germany, informal skills (communication skills, interpersonal and digital skills) make up 12% of the job profile. In Estonia, the presence of informal skills in the curriculum is comparatively strong and they make up 28% of the job profile, formal skills 72%. This is because each training module describes in detail the required informal skills (for example, participation in teamwork, appreciation of cooperation, solving situational problems through professional communication) and two training modules specifically address customer service and sales tasks, where students acquire skills in handling complaints and grievances and develop conflict resolution strategies (Rakvere Ametikool 2017).

Therefore, the curricula for logistics assistants in Estonia and Germany differ, on one hand, in terms of their job-specific focus, with Estonia placing more emphasis on communication and customer-related skills, as well as on providing a good general knowledge in several areas of logistical processes, while Germany places more emphasis on detailed training in operational logistics and management processes, as well as in quality and safety issues. In both the training courses and the modules, informal skills are considered essential. On the other hand, the two training courses differ in the extent to which the informal skills mentioned are to be achieved through training in relation to the formal skills. The Estonian programme integrates several informal skills more comprehensively than is the case in Germany.

IT specialist: skills profiles in Estonia and Germany

IT specialists in the field of system integration work with networked systems of hardware and software. An important part of this involves providing advisory information in order to implement, manage and document technical solutions within the firm or as a service for other companies. Providing user or change support is an integral part of this. In particular, since the IT environment is highly innovative, there are new trends in the area of new products and business ideas that are based on comprehensive networking, high computing power and software flexibility. Throughout their training, students are confronted with the application of digital tools and media, as well as with digital work and business environments (Estonian Qualifications Authority 2019; Bundesagentur für Arbeit 2020a).

The training plan in Estonia reflects these tasks. Most of the training takes place in software, where trainees learn the difference between system software and application software and gain insights into operating systems such as Windows and Linux, scripting techniques and various kinds of application software (see Table 10). These contents are part of the modules in which IT-related knowledge and skills are the focus (68% of the curriculum). As in electronics and logistics, general studies (17%) and a required elective part (16%) round out the plan (Pärnumaa Kutsehariduskeskus 2020). In Germany, where all computer science-related training programmes were updated in 2020, a large part of the training consists of general computer science-related subjects for a range of occupations (65%) and training in the sub-specialization of computer science in system integration (33%). Furthermore, as in all German training curricula, work standards are taught in an integrated way throughout the entire training period, with particular emphasis on foreign languages, social skills and digital skills as cross-cutting topics that are integrated into several areas of training. In particular, the application of digital skills – as is typical for the profession – and ethical considerations when dealing with sensitive user data or autonomously operating systems are emphasized as important skill components throughout the entire training period (Bundesgesetzblatt 2020).

Table 10: Structure and main occupational content of training for IT specialists, Estonia and Germany

Estonia	Scope	Germany	Scope
Training structure:			
Occupation-related training	68%	Occupation-related training: general informatics	65%
General study subjects	17%	Occupation-related training: sub-specialization	33%
Elective subjects	16%	Work standards: first year and continuing throughout VET	2%
The main content of occupation-related training:			
System and application software, administration and scripting		Conceptualization and implementation of IT systems[1]	
Management and services in computer networks		IT system administration and maintenance[2]	
IT system hardware and maintenance		Quality and security measures[3]	
Organization, business environment and career planning		Organization and working techniques[4]	
Application server management		Management of networked systems[5]	
Internship		Programming software solutions	

Notes: The Estonian curriculum lists modules and ECTS points. Modules are summarized accordingly. In Germany, time schedules are given, and training fields are summarized accordingly: 1: Training regulation §4 Abs. 2 (3), (4a), (4b), (7), (9) and §4 Abs. 4 (1). 2: Training regulation §4 Abs. 2 (4c), (4d), (4e), (8) and §4 Abs. 4 (3). 3: Training regulation §4 Abs. 2 (5), (6). 4: §4 Abs. 2 (1), (2). 5: Training regulation §4 Abs. 2 (8) and §4 Abs. 4 (2).

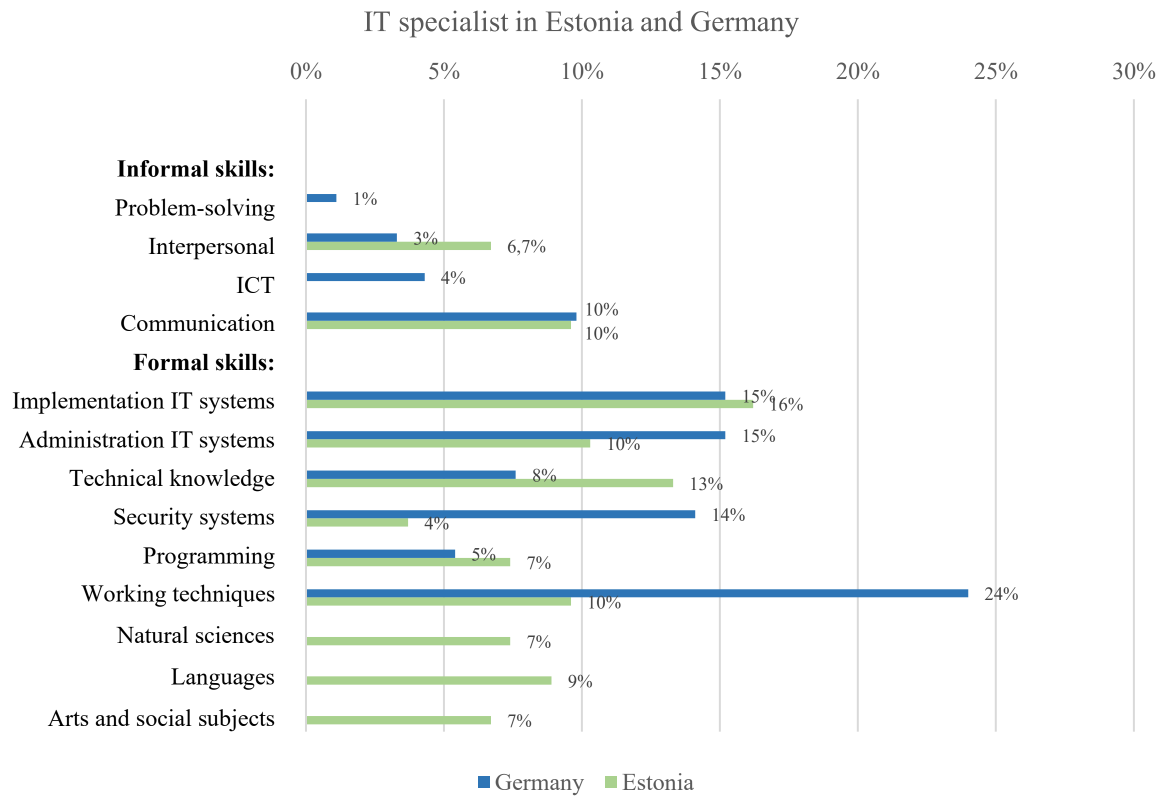
Sources: Pärnu Kutsehariduskeskus 2020; Bundesgesetzblatt 2020.

In addition to training in system and application software, in Estonia it is essential to be able to manage computer networks and devices and to have basic knowledge and maintenance skills in the area of hardware. Another focus is on developing an understanding of the organizational environment in which the student will work. To this end, students gain an understanding of business processes and the corporate culture of a multicultural company, reflect on the role that computer science can play in achieving strategic business objectives, and learn how to behave cooperatively and ethically. Practical experience and training in server management underpin this (Pärnumaa Kutsehariduskeskus 2020).

In Germany, in contrast to Estonia, the focus is not so much on gaining a comprehensive understanding of software. Although programming and scripting skills are taught as part of the training plan, the design, planning and implementation of new IT systems, as well as the administration of existing IT systems, seem to be more relevant. This includes software, but the focus is on realization. Another difference from the Estonian programme concerns quality and safety aspects, which seem to be quite important in the German training plan in terms of scope. Another part of the training relates to recent developments in an industry in which networked systems are important. Here, communications between real work environments and IT systems are dealt with, also including cyber-physical systems. As in Estonia, emphasis is placed on learning organizational principles and working techniques in changing (labour market) environments (Bundesgesetzblatt 2020).

When comparing the training curricula, it is striking that both countries put a strong emphasis on teaching the fundamentals of IT systems, their hardware components and software solutions, and network settings. This is reflected in the occupational skills profiles, which consist of various formal and informal skills (see Figure 13 and Appendix Table A.2-5 and Table A.2-6 for the assignment of skills to the skill categories in the curriculum). The Estonian skills profile consists of 84% formal and 16% informal qualifications, while in Germany it is 81% formal and 19% informal. The main IT-related skills in Estonia are mainly in system implementation (16%), system administration (10%) and technical knowledge (13%). As the focus of training is quite similar in both countries, the most important occupational skills are comparable. Slight differences in the training plan and skill emphases relate to a stronger focus in Estonia on specific system software applications. At the same time, safety and quality measures (14%) and IT-related and organizational working techniques (24%) account for a larger share in Germany than in Estonia.

Figure 13: Skills profile of IT specialists in Estonia and Germany (%)



Sources: Pärnumaa Kutsehariduskeskus 2020; Bundesgesetzblatt 2020.

In terms of informal skills, the Estonian curriculum strengthens teamwork (interpersonal skills, 7%). Customer contact is frequent, as regular tasks consist of user support and guidance. Students are prepared to apply good practices in customer service, acquire communication and self-regulation skills, and develop a good knowledge of English. Communication skills make up 10% of the profile. This ratio is the same in Germany. However, ICT knowledge and problem-solving skills are less important here, although they are explicitly mentioned in the programmes (Bundesgesetzblatt 2020; KMK Ständige Konferenz der Kultusminister der Länder 2020; Pärnumaa Kutsehariduskeskus 2020). In Germany, compared with Estonia, there is a slightly larger and more diverse range of informal skills in relation to formal skills within the designated IT training profile.

Summary

The learning content shows that the VET programmes teach similar skills to a large extent. However, there are differences. In Estonia, more emphasis is placed on commercial activities and general skills. In Germany, the focus is on skills related to (occupational) safety issues and quality assurance measures, as well as on practical and operational skills. The emphasis on general skills in Estonia goes hand in hand with a stronger emphasis on creating a comprehensive overview of knowledge. This is particularly evident in the curricula for electronics and computer science. In Germany, the training plans show that the practical dimensions are more in focus and are explicitly excluded in the training plans. This is reflected in a larger proportion of occupation-specific skills for implementation and installation and a stronger focus on working techniques compared with Estonia. This leads to the conclusion that the structural difference between Estonia and Germany in terms of their systems of skill formation and the different training locations where skills are taught, whether school-based or in dual learning locations, is also visible at the content level of the training plans.

Looking more closely at the content of skill formation, it was also of interest to see how formal occupation-specific skills and informal skills are related. From the structure of skill formation it can be deduced that in Germany the explicit notion of informal skills is more pronounced in the training curricula than in Estonia. This difference indicates greater potential for the application of informal competences in the dual training system and thus to a stronger emphasis within the training. By highlighting the different representations of formal and informal skills in the curricula and illustrating the professional skills profiles, the assumptions of hypothesis H1 can be partially confirmed.

Informal skills are more frequently explicit targets and outcomes in the training of electronics technicians (informal skills: Germany 19%, Estonia 7%) and IT specialists (informal skills: Germany 19%, Estonia, 16%) in Germany than in Estonia. In logistics, the situation is reversed: statements about informal skills are made more frequently in Estonia (28%) than in Germany (12%). Interestingly, the stronger emphasis on informal skills in Germany was taken into account in the recently updated training plans (see Chapter 5.2.2): training for electronics technicians was updated in 2020 and for IT specialists in 2021, with the standard training elements of the profession also being adapted to current requirements with regard to digitalization. The comparison of informal and formal skills thus shows that, in addition to a basic need for ICT skills, communication skills and interpersonal skills are considered essential for practicing a profession and acquiring occupational work capacity. They are included in a standardized and structured way in the training plans of both countries.

5.3 Workforce skills

Chapter 5 is devoted to aspects of skills supply in Estonia and Germany and a search for explanations of the differences between the two countries. So far, it has been shown that the systems of skill formation in Estonia and Germany differ. Both countries strengthen formal and informal qualifications through formal processes of skill formation in a similar way, but to different degrees. The specificity of the skills thus developed is different and more pronounced in Germany – in the recently updated training regulations – than in Estonia. This chapter takes up this finding in relation to differences in skills and aims to further deepen knowledge about the relevant skills profiles. This is because the role of skill formation systems goes beyond skills development to include ensuring that these developed skills are activated and subject to appropriate matching in the workplace and labour market.

5.3.1 Method and database

Methodological approach

The aim of this chapter is to provide an overview of the situation in Estonia and Germany regarding the workforce's ability to activate and use various skills after vocational training. It presents skills profiles in the workplace in practice and describes the diversity of the skills in use. The key question is which skills are activated by employees and used for work. The ability of employees to use their range of skills is therefore strongly related to any mismatch between skills supply and demand and employers' perceptions of skills shortages. This chapter therefore draws on the earlier findings on institutional settings in education and on recent studies on skills mismatches.

The problem of skills mismatches is usually analysed from an aggregate perspective with a focus on distinct or individual skills. Comparative studies confirm, however, that a country's overall skills mismatch situation is correlated with mismatches in individuals' technical or social skills. To get a sense of the job situation within the workforce, micro-level data are required that express employees' assessments of skills and their use. PIAAC, the OECD Programme for the International Assessment of Adult Competencies, and the EU-wide European Survey on Skills and Jobs (ESJS) are suitable data sources.

ESJS data show that 53% of adult employees in the EU have to acquire new knowledge continuously to avoid skills mismatches. This is because their task variety has increased significantly since they started their job. This highlights the fact that different forms of skills contribute to mismatches, including skills acquired mainly during formal schooling (for example, literacy, numeracy, technical skills) and on-the-job skills (for example, customer service and communication skills) (Cedefop 2015).

Further results on the use of workers' skills in the workplace show that 21% of adult workers in the EU believe that some of their skills are very likely to become obsolete in the next five years. This points to skill obsolescence among workers. Regarding the mismatch between over- or underskilling, the ESJS results show that a high share of reported overskilling among EU adult workers tends to be associated with high mismatches in literacy skills at their work, but also with high skills mismatches in transversal skills, such as insufficient opportunities for employees to apply their problem-solving skills. By contrast, high levels of underskilling are typically underpinned by high technical or digital skills deficits and a lack of planning and organizational skills among employees (McGuinness, Pouliakas, and Redmond 2017). This result underscores the need to disentangle different types of skills and their use at work, as well as their relationship to the institutional conditions of skills development.

Hypothesis H2 is formulated based on these impressions from the ESJS and related to the country differences presented so far. In the context of digital transformation, VET systems foster informal skills and provide a context for the further development of formal skills. Based on the description of skill formation in different institutional contexts (chapter 5.1) and their relation to inherited knowledge and skills in VET programmes (chapter 5.2), it is assumed that skills development and activation is consistent with and goes hand in hand with country-specific patterns. It is assumed that there exist country-specific differences with regard to employee skills in accordance with the already observed differences in skill formation between Germany and Estonia. Building on the findings from Chapter 5.1 and Chapter 5.2, the assumption is that the focus in Germany is more on occupation-specific skills during VET and that employees in Germany hold an equivalent high proportion of occupation-specific skills.

H2: When employees describe their skills profiles, informal skills are more pronounced in Germany than in Estonia.

We are interested in understanding the causes of skills mismatches. As studies show, mismatches can be intensified by different types of skills, for example, by relying more on formal or informal skills. This chapter's approach is to present country-specific skill profiles within the labour force and to provide information on the relationship between these two types of skills. Comparing skills profiles with each other also provides information that allows a discussion of the relevance of the individual skills profiles in terms of employability in the respective occupational field, as insights from practice in the workplace are incorporated into the comparison. Overall, it is important to highlight this facet of skills supply in order to obtain a comprehensive picture of skills supply in both countries.

Dataset

The approach chosen requires individual employee data. The European Skills and Jobs Survey (ESJS) contains micro-level data on employees in all European Union member states. It is a regular survey that collects information on skill requirements, skill levels, and initial and continuing training needs for adults. Examining workers' educational and skills needs provides insights into the situation across occupations and industries across the European Union. The Programme for the International Assessment of Adult Competencies (PIAAC) also assesses skills at the micro level. However, compared with the ESJS, it captures adults' basic skills in only three main areas: literacy, numeracy and digital problem-solving. The strength of the ESJS is that it assesses a wider variety of skills than the PIAAC data.

The ESJS surveys skills to find out which skills are currently present in the labour market or are perceived as important for future requirements. Workers are asked to assess their match with a subset of 11 specific skills (literacy, numeracy, ICT, technical skills, planning, problem solving, learning, foreign languages, customer service, teamwork, and communication). Questions on skills imbalances complement this skills assessment (for example, overskilling, underskilling, skills obsolescence). In addition, it enables the identification of drivers of skills and qualification development – always in the context of changes in the labour market due to digital transformation. This detailed measurement of skill and qualification levels in all EU member states is unique and particularly suitable for comparative approaches to questions of skills mismatch.

The body responsible for this data set is Cedefop, the European Centre for the Development of Vocational Training. It is a European agency for improving VET policy across the EU. The agency strengthens information and knowledge exchange and cooperation on VET policy, skills and qualifications between the European Commission, member states and social partners. Through the ESJS, Cedefop contributes to the European Skills Agenda, a European Commission initiative that promotes social fairness in line with the European Pillar of Social Rights. It also aims at sustainability in line with the new Green Deal, fosters resilience in times of crisis and supports further action as part of its five-year plan (European Commission 2016, 2023a).

The first round of the ESJS was conducted in 2014. Data have been available since 2015 and include information on approximately 48,676 respondents (aged 24 to 65 years) from all (currently) 27 EU Member States and the United Kingdom. The ESJS is designed as a continuous longitudinal study, conducted at regular intervals of five to six years. The second wave was conducted in 2021, but the data are not currently available for scholarly purposes. While the first round of data focused on providing a picture of the drivers of skills development and the dynamics of skills imbalances, the second survey focuses on changing skill requirements, skills needs and changing work tasks, and relates to digital transformation and technological change in the workplace. The second wave covers 45,000 adult workers (aged 24 to 65) from all EU Member States, as well as Norway and Iceland (Cedefop 2022).

For subsequent analysis, the first ESJS data are used. The sample was drawn from an online panel conducted by Ipsos MORI. Its large sample size for each country (between 1,000 and 4,000 entries) is achieved by quota sampling and because interviews took place by telephone or online. This mixed approach was applied in a subset of countries to increase inclusiveness and speeded up the field work.

The sampling procedure was based on a quota sampling approach. First, targets were set for the number of interviews to be conducted in each country. Then targets were set for interviews in each country and in accordance with quotas, taking into account the following variables: age, gender, occupation and industry. The weighting aspect is relevant for the quota sampling approach. Variables selected as closely related to skills mismatches were weighted. These are: age, gender, education, economic activity and occupation (Ipsos Mori 2014).

The key characteristics of respondents in Germany and Estonia provide an overview of the comparability of the ESJS data for both countries (Table 11). After data cleaning and the exclusion of cases with a null value for the main survey weight 'education', the number of respondents in the EU is reduced to 48,170. The dataset contains information on 988 employees in Estonia and 3,971 employees in Germany (Forth 2016).

Table 11: Respondent characteristics in the EU, Estonia and Germany

	in %		
	EU-28	**Estonia**	**Germany**
Gender			
male	51.9	48.9	52.6
female	48.1	51.1	47.4
Age			
24-39 years	41.1	40.4	35.5
40-54 years	43.8	39.9	45.9
55-65 years	15.1	19.8	18.6
Education (ISCED-97 levels)			
No completed education	0.4	0.0	0.0
Primary Education (ISCED 1)	1.4	3.4	0.4
Lower secondary education (ISCED 2)	11.9	3.6	7.0
Upper secondary education (ISCED 3)	40.1	33.3	44.8
Post-secondary non-tertiary education (ISCED 4)	10.8	17.8	18.7
Tertiary education - first level (ISCED 5)	29.9	41.3	28.1
Tertiary education - advanced level (ISCED 6)	5.7	0.8	1.0
total	100	100	100
	N = 48,170	N = 988	N = 3,971

Source: Cedefop ESJS, 2014; author's calculations.

In terms of gender and age, respondents in Estonia and Germany are distributed almost equally, as is also the case with the general EU average. However, the data set for Germany contains more older respondents than those of the EU and Estonia. The sample also reflects the distribution of education characteristic of the two countries: in Estonia, a larger number of respondents have attained higher levels of education (ISCED 4 and ISCED 5), while in Germany the most common educational group is upper secondary level (ISCED 3). The certificates for general upper secondary education and for vocational education and training are classified in ISCED group 3. The larger number of post-secondary, but not tertiary, educational qualifications (ISCED 4) also confirms the vocational orientation of the education system and population in Germany. The proportion of vocational qualifications in Germany (79.7%) is also much higher than in Estonia (60.1%) and the EU average (56.5%). For the analysis of the skills profiles of the labour force in the selected occupations, the sample distribution of the 'employment' variable is significant. Together with company characteristics, a brief overview of these variables in the ESJS data set is given below (Table 12).

Table 12: Respondent information in the EU, Estonia and Germany: occupation, sector and company characteristics

		in %	
Occupation (ISCO-08 groups)			
	EU-28	Estonia	Germany
1: Manager	7.3	11.3	8.6
2: Professional	18.1	16.9	11.9
3: Technician or Associate Professional	17.4	13.5	22.4
4: Clerical Support	23.9	9.2	26.2
5: Sales, Customer or Personal Service Worker	14.1	17.0	13.3
6: Skilled Agricultural, Forestry and Fishery Worker	0.8	0.7	0.3
7: Building, Crafts or a Related Trade Person	6.8	13.7	6.0
8: Plant and Machine Operator and Assembler	6.8	12.8	7.8
9: Elementary Occupations	4.7	5.0	3.6
None of the listed occupations	0.1	0.0	0.1
Enterprise type			
A private company or partnership	64.5	70.6	69.8
A national, regional or local public sector organisation	24.7	24.2	15.5
A not-for-profit trust, charity or NGO	4.2	2.3	6.4
Another type of organisation	5.3	2.4	7.3
Missing	1.3	0.5	1.1
Enterprise size			
Under 10 employees	19.5	30.4	15.4
10-49 employees	25.6	38.8	22.4
50-99 employees	12.3	11.8	12.3
100-249 empoyees	13.1	8.9	14.4
250-499 employees	8.5	3.6	11.1
Over 500 employees	17.8	4.7	21.8
Number of employees varies	0.8	0.5	0.9
Missing	2.5	1.2	1.8
total	100	100	100
	N = 48,170	N = 988	N = 3,971

Source: Cedefop ESJS, 2014; author's calculations.

The higher levels of education in Estonia correspond to a higher proportion of occupations classified as managers and professionals in the Estonian labour market (ISCO groups 1 and 2). At the same time, the construction and manufacturing sectors are very important in the Estonian economy. This is also reflected in the Estonian sample and the distribution of respondents in the associated occupational groups of construction, craft and related trades workers (ISCO group 7) and plant and machine operators (ISCO group 8). The same picture emerges in the German sample: we find a high proportion of employees working as technicians or associate professionals or as clerks (ISCO groups 3 and 4), occupations that require an upper secondary level of education (and/or further specialized vocational training) or a post-secondary level of education and corresponding skills (ILO 2023).

Most respondents in Estonia (70.6%) and Germany (69.8%) work in private companies. In Germany, the non-governmental and non-profit sector is more important than in Estonia. In addition to the type or organization, size of company is a relevant indicator for capacities in the areas of vocational training, digitalization and the shortage of skilled workers, and completes the picture of workplace characteristics. In Estonia, the share of SMEs in the economy is above average: 30.4% of respondents work in companies with fewer than ten employees, and a further 38.8% in companies with fewer than 50 employees. In Germany, company sizes are more evenly distributed, with a larger share of respondents working in large companies with more than 500 employees (21.8%).

Operationalization

To obtain an impression of workers' skills profiles in the selected electronics, logistics, and IT training fields, the following ESJS variables specify the skill sets.

Occupation: The ESJS gives occupational information at the 1-digit level and at the 2-digit level of ISCO-08 groups as answers to the question: 'Which of the following best describes your current job...?' It then attempts to specify the features of the current job: 'We will now ask you some questions about your main paid job. This is the job that you are currently working the most hours. We will be referring to this as "your current job".'

The respondents of the respective two-digit groups are selected for the analysis of the skills profiles of employees in the selected occupational fields of electronics, logistics and IT. This applies to electronics technicians, the ISCO-08 group 'Electrical and electronics occupations', logistics assistants, the group of 'Numerical and material recording clerks', and to IT specialists, the group of 'Information and communication technicians'. The response categories pertaining to the ISCO-08 occupational codes correspond to the occupations in which VET programmes provide training. As respondents usually have difficulties assigning themselves to one of these occupational groups, the ESJS questionnaire provides sample occupations as a guide. It defines the occupations under study as examples (electrician and IT technician). The expectation is that respondents will choose the applicable category correctly. A more concrete match between the VET programme and occupation would have been provided by the three-digit ISCO code for occupational groups, but the ESJS does not provide this information.

Skills profile: To understand which skills are needed in an occupation, the respondents' assessment of the skills required for a job application is used. Several skills together form a skills profile, which is divided into the categories of formal and informal skills (see Chapter 3 for the theoretical explanation and Chapter 5.2 for skills profiles in VET). The ESJS question on the knowledge and skills acquired by the respondents as part of their training and during their professional life, 'How important are the following skills for doing your job?' is used for operationalization. The questionnaire explains the meaning of various skills and records the relevance of 11 skills. These are: literacy, numeracy, ICT skills, technical skills, foreign language skills, communication skills, teamwork skills, customer service skills, problem-solving skills, learning skills, and planning and organizational skills. For each skill, its importance is indicated on an 11-point scale ranging from '0 - not important at all' to '5 - moderately important' to '10 – essential'. To examine the respondents' assessments in more detail, the answers on the 11-point scale are categorized as follows: not important at all, not very important (values between 0 – not important at all and 5 – moderately important), moderately important, very important (values between 5 – moderately important and 10 – essential) and essential.

Formal skills, such as general knowledge and competencies, as well as job-relevant formal skills needed to practice the profession are used to describe its skill profile. The skills of literacy, numeracy, technical skills, and foreign languages are closely related to formal school teaching. In terms of formal skills, literacy and numeracy are frequently asked about. The ESJS defines literacy skills as the ability to read manuals, procedures or letters and to write documents such as reports, manuals or articles. Numeracy skills include the knowledge and competence needed to perform calculations and to understand tables, graphs or statistical procedures. With regard to technical skills, the ESJS asks respondents about their specialist knowledge, which is required to carry out job duties or to understand job-specific products or services and to operate specialized technical equipment. Foreign language skills refer to the ability to use a language other than the mother tongue to perform tasks and duties.

Informal skills are also associated with educational processes within institutionalized school education, but they have a different character, as they are more tied to experience and social behaviour. The informal skills used to describe the occupational skills profile therefore include the following. Interpersonal skills, measured in the ESJS as teamwork, refer to the ability to collaborate and interact with colleagues, as well as to deal with and negotiate with other people. Communication skills, such as sharing information, teaching, guiding people and giving presentations, as well as customer service skills, such as selling, advising, mentoring or caring, are also relevant for interaction. In the context of digital transformation, keeping up with digital tools and technologies is becoming important, and this includes not only the use of ICT skills such as using a PC, tablet or mobile device for email or the internet, but also writing and using software, programs and apps. Therefore, the ESJS measures learning new things in terms of 'learning skills'. Organizing one's own work and tasks is measured through planning and organizing skills, as well as problem-solving skills to find solutions and identify the causes of a problem.

Skills utilization: The respondents' proficiency in these skills is used *to analyse* actual utilization at the workplace. This makes it possible to assess any skills gaps or overskilling of employees. The question is: 'How would you best describe your skills in relation to what is required to do your job?' The answer categories range from '0 – My level of skill is a lot lower than required' to '5 – My level of skill is matched to what is required' to '10 – My level of skill is a lot higher than required'. Answers are grouped into the categories: A lot lower, lower than required (values between '0 – a lot lower than required' and

'5 – matched'), matched, higher than required (values between '5 – matched' and '10 – a lot higher than required'), and 'much higher'.

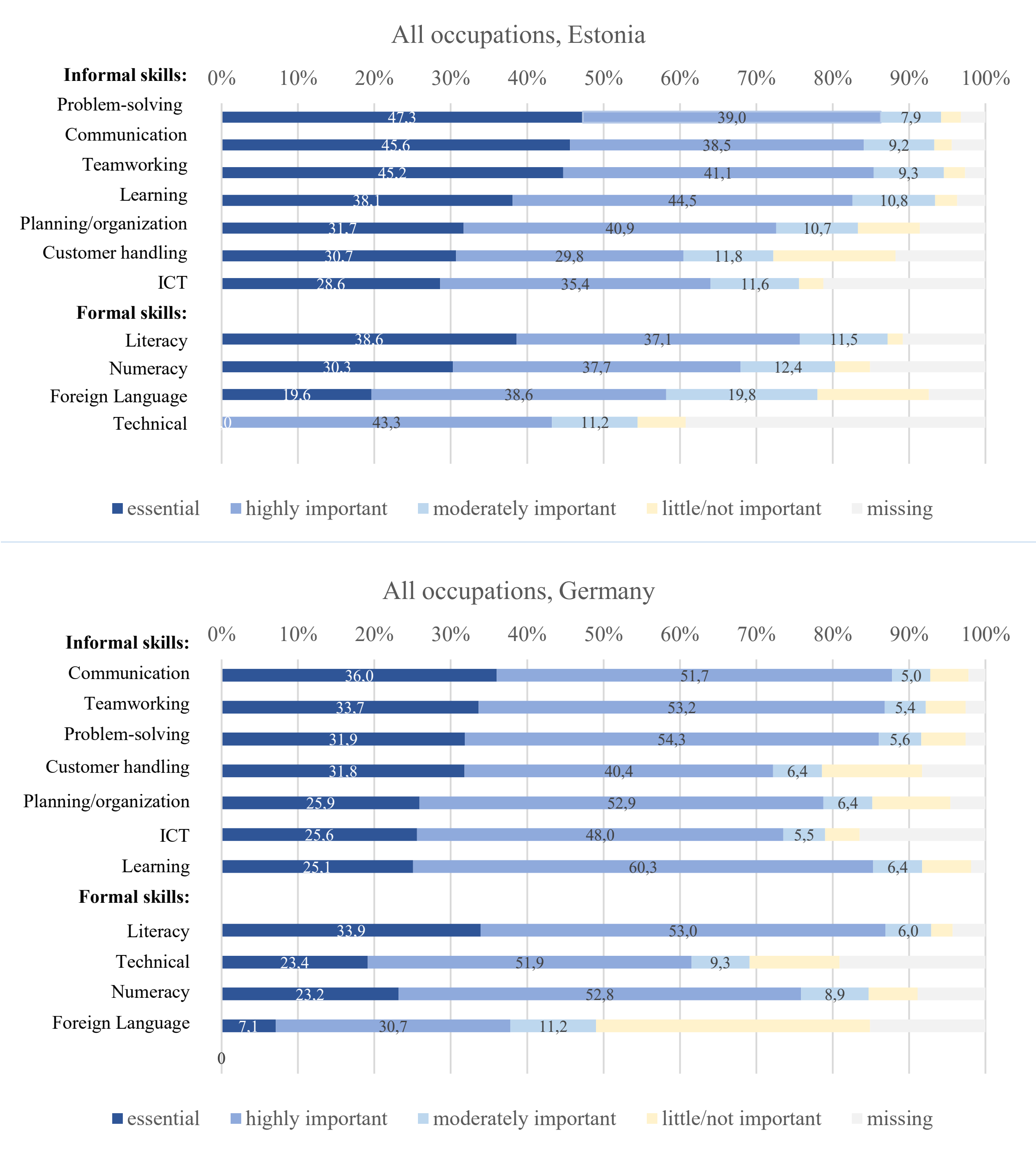
5.3.2 Workforce skills profiles: importance and utilization of skills

For each skill item, respondents rate its importance in actually doing their job. The skills are grouped into formal skills and informal skills. When performing tasks, employees utilize a range of skills. Therefore, the relative importance of several skills is given in the ESJS rather than the ranking of, for example, the most important or second most vital skill. Figure 14 provides information on respondents' evaluation at country level for all occupations. Most attention is paid to highly important (blue) and essential (yellow) answers.

There is considerable variation between skills in terms of their relevance for work. Generally, we see that respondents put more weight on informal than formal skills. This is true for Estonia and Germany equally when taking a cross-sectional first look at all occupations.

In Estonia, the importance of problem-solving skills (47.3%), communication skills (45.6%) and teamwork (45.2%) is very pronounced. According to almost half of all respondents, these three skills are essential for performing well at work. More than a third of respondents say that they need learning skills (38.1%) and good literacy skills (38.6%). Given learning skills, technical skills related to the job seem to be very important, but are not necessarily required. Foreign languages, planning or organizational skills and customer service skills are not considered to be as important. In Germany, the response patterns are similar across occupations and respondents place more emphasis on informal skills. Here, the highest proportion of employees believe that communication skills (36.0%) are essential to perform their jobs. In general, informal rather than formal skills are considered necessary for day-to-day work tasks. A third of respondents consider literacy skills (33.9%), teamwork (33.7%), problem-solving (31.9%) and customer relations (31.8%) to be important for their daily work tasks. Furthermore, language skills are not considered as important in Germany as they are in Estonia.

Figure 14: The importance of skills for work performance – workers in all occupations in Estonia and Germany (%)



Source: Cedefop ESJS 2014, Estonia: N = 899, Germany: N = 3,971; author's calculations.

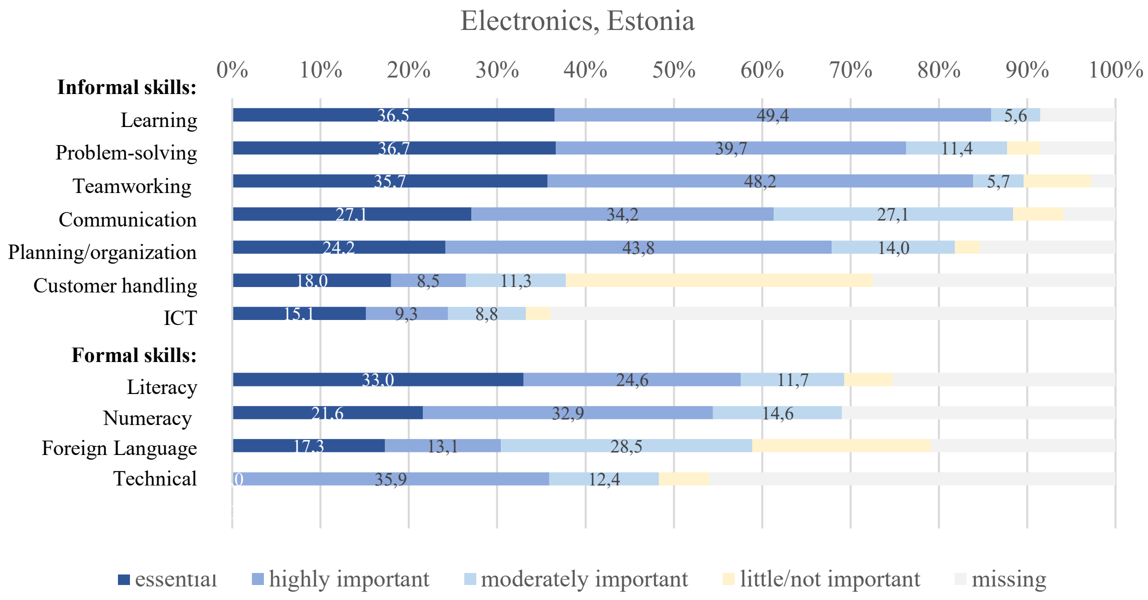
These general skills requirements are specified for the selected electronics, logistics and IT occupations. This enables us to specifically identify the professional requirements with regard to the use of skills. A detailed consideration of occupational skills profiles and the observed frequencies of informal and formal skills within occupations is better suited to assessing the hypothesis and clarifying whether there are country-specific differences. Furthermore, differences in the frequencies of informal and formal skills are of interest with regard to the differences between Estonia and Germany. When looking at the level of individual occupations, one can also evaluate workers' responses regarding the importance of skills in relation to vocational training (Chapter 5.2). However, the analysis of the selected occupations is complicated by the small number of respondents, which is most evident in the area of logistics in Estonia.

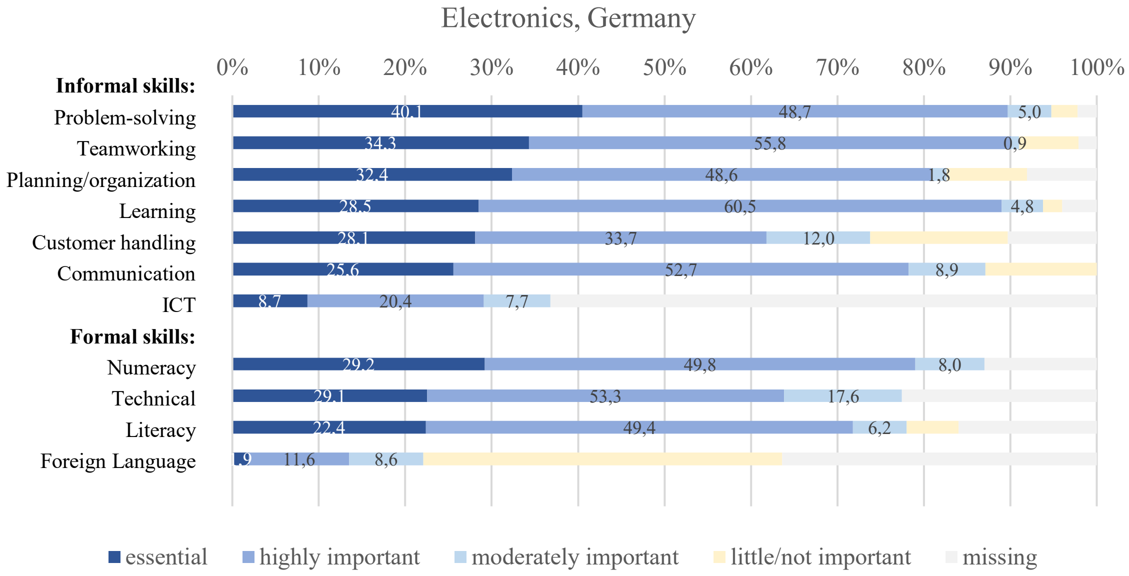
Electronics in comparison: skills profiles and skills utilization in Estonia and Germany

When looking at the distribution of skills required in electronics compared with occupations overall, it is noticeable that they are more nuanced. The responses in the section on basic and very important skills for the job are crucial to the definition of skills profiles, as they significantly define workflows in this field.

In electronics, the answers given correspond to specific tasks: electronics technicians work on electrical components and install and configure such components in and with devices, operating systems or programs. In doing so, electronics technicians work together with other skilled workers on site, such as engineers, or are in contact and exchange with customers and other trades. They are also responsible for finding solutions when something unexpected occurs during the design and implementation of production or installation processes. Problem-solving skills are by far the most frequently mentioned skill type for electronics employees in both countries (36.7% in Estonia and 40.1% in Germany consider it essential) (see Figure 15). In Estonia, three other skills are clearly among the skills required for working as an electrician: more than a third of respondents attach great importance to learning skills (36.5%), the ability to work in a team (35.7%) and general education (33.0%). Furthermore, learning skills are important (very important for 43.8%; essential for 24.2%), but other skills also come into contention. In Germany, employees put a very similar emphasis on these skills. After problem-solving, teamwork is widely seen as an essential skill (34.3%), followed by planning and organizational skills (32.4%). Language skills play a subordinate role for employees in the electronics sector in both countries (essential for 17.3% in Estonia and 1.9% in Germany), which leads to the assumption that the work is carried out mainly in the respective national language. In addition, more attention is paid to customer contact in Germany than in Estonia, where respondents often indicate that this skill is of little importance. Because of the large number of missing values, it is not possible to get a good impression of the importance of ICT skills.

Figure 15: The importance of skills for work performance – electronics workers in Estonia and Germany (%)





Source: Cedefop ESJS 2014; Estonia: N = 33, Germany: N = 56, author's calculations.

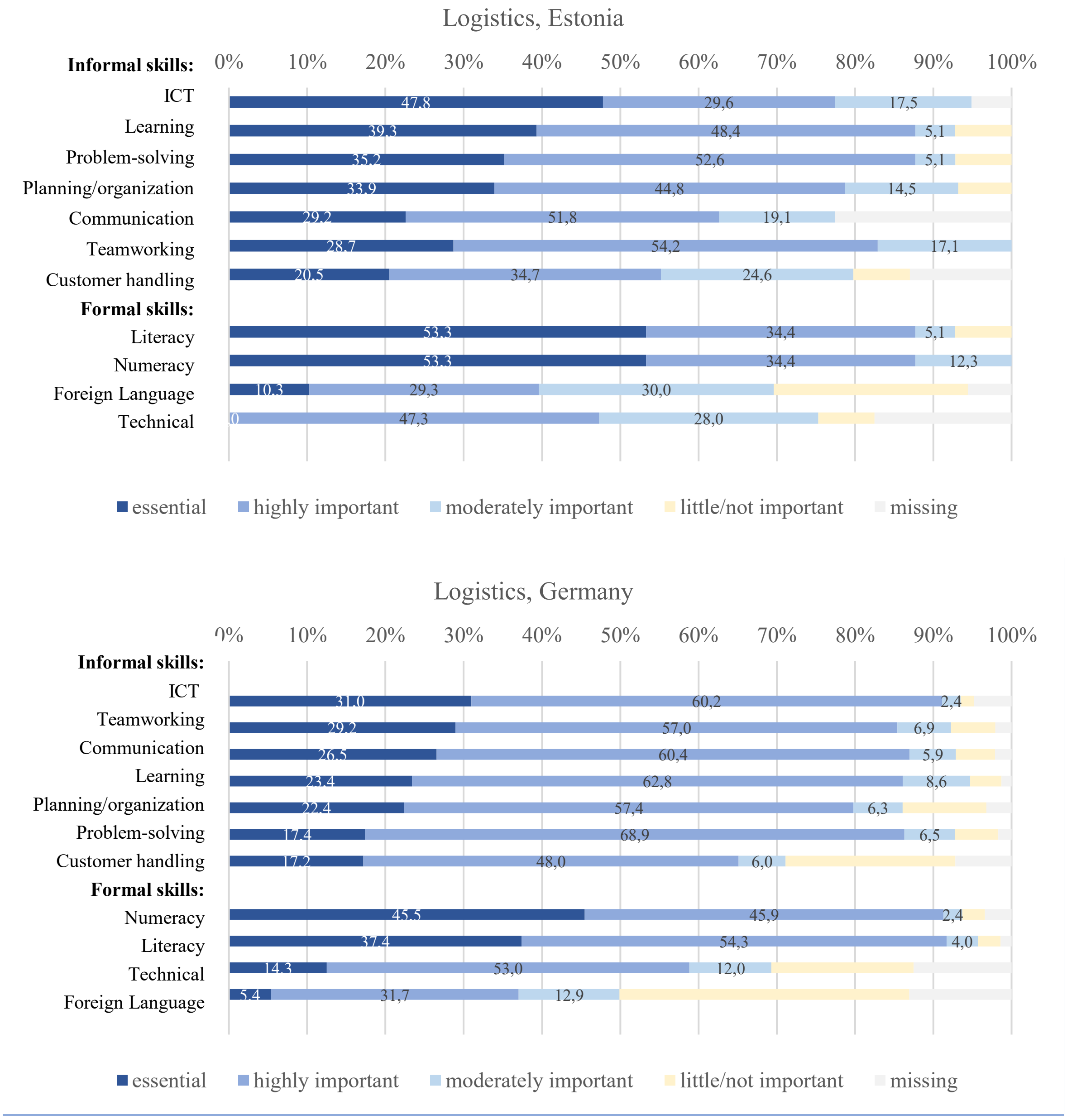
Based on these skills required for work, the respondents' self-reported skill levels provide insights into the relationship between the importance of skills and their use. Employees identify matching problems in relation to all the skills. Most respondents feel that they are overskilled in almost all of the skills examined (answer: 'my skills are higher than required'), as is indeed the case with regard to all occupations. This applies more to German electronics than to Estonian electronics: one in four respondents state that they have much higher problem-solving, teamwork, communication and technical skills than their job requires. An exception is customer service skills: here, Estonian respondents report obvious underqualification (see Appendix A.3). This discrepancy reflects the higher demands of the work in this regard and the insufficient preparation for such tasks. However, almost half of the respondents in Estonia consider customer service skills to be of little or moderate importance for their job, unlike in Germany.

To sum up, the skills profile is perceived very similarly in the electronics industry by employees in both Estonia and Germany. Informal skills are of great importance. The skills profile essentially includes problem-solving, teamwork, learning and planning/organization. Employers are more likely to value informal skills in Germany than in Estonia. In addition, German respondents add the formal skills of literacy, numeracy, and technical skills to the skills profile and consider these to be extremely important for work (essential and very important). Due to the high importance of informal skills, electronics workers in Germany are sometimes unable to fully utilize their informal skills in their positions, and electronics workers in Estonia seem to take on tasks related to dealing with customers that are beyond their skills.

Logistics in comparison: skills profiles and skills utilization in Estonia and Germany

In contrast to the field of electronics, formal skills are emphasized more often than informal skills as an important prerequisite in logistics. This is true for both countries and concerns literacy and numeracy (literacy: essential for 53.3% in Estonia, 37.4% in Germany; numeracy: essential for 53.3% in Estonia, 45.5% in Germany). These are the highest results for a skill in both countries (see Figure 16). A strong knowledge of these skills is highly relevant to the tasks of logistics staff when calculating the volume or weight of goods, calculating prices, corresponding with partners or customers, knowing the details, checking the descriptions of certain goods and confirming their condition in detail on the basis Furthermore, ICT skills are very important. They are the most frequently weighted skills in the group of informal skills and are essential for 47.8% of respondents in Estonia and 31.0% of respondents in Germany. There is also a close connection between the workplace and this skill: employees in logistics often – and increasingly – come into contact with apps, wearables or programs that track and improve internal warehouse conditions or material flows. Learning, problem-solving, planning and organizational skills round out the skills profile in Estonia. In Germany, it is also important to have teamwork (29.2%) and communication skills (26.5%) to succeed at work. Although the field of logistics is also often associated with international trade and trade routes, language skills do not necessarily appear to be crucial for performing their work tasks of delivery notes and accompanying documents.

Figure 16: The importance of skills for work performance – logistics workers in Estonia and Germany (%)



Source: Cedefop ESJS 2014; Estonia: N = 16, Germany: N =287, author's calculations.

The situation of overskilling is quite pronounced in German logistics. For each skill under analysis, a large majority perceive themselves as having higher or a lot higher skills than the job requires. The feeling of being mismatched is particularly profound in relation to literacy and numeracy, two skill types that are core to the logistics skills profile. In these essential skills, German respondents don't seem to be able to utilize their skill levels adequately. Results on skills in use in Estonia are too erratic to be presented (see Appendix A.3).

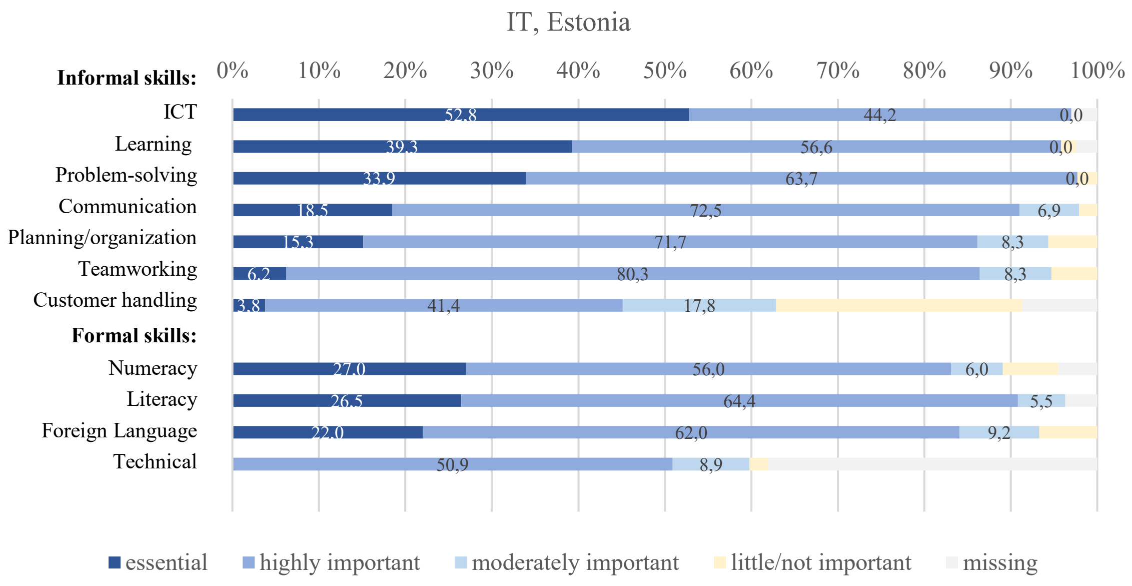
Overall, the focus in logistics is mainly on the importance of high skill levels in literacy, numeracy and ICT, and to a lesser extent on various soft skills such as learning, planning and organizing, communicating and working in teams. The cross-country comparison also shows that German workers endorse more and more diverse soft skills, except for dealing with customers (the responses ‘very important’ and ‘indispensable’ combined). By contrast, when it comes to ICT and learning skills, respondents in Estonia are very specific in their assessment of specific skills, which, compared with other skills, receive quite a clear endorsement that is higher in Estonia than in Germany. However, due to the small number of cases, the results for Estonian logistics employees should be treated with caution.

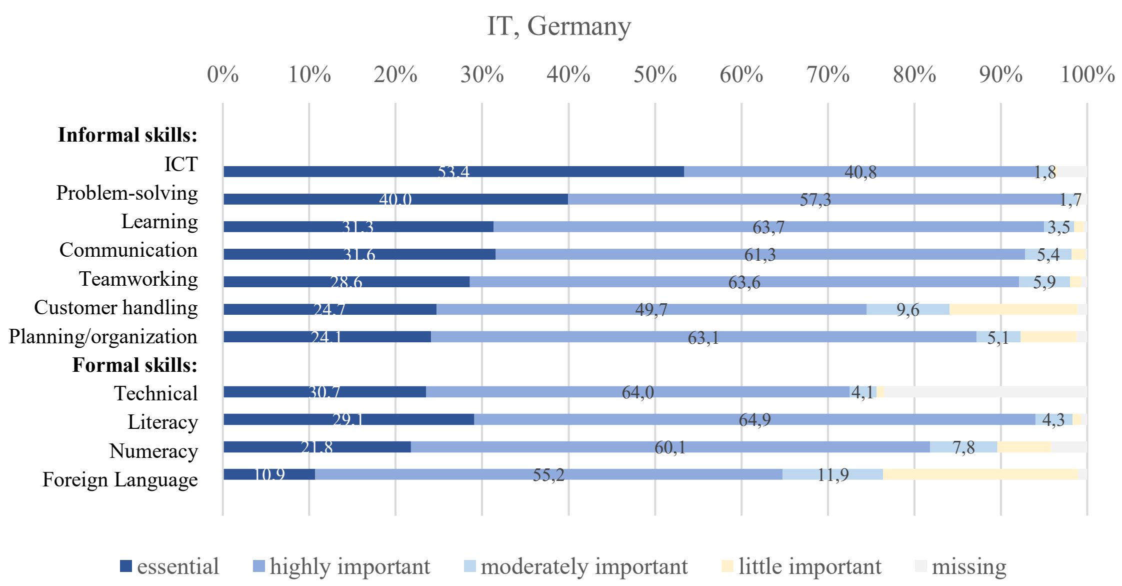
IT in comparison: skills profiles and skills utilization in Estonia and Germany.

The IT skills profiles are very similar in Estonia and Germany, and ICT skills are of great importance for work performance (52.8% essential in Estonia, 53.4% essential in Germany) (see Figure 17). IT workers’ main tasks include working with computers, servers, cloud applications, or tools and platforms on a daily basis.

In addition to ICT knowledge, the IT skills profile ranks leadership qualities first, together with other informal skills, which is in line with Estonia and Germany. In Estonia, more respondents consider learning skills (39.3%) to be essential, followed by problem-solving skills (33.9%). In Germany, problem-solving skills also receive strong support: 40% say they are essential and 57.3% say they are very important. Learning skills (31.1%) and communication skills (31.6%) are also rated as essential quite frequently. Keeping up with changes, adapting workflows to new products or processes, and acquiring new content are particularly relevant in the IT sector. It depends on the job profile, but a common task for IT employees is providing IT support. These tasks include explaining the causes of IT-related problems and guiding users through problem-solving processes. This involves communicative tasks and, as we can see, skills. According to respondents, their tasks at work in both countries require a high level of formal skills (literacy and numeracy) as well as broader technical understanding and abstract thinking, which is emphasized in Germany (technical skills: 30.7% essential, 64.0% very important). On the other hand, Estonian employees put more emphasis on language skills than German employees.

Figure 17: The importance of skills for work performance: IT workers in Estonia and Germany (%)





Source: Cedefop ESJS 2014; Estonia: N = 40, Germany: N =287, author's calculations.

With regard to the relationship between key skills requirements and the use of skills, IT staff are apparently overqualified, apart from in relation to language skills (see below): in Germany, almost all respondents assume that they have higher and much higher skills than required, with particularly high values for ICT skills, problem-solving skills and literacy. In Estonia, widespread overskilling is not as pronounced, with more respondents reporting that their skills match requirements. Interestingly, some respondents appear to need to improve their language skills: around 17% in Estonia and Germany report that their skills are below requirements (see Appendix A.3).

Overall, the IT skills profile consists mainly of ICT, problem-solving, learning and communication skills. In Germany, technical skills are added to the profile. From a comparative perspective, the answer patterns show that respondents in Germany put a stronger emphasis on essential informal skills than those in Estonia.

Reported skills mismatches and dealing with change

The skills profiles illustrate which skills are required to perform a job. The relationship between the importance of skills and their use provides initial insights into how people view working under conditions of a mismatch between skills and requirements. The significantly high level of overskilling in the selected occupations is also stable across all occupational groups and is confirmed by an additional control question (see Appendix A.3).

Almost half of the respondents in all occupations in Germany (45%) state that they work with higher skills than required, to a greater extent than in Estonia (22%). Looking at the group of respondents who report being overskilled in Germany, men (55%) are more likely to be affected than women (45%). This applies mainly to employees with upper secondary education (ISCED 3) (43%). The fact that employees in Germany are increasingly affected by skills mismatches shows that employees with only intermediate qualifications in particular remain in positions that no longer match their skill level, rather than moving into higher-level positions with more responsibility in which they can apply their skills. This represents a challenge for personal career development.

The situation is different in Estonia. Looking more closely at the group of overskilled employees, this is a skills mismatch situation predominantly for younger (52%), higher-educated (ISCED 5) (48%) employees entering the labour market. In Estonia, on the other hand, gender makes no difference. This frequency distribution suggests that in Estonia, higher-skilled employees take up positions in the more or less early stages of their employment that do not correspond to their profile and skills.

These results on reported skills mismatches indicate a growing need for insights into the interrelations between skills, (changing) job requirements and the structural conditions of education and labour market systems. To meet this demand, the ESJS provides further information on how respondents assess changes in the workplace and in the job characteristics of employees since they started their jobs. As digitalization is affecting workplaces, the results on how employees in the three occupations perceive change add important information on skill formation and skills supply of these occupations in the labour markets.

In the survey, respondents are asked whether the variety of tasks in their job, the difficulty of these tasks or the need to learn new things has decreased, increased or remained the same. When we compare what the respondents observe at their workplace, employees in logistics and IT are confronted with changes more intensively than those in other occupations. Their task variety, task difficulty and work content have increased more than in other occupations. Above all, however, work content continues to change and develop. This requires that employees adapt to changes and learn new things, which is more pronounced in Estonia than in Germany or other European countries (logistics: Estonia: 94.5%;

Germany: 83.6%; EU: 83.6%) (IT: Estonia: 90.0%; Germany: 85.7%; EU: 84.9%) (see Appendix A.3). Impressions in the field of electronics correspond approximately to the EU average.

Summary

In relation to the research question, workers in the electronics, logistics and IT sectors rate the importance of skills for their job as follows: informal skills are more often rated as essential and very important in the electronics and IT sectors. This picture is more pronounced in Germany than in Estonia. Hypothesis 2 is therefore partially confirmed, as this pattern can be found in the electronics and IT sectors, but not in the logistics sector. We must be cautious, however, because of the small number of cases in these occupations. The answers refer to the entire workforce in these occupations and not only to employees in the initial phases of their career. A stronger emphasis on informal skills is therefore seen not only as an indication that informal skills are developed more intensively in vocational education and are somewhat more present in workplace activities in Germany than in Estonia, but also refers to experience gained on the job. The results are based on the ESJS data and the responses in relation to 11 different skill types.

Besides the fact that employers emphasize formal or informal skills, this chapter is interested in the skills profiles in each profession to get a sense of what particular skills are required for work in Estonia and Germany. Examining the respondents' evaluations in the ‘essential’ and ‘very important’ response groups in relation to creating the skills profiles for the three selected occupations we see that these profiles vary. On this basis it makes sense to observe the requirements for skills and the use of skills at the level of occupations. In the case of electronics, the skills profile is characterized by teamwork, problem solving, learning and planning/organizational skills. In logistics, basic formal skills such as literacy and numeracy are a strong skills requirement for employers in both Estonia and Germany, and are complemented by several informal skills such as ICT, learning skills, planning and organization, communication and teamwork. The skills profile in IT consists to a large extent of ICT skills, problem-solving skills, learning skills and communication skills.

Overlaps between the occupations examined can be seen particularly in the areas of ICT skills, problem solving and learning ability – skills that are of enormous importance in the face of changing working conditions and the need to learn new things in order to maintain employability. The ESJS data could be used to further explore the causes of such mismatches, for example, whether it is linked to job changes, education or work experience. Using multivariate statistical analysis, explanatory factors for the skills mismatch could be estimated. However, country comparisons within the three occupational groups would be complicated by the relatively small number of cases in Estonia. Therefore, the chapter focuses on the descriptive presentation of the skills profiles and on embedding the results of the significance and use of skills in the structural and institutional conditions of skill formation (Chapter 5.4) and skills demand (Chapter 6).

5.4 Discussion and conclusions

This chapter on skills supply aims to look at skill formation in the light of digital change. It is about how VET systems in Estonia and Germany function and are prepared for situations of change in providing relevant skills for digitalized labour markets. Skill formation and use of the right skills are crucial prerequisites for society and the economy, especially for the respective employees in their work positions because skills are at the core of work tasks and performance. To this end, the chapter analyses the conditions, structures and results of vocational education and training using the example of the occupations of electronics technician, logistics assistant and IT specialist.

The three occupations are foregrounded because they contribute to technological development and innovation and manage change in response to the challenges of digital and socio-ecological evolution. Managing change is one of the most important and challenging tasks for the Estonian and German economies. In addition to the relevance of occupations for digitalization (see Chapter 5.2.1), the effects of digitalization on these occupations are observed at the workplace and task levels. The findings from the ESJS survey show that employees in the occupations studied are more exposed to changing requirements at the workplace than in other occupations. In IT and logistics, there is a great need to acquire new knowledge and adapt to changing work content (see Chapter 5.3.2). Although the reasons for workplace changes are not specifically asked about in the survey, the respondents' answers are consistent with other workplace studies that establish a more direct link to digitalization (Eurofound and Cedefop 2020; Eurofound 2017b, 2018).

These results show that digitalization is often perceived as a double-edged sword. On one hand, digital technologies bring advantages by relieving the burden of work processes, making them more agile and flexible, or, above all, guaranteeing further employment. In the digital transformation, there is an increasing demand for the selected occupation itself because it is of enormous importance for the future, and in order to keep up economically and to maintain their significance, structural change must also take place in other occupations in industry or manufacturing. On the other hand, digitalization also entails risks that endanger health, well-being or employee rights – for example, when we consider the technical possibilities for monitoring employees' activities and performance (Staab and Gesche 2019). However, the greatest risk posed by the digital transformation is that employees will either be left behind by these developments and, as a result, their employability will suffer, or that future employees will be faced with needs resulting from newly available digital products that have not yet been taken into account in their training.

The ESJS findings on skills mismatches among employees (see Chapter 5.3.2) due to the digital transformation offer a first approach to understanding the relevant risks and how they are related to the vocational training system. Seeing how employees talk about mismatches in practice helps us to understand skills shortages and changing skill requirements in the workplace. The design of the question on skills mismatch captures over- and underskilling at the skill level and confirms it with an additional general question. The question establishes a specific link to the skill level being assessed and to the job requirements, to make clear that the survey is targeting mismatches in the workplace. This reduces the risk of distorted estimates in relation to unrelated skills, for example, outside of work. However, in general, such skill measurements are based solely on subjective impressions, which makes them susceptible to subjective distortions.

The results point to a skills mismatch in both countries, with workers in Germany more likely than in Estonia to report that their skills do not match the requirements of the job. There is more overskilling than underskilling in Germany, and the effects are more substantial there than in Estonia. Specifically, skills mismatches affect some skills more than others, but correspond to skills types in both categories: skills acquired mainly in formal schooling (literacy and numeracy in both countries, and electronics, logistics and IT), but also skills that are cross-disciplinary and acquired through (work) experience. For example, German respondents in the IT field find insufficient opportunities in the workplace to apply their problem-solving and customer service skills. Underskilling in all three occupations is also associated with lower language skills.

When interpreting the results, overqualification can be caused by a weak link between employers' demand and the vocational training system (McGuinness, Pouliakas, and Redmond 2017). This might apply to Germany, where we find a very strong emphasis on overskilling in all occupations and for all employees, but more clearly for employees with at most upper secondary school qualifications and moderate work experience. This underlines the relevance of further training within careers. In Estonia, overskilling is more likely to reflect personnel and labour distribution problems, as it occurs more frequently in younger age groups. This highlights the importance of the recruitment situation and university graduates' willingness to accept a job. As the literature suggests that there are likely to be spillover effects of overskilling with mismatches in other employee groups, strong indications of overskilling in the working population, particularly in Germany, lead us to discuss the educational aspects of skill formation (see below) and, in a second step, to analyse employers' demand for skills (Chapter 6).

VET systems and incorporating change: logics and processes of future viable skill formation

The comparative analysis of skill formation (see Chapter 5.1) is based on training structures and the content of curricula to show how skill formation works within the framework of transformation and how it integrates new content based on the digital transformation. It shows that education and training in general are slower to absorb digital change than the world of work in the form of workplace practices. The result shows that training programmes have difficulties in absorbing short- or medium-term digitalization developments and embedding them in training curricula as learning content within short timeframes.

But even more than the fact that there are differences between the education system and the economic system in relation to digital transformation, the question of what consequences this situation has and whether countries benefit from taking up new developments is important. The institutional conditions for absorbing change differ from country to country and vary between Estonia and Germany. As already mentioned, they depend on the type of skill formation system prevailing in the country and are based on the respective contextual factors that promote or hinder change.

As we have seen, Estonia integrates changes taking place in all three vocational training-based occupations in the form of new requirements and standards more quickly than Germany. The Estonian education system was built from the ground up after regaining independence in 1991. Due to its past and in terms of the educational structure, there is not such a strong reliance on certain institutions as in Germany, but rather a fundamental break and new beginning took place. Although this entailed an enormous effort, it offered Estonia real opportunities to create a new foundation for the requirements and new educational standards in the twenty-first century. The education system that was introduced differs in its general structure from that in Germany and other European countries, because in Estonia computer science is taught extensively. Schools are equipped with modern IT equipment and infrastructure. It offers equal educational opportunities (low stratification). A path dependency in cultural terms lies in the appreciation of educational achievements, which leads to a high proportion of high levels of competence in the Estonian population.

More important for the ability of skill formation to respond to change, however, is that the school-based VET system prevalent in Estonia and its relationship with other societal and economic subsystems are in line with each other within the framework of a liberal market economy. This creates a further prerequisite when it comes to dealing with change than in the coordinated market model of Germany. The strong market orientation of Estonia’s economy implies a need for flexibility, which translates into pressure to respond and adapt to new labour market conditions. The changing context is also reflected in vocational education and training and skill levels, including the reorganization of curricula. In the occupations studied (electronics, logistics, IT), training programmes are taught with national framework curricula, and school curricula are derived from them. They may be valid only for a few years (on average about four to five years). Learning objectives and learning content are regularly adapted as the responsible curriculum groups monitor and discuss new work requirements. This structure also provides space for minor annual adjustments within the school curricula. This standard monitoring is carried out not only in the occupations studied here, but in all training occupations in Estonia. The regularity with which training is updated is governed by law.

In Germany, framework curricula are monitored, further developed and defined in cooperation between the state, social partners and associations. However, there is no regulation on the timing of curriculum updates as there is in Estonia. Nevertheless, the representatives on the respective VET committees decide whether to initiate a discussion on curriculum changes. Therefore, in Germany, where the 16 federal states are responsible for education and there is a high degree of standardization in education, the coordinative challenges for such processes are greater and modernization processes take longer. The German vocational education system is characterized by its stable corporatist governance model, dual learning and the importance of occupational socialization. It is integrated into a coordinated market economy that absorbs changes gradually rather than disruptively. This environment of relatively gradual change dynamics in the economy is thus also reflected in the dynamics of training programmes.

The different degrees of (formal) adaptability to changing requirements in Estonia and Germany are seen as explaining their respective types of skill formation. An examination of skill formation in relation to the ability to adapt to change shows that both systems remain in their path-dependent logic. On one hand, such adaptation of the education system and the creation of skills in accordance with the nature of the economy can be seen as positive because the mechanisms of skills creation and demand (in terms of structure and institutional responsibility) are aligned and seem to offer stability and predictability. This view is supported by the generally low youth unemployment rate in these occupations (favoured by the overall demographic situation in both countries), coupled with the fact that the occupations are highly relevant to the future.

On the other hand, a more detailed consideration of skills imbalances and bottlenecks in Estonia and Germany suggests that changes are being approached differently because of the respective capitalist models, with their different advantages and disadvantages. The discrepancies and skills bottlenecks make it clear that the external effects of digitalization affect Estonia and Germany differently, also due to their particular economic production systems. This leads to discussions about the extent to which the two countries are prepared to deal with such external effects on their country-specific conditions in the future. As the digital transformation is complemented by further transformative developments to combat climate change, it is essential to discuss the conditions of different institutional structures and their relationship to change in relation to qualifications.

In general, the integration of the requirements of digitalization, the understanding of change and the adaptation of learning content within the education system is an essential factor in ensuring that the vocational education system remains relevant. In a formal sense, it is easier to cope with change in Estonia because of the school-based system within the liberal market economy. In terms of digitalization, this is seen as an institutional advantage, as the country is well prepared for the rapid and disruptive dynamics of digital transformation. This is also supported by societal factors, such as Estonia's stronger focus on digitalization in recent decades, coupled with a positive cultural attitude towards new digital solutions and a higher level of digital literacy in the country.

Germany’s corporate model means that urgent change cannot be implemented quickly within the framework of vocational training curricula. Its institutional pursuit of incremental, relatively gradual change seems to offer advantages in the long term. These include carefully weighing decisions on change and consensual cooperation between substantial parts of the education/training system and the economy. In the short term, this lack of dynamism and pace can have disadvantages when it comes to rapid and disruptive change. However, the dual system can incorporate changes that occur initially in the workplace as a result of digital transformation in a more informal way because those changes, whether they be new work techniques or processes, can then be addressed within the framework of vocational training. This form of training and gaining experience provides students with subject-related practical knowledge and equips them with job readiness or employability. Given the interaction between educational/training and business institutions, vocational education in Germany seems well prepared to integrate such aspects of change into the relevant learning objectives. What has been observed and practiced in the workplace can be then included as new elements in existing training programmes. Germany's particular forms of cooperation in this area and the relevant bodies are also well equipped for such processes, which have accelerated in recent years with the modernization of occupations.

The increasing importance of informal skills is in line with other studies that have found that informal skills are generally essential for the employability of young students (Protsch and Solga 2015; Di Stasio and van de Werfhorst 2017; Humburg and van der Velden 2015). Furthermore, the relevance of informal skills is linked to observations in the workplace and workers' descriptions of skills arising from reorganization and restructuring in the wake of digitalization (Estonian Qualifications Authority 2021c; Matthes and Dengler 2021; European Foundation for the Improvement of Living and Working Conditions 2018). Studies in the sociology of work and industry have expressed concerns that the newly introduced references to technology in VET training regulations focus solely on the technology itself (Lee and Pfeiffer 2019). With regard to the progress made in curriculum development, this concern is not observed in the occupations analysed here, in which there is a greater focus on informal skills that go beyond the domain of technology.

Beyond the updating of curricula and training regulations, the aim of Chapter 5 is to outline which formal and informal skills are taught in VET (Chapter 5.2.2) and which are regarded as important for employees in their work (Chapter 5.3.2). The skills profiles show slight differences in the relevance of informal skill types between the selected occupations. A brief overview follows.

In Germany, communication skills are highly valued in the training of electricians (followed by ICT knowledge and interpersonal skills). By contrast, in Estonia, interpersonal skills are most emphasized in vocational training (followed by ICT knowledge) (see Chapter 5.2.2). This is in line with new training content that addresses security aspects and emphasizes the need to teach technical (networked) systems with new work tools and (software) applications. The results of the employee assessments reveal that the differences between informal skills, in the way they are differently taught during VET, do not apply to employees. Employees emphasize that problem-solving skills, teamwork and planning and organizational skills are equally important. However, a larger proportion of employees consider informal skills to be more important than formal skills, such as literacy, numeracy and technical skills in the workplace (see Chapter 5.3.2). Formal and job-related skills are the basis of electronics occupations and are obviously taught as part of vocational training, as the analysis of the VET profiles shows. With regard to formal skills the focus in Germany is mainly on job-specific skills with technical and electrical engineering content. In contrast, computational and language skills are less emphasized. In Estonia, the weight of general formal skills (literacy and numeracy, languages) is more or less equivalent to that of occupation-specific skills, such as knowledge and practical implementation of the installation and implementation of electronic systems and networks, as well as the implementation of security measures.

In logistics, the skills profile in training places equal emphasis on formal qualifications in the areas of warehousing and transport. Informal skills complement the profile in terms of communication skills, interpersonal skills and digital skills. The different types of skills are mentioned equally in both countries, although there is a stronger trend in Estonia than in Germany. In Estonia, informal skills are assigned to specific learning modules and work situations in more detail in the curriculum. In logistics, respondents (EU) emphasize mainly the importance of numeracy, literacy and ICT skills. The training profile and the job profile agree on the relevance of ICT skills. This confirms that digitalization is having an impact and requires considerable attention in the workplace and for employees. Other informal skills appear to be important for employees' work, such as communication skills or interpersonal skills, but receive more emphasis in training than in the workplace. This tendency is found among respondents in both Germany and Estonia, but because of the small number of respondents in the logistics group, further country comparisons are not possible.

In IT, the skills profile includes a combination of important IT-related skills, such as technical skills for implementing and managing systems or technical knowledge, and essential informal skills in the area of communication and interpersonal skills. Slight differences between Estonia and Germany concern the development of system software and application aspects, as well as safety and quality measures. The skills profile of the workforce corresponds to the focus of the vocational training in terms of ICT skills, as these are central to the subject. However, as in other occupations, the focus of the training is not on the communication profiles of the workforce, but on problem-solving and learning skills.

Overall, the skills profiles in training and in the workforce show that informal skills are somewhat more pronounced in Germany than in Estonia. As the results show, the increasing importance of informal skills is not only a workplace requirement for highly qualified and well-trained employees, but also for skilled workers with vocational training. In the debate about the impact of digital change, concerns have often been expressed that the core of traditional workforce tasks, which tend to be in the technical area of application, will be become redundant. However, the analysis on skills profiles shows that changes have been made in the training fields of VET-programs that refer to technical knowledge and applications. Such technical and technology-centred developments, however, are being complemented by a broader range of other skills, including problem-solving, communication, teamwork, or skills related to information technologies. The skills spectrum is thus being diversified, and informal skills accomplish technical skills more often.

However, the skills profiles are technically complemented by a broader spectrum of other skills, including problem-solving, communication, teamwork or skills related to information technologies. The range of qualifications is thus becoming more diverse, and informal skills are increasingly complementing technical skills.

Increased customer orientation, customer care, communication and collaboration are emphasized by the training programmes in the occupations studied and require the application of communication skills. However, this emphasis on communication could be related to the learning objective of preparing students for various communication tasks, as well as problem-solving and teamwork. In addition, ICT skills are naturally of great importance in the IT and logistics sectors.

In Estonia, individual informal skills, such as teamwork or communication skills, are assigned to specific training modules. In Germany, they are more often assigned to general work technique modules in the interdisciplinary part of vocational training. This shows that responsibility generally tends to be transferred to companies and overlaps with the emphasis on experiential learning within dual systems. Both strategies, the structured integration of informal skills into technical modules and situations and the assignment of informal skills acquisition to the practical part of training, correspond to assumptions about skills development and experiences from other projects: informal skills are best developed when they are trained in combination with technical competences and not separately. The connection to practical learning sites is required. Despite the strong emphasis on informal skills to cope with transformation requirements in this project, it should therefore be emphasized that it considers vocational and technical skills to be of fundamental importance in the context of vocational training. On one hand, a vocational profile, an image of the occupation and at least some vocational socialization can only arise through these skills. On the other hand, even if they change or become obsolete quickly in the course of further digital changes, job-related content serves as an essential field of exemplary processes for acquiring and learning a range of formal and informal skills, not least the certainty that lifelong learning is becoming all the more important.

In Estonia, individual informal skills, such as teamwork or communication skills, are firmly attributed to particular modules in which they are to be trained. In Germany, they are more often attributed to the general work techniques modules in the interdisciplinary section of VET. This illustrates that responsibility tends to be assigned to companies in general and coincides with the emphasis on experiential learning within the dual system. Both strategies, the structured integration of informal skills into technical modules and situations, as well as the assignment of the informal teaching of skills to the practical part of training, are in line with assumptions about skills development and experiences from other projects: informal skills are best developed when they are trained in combination with technical skills and not separately. A link is needed to practical places of learning. Despite the strong emphasis in this project on informal skills for coping with transformation, it should be emphasized that occupation-specific and technical skills are of fundamental importance in VET. On one hand, only through these skills can an occupational profile and at least vocational socialization emerge. On the other hand, even if, in the course of further digital changes, occupation-related contents of training change quickly or even become obsolete, they are still a vehicle by which a range of formal and informal skills can be acquired. Furthermore, lifelong learning becomes all the more critical in that case.

In digitalization, corporate practice thus takes on a broader significance for the purpose of experiential learning. In Germany, this is encountered in the company-based part of VET and in Estonia in the context of internships. Germany shows a stronger vocational orientation and vocational specificity due to its institutional structure of VET (dual system) – as introduced by Bol and van der Werfhorst (2011). With two sites for learning, training college and company, apprentices have more opportunities to develop their occupation-specific and thus informal skills. By learning on the job, highly specialized occupation-related skills and informal skills are imparted in apprenticeship training systems. Nevertheless, both types of skills are barely formalized and also highly transferable to other work situations or employment positions. In school-based training systems, the acquired general skills are transferable (Streeck 2011). The comparative analysis of Estonia and Germany seems to support this theoretical view.

The types of informal skills in the skills profiles highlight the importance of soft skills or, as already mentioned, ‘twenty-first century skills’. In terms of predictions of future changes and potential ways of completing tasks using technology and techniques, these personal abilities and skills are future-proof. As the digital transformation continues to develop, it is particularly important to understand interrelationships, maintain an overview, control situations and reflect critically, apply experience to processes and tasks, and make decisions. These are tasks that are likely to be performed by people in the future as well. The increased awareness and impact of informal skills in vocational training points to necessary requirements for future work. One open question, and another area for research, is how such informal skills can be better validated and more effectively certified in the future, so that employees can demonstrate their skills and employers can observe and recognize them.

6. Skills demand: recruiting processes

So far, the project has highlighted the different qualification strategies in Estonia and Germany in terms of skill formation. It has illustrated which skills are at the fore in different VET study subjects and which skills are utilized in the workplace. It has presented digitalization processes and their significant impact on skill formation and (future) employees.

Digitalization is also an aspect of corporate environments. Many companies face decisions about investments in (digital) technological equipment and in corporate restructuring. In Germany, companies tend to be reluctant to take advantage of new technological opportunities. New digital technology solutions such as resource planning software, social media, big data or e-commerce opportunities have been adopted to some extent, but more often by large companies. By contrast, computer use is widespread. In Estonia, the range of applications of technologies is more established. This confirms the image of the country as a digital pioneer (European Commission 2020b, 2022a). The availability of employees with strong and advanced digital skills is a crucial factor for such investments. One common strategy is to meet the demand for such skills by hiring; another is to close digital skills gaps within the workforce through upskilling and reskilling.

This makes recruitment processes a central component of corporate strategies. Success means meeting (new) demand. However, recruitment is also of particular research interest in situations in which it is unsuccessful (mismatches). Chapter 6 focuses on the demand side and analyses employers' skills needs within the framework of their labour demand. Many research projects examine the conditions for the provision and development of skills or focus on the influence of various parameters on the youth labour market. Research on skills demand is still rare. However, it is important to be aware of employers' strategies in relation to skills and to try to obtain detailed insights into skills requirements in occupations in order to improve and provide support on problematic developments in the labour market, such as skills shortages.

This chapter therefore contributes to this research gap and provides demand-side answers to the research question: How are the supply and demand for skills interrelated in Estonia and Germany in the context of the digital transformation? Similar to skills supply (Chapter 5), the focus is now on examining which skills (type and level) are required by employers in digital labour markets. Because the relationship between supply and demand in both countries is characterized by skills shortages and a lack of balance, it seems relevant to provide answers to the supply-side dimension. After explaining the method (Chapter 6.1), the project goes further and determines recruiters' preferences with regard to informal or formal skills in recruitment processes for vocational training graduates (micro level) (Chapter 6.2). HR processes take place within this framework. This is against the background of the 'size and skills of their workforce' (Eurofound 2015: 59), the (social) position of the HR manager within the company, professional experience and their own professional and educational background. Therefore, the analysis takes into account company characteristics (meso-level) (Chapter 6.3). With this approach, the project aims to examine qualification requirements in their micro-meso context.

6.1 Method and database

6.1.1 Construction of the factorial survey experiment

Due to a lack of data on employers' (comparative) hiring behaviour for sociological consideration, a quasi-experimental factorial survey was conducted as part of the project, specifically designed to investigate skills, the project's focus. Factorial surveys are used to model situations that, while common for the respondents, are prone to distortions. The situation created for this analysis is a classic recruitment situation, ultimately providing cross-sectional data on hiring intentions through the evaluation of multiple candidate profiles. This is a valuable strategy for targeting corporate stakeholders with a common task, while also taking into account the sensitivity of this business issue.

Factorial surveys are experimental because the vignette characteristics presented to respondents are varied systematically. This type of presentation distinguishes factorial surveys from item-based presentations and makes it possible to examine the effects of different dimensions or their combined effect on the response. Another advantage of vignettes is that respondents may not always be aware of the factors that influence their judgment or evaluation. Thus we may obtain insights into what really drives their actions. Within a multi-level perspective such as this, the cross-sectional design enables a comprehensive investigation of current recruitment behaviour that also takes budgetary and time constraints into account.

The design and content of the factorial survey is strongly oriented towards the hypotheses we have laid out (see Chapter 3.3.2). The experiment is integrated into an online survey and studies employers' recruiting decisions in relation to VET graduates in Germany and Estonia. With this deductive procedure, the survey aims to test the hypotheses derived from the theoretical foundations.

The central argument for a cross-country approach to recruitment is that the demand for skills is related to the institutional environment. First and foremost, training is a key element for companies when it comes to attracting employees with the right skills. However, because training is linked to other institutions through institutional complementarities, companies engage in training in different ways. They participate in in-company vocational training in the context of apprenticeships or offer internships. The description of skill formation in Estonia and Germany has shown that the two countries differ in the way they impart job-specific and informal skills. Furthermore, other studies have shown that the institutional context in which employers operate influences their recruitment strategies (Bills, Di Stasio and Gërxhani 2017). The aim of this chapter is therefore to compare the patterns of skills demand. The results on preferences for different types of skills based on a factorial survey comparing Estonia and Germany serve this purpose.

In terms of the theoretical background and the hypotheses derived from it, the problem of information asymmetry in recruitment was presented in Chapter 3.3.2. In formal recruitment processes, the two actors, the employing company and the applicant, are largely unknown to each other. Recruitment takes place under uncertain conditions, whereby the personnel managers must necessarily rely on information presented to them in the written application documents. The application documents contain indicators that are useful for the hiring decision because this information is easily accessible (Elgin and Clapham 2004; Campitelli and Gobet 2010). In theoretical terms, employers try to overcome the challenges of imperfect information by using market signals. These signals indicate the candidate's potential as a productive worker in the future.

According to screening theory (Stiglitz 1975), educational signals are particularly suitable for this purpose because, in human capital terms, education indicates individual effort and investment and allows predictions to be made about the person’s ability to acquire certain skills after recruitment, as well as about (learning or work) commitment and motivation, and provides indications of self-selection and external selection processes. In addition, the information situation is even more limited in the case of labour market entrants. As previous studies have shown, educational signals that predict aptitude and education are extremely important in recruitment situations (Humburg and van der Velden 2015; Bills, Di Stasio and Gerxhani 2017).

In this sense, educational credentials provide easily accessible information, especially with regard to school education. This information on the type of school or qualification reflects education within the framework of the institutions of the education system and enables recruiters to categorize and group applicants according to their training. It is known from previous studies that recruiters use several educational criteria for their hiring decisions, leading to the assumption that this principle also applies in Estonia and Germany (see H3.1 below). This is based on screening theory, which sees rationality in the procedures used by recruiters to draw on all available information, differentiating between levels of education, types of schools and/or grades. Furthermore, recruiters try to identify which candidates are the most productive. From this, we can deduce that they favour candidates with higher educational attainment over those with lower educational attainment, because they rely on the differentiation of performance that prevails in education systems as a way of divining future productivity (see H3.2 below). The weakest evidence of future productivity is discerned among those with no educational qualifications (see H3.3 below).

These educational signals refer to information on skills that are taught within formal learning processes (formal skills). Furthermore, educational programmes also train more hidden, but no less important skills related to cognitive abilities, motivation and work habits (informal skills). Because the employer is looking for the most productive candidates, it is deduced that productivity equals suitability. From this, hypotheses H3.1 to H3.3 are derived:

Hypothesis H3.1: Employers screen applicants using several available educational market signals during recruiting processes.

Hypothesis H3.2: Recruiters rank applicants according to their levels of education market signals and prefer high levels over average or low levels.

Hypothesis H3.3: The lack of an educational certificate is an exclusion criterion for recruiters because it is a weak signal for productivity.

Information asymmetry makes education a useful predictor of productivity. Furthermore, it is discussed in the literature that the type of education and vocational training could also be seen as an entry ticket to jobs. Such a mechanism indicates occupational closure if education serves to impart occupation-specific skills, as is the case in vocational training (Haupt and Ebner 2020; Damelang, Stops, and Abraham 2018) (see Chapter 3.2.2). This mechanism shows that recruiters take into account the structural conditions pertaining to vacant positions. They are able to demand specific occupational profiles and occupational qualifications. If there are no formal access rules, such as professional licenses, to practice the occupation, then professional closure has more of a symbolic character. Recruiters take into account the necessity and relevance of professional qualifications in the context of the respective labour market segment (horizontal structuring of employment systems) and in the context of the qualification patterns that prevail among the workforce in that segment (vertical structuring of employment systems).

Derived from segmentation theory and occupational closure, it is emphasized that for employers not only VET certification is important, but also the occupational field in which the applicant was trained and consequently the type of VET certificate an applicant holds. Because VET in Estonia and Germany refers to different, occupationally structured labour markets for VET graduates, it seems worth considering the signalling value of the type of VET. In terms of segmentation theory, a degree in the respective specialized occupational field can be seen as an entry ticket into the labour market and as a valuable signal of the applicant's suitability. This leads to the following hypothesis:

Hypothesis H3.4: Recruiters evaluate applicants with a qualification in the corresponding occupational field as better suited than applicants with a qualification in another occupational field.

In addition, the factorial survey integrates ways of surveying informal skills. In view of what we have seen about the impact of digitalization on skill formation, how informal skills are valued by employers is central to the project's analysis. The project therefore distinguishes between the three informal skills: *interpersonal skills*, *problem-solving skills* and *ICT skills*, which are seen as signals from the education system that are indirectly acquired through formal vocational training. From Imdorf's theory, it can be deduced that recruiters use informal skills to predict applicants' employability (see Chapter 3.2.2). Although informal skills are related to productivity for employers, informal skills are often applied in the social environment of the organization. In training situations, social closure mechanisms may occur when recruiters make use of informal skills as recruiting criteria. This assumption is based on Imdorf's theory of multiple adaptation to corporate logic. For the recruiter, it becomes important to find candidates who are productive not only in the sense of achieving economic added value, but also in the sense of not causing damage to processes or the social climate. In his theory, applicants have to prove that they are capable of performing in these different worlds. Suitable applicants are the best possible choice if they fit in every dimension, rather than fitting perfectly in one dimension. Hypothesis H3.5 is thus derived:

Hypothesis H3.5: The lack of informal skills may be an exclusion criterion for recruiters because it is a weak signal for suitability.

This educational information is transferred into the structure of the factorial survey by designing a series of educational variables. The factorial survey therefore contains parameters that are used as central independent variables in accordance with the current literature and theoretical arguments from screening theory, occupational closure and the multiple forms of fit. Because skills are relevant for employers, the exact skills that applicants are supposed to possess are examined. In this approach, the factorial survey compiles several formal and informal skills of fictitious job applicants. In the experiment, skills are measured at various levels. How personnel managers handle these profiles allows an empirical examination of their skills preferences.

Independent variables: the vignettes describing VET graduates

Vignettes describe hypothetical VET graduates with various characteristics. These attributes define the central independent variables in the experiment. They are operationalized in terms of several dimensions and levels, which together, in the sum of their combinations, produce a vignette sample. During the investigation, the hypothetical VET graduate is introduced as an applicant for a job position, and the survey respondent is asked to evaluate him. Therefore, the dependent variable is the employer's recruiting decision. The intention to hire operationalizes what a respondent expresses in the context of the factorial survey experiment.

In this study, the **main independent variables** constitute the applicant profile in terms of education. These educational market signals are defined in terms of **six indicators** derived from the theoretical framework (see above). The vignette covers formal as well as informal skills and varies in terms of level. The operationalization results in **1) general education**, **2) vocational education,** and **3) the study field within vocational education** in the section on formal skills, and in the section on informal skills results in **4) interpersonal skills**, **5) problem-solving skills,** and **6) ICT skills**. These indicators are introduced as the vignette sample for measurement within the experimental design. Table 13 presents an overview of the vignette sample and specifies the wording used in the factorial survey.

Vignette dimensions

D1) General education is measured by the general school-leaving certificate and contains information on the level of qualifications and individual grades in both countries. In Germany, due to strong stratification and tracking, employers often express specific preferences for the type of school attended. Although there are no entry requirements for dual vocational training in terms of school type and degree (Bundesinstitut für Berufsbildung 2017a), in reality employers prefer school-leavers with an intermediate or A-level school-leaving qualification over a lower secondary qualification (Kleinert

Corinna 2012; Anbuhl 2016). In order to address these differences in Germany and Estonia, this aspect is taken into account in the design of the survey experiment. For the German factorial survey, the school type is pre-defined. For each VET study programme, the most common school type is chosen. Graduates in the VET study field of electronics technician and logistics assistant are said to have attended the general school type ‘Realschule’. In contrast, IT specialists have attended ‘Gymnasium’ (Bundesinstitut für Berufsbildung 2019a, 2019b, 2019c). In the Estonian version, the school type is uniform, as no such tracking exists for compulsory lower secondary general schooling. When graduating from ‘Põhikool’, Estonian students receive a basic school graduation certificate (Estonian Ministry of Justice 2010).

Table 13: The vignette sample: dimensions, levels and text

	Dimension	**Level**	**Text phrase**
D1	General education		General educational certificate:
		1 2 3 4	above average within this applicant group average within this applicant group below average within this applicant group no certificate
D2	Vocational education		Vocational educational certificate:
		1 2 3 4	above average within this applicant group average within this applicant group below average within this applicant group no certificate
D3	VET-study field		with
		1 2	exact other field of study
D4	Interpersonal skills		Germany: In dealing with supervisors and in cooperation with other employees,
		1 2 1 2	his conduct was impeccable. he made every effort to maintain a good relationship. Estonia: The applicant received the following grade in dealing with supervisors and in cooperation with emplyees: (note: 5 väga hea; 4 hea; 3 rahuldav; 2 puudulik) grade 4 grade 2
D5	Problem-solving skills		Problem-solving skills
		1 2	comprehensive rudimentary
D6	ICT skills		ICT (information and communication technology) skills and professionally relevant programs
		1 2	comprehensive rudimentary

Source: Factorial survey experiment, author’s illustration.

D2) Vocational education certificate. This certificate provides information about the vocational education achievements gained within the schooling part of the dual training system in Germany, and upper secondary vocational education within the framework of the school-based vocational programmes in Estonia. The supplementary school report (annex to the certificate in Estonia) indicates final grades. It is therefore important information (Government of the Republic of Estonia 2019).

D3) The field of VET study gives information on which VET programme the applicant has participated in. The professional certificate measures the level of achievement. In Germany, VET graduates usually obtain two kinds of professional credentials: from the apprenticeship training company they receive at least a vocational training-company certificate (*betriebliches Ausbildungszeugnis*) or a qualified vocational training-company certificate (*qualifiziertes betriebliches Ausbildungszeugnis*) after graduation. It supplements the vocational education certificate received from school. It contains a range of mandatory information such as the type of apprenticeship, duration, as well as the acquired skills and competencies (and in the case of the qualified professional certificate, a broader spectrum of information, such as personal skills, achievements and specialized profession-related skills). In addition, it is quite common to receive a further professional certificate from the chamber of commerce and industry, which specifies the exact VET study field and lists relevant grades (Bundesministerium für Bildung und Forschung 2020b; Vogel 2014). In Estonia, the professional certificate (*Kutsetunnistus*) is comparable to the German certificate issued by the chambers. VET students in Estonia receive it after they have successfully taken the professional examination at an acknowledged awarding body that comprises employers and representatives of the respective professional associations. It affirms that the VET graduate's skills and knowledge conform to the professional qualification standard (Kaldma, Kiilo, and Siilivask 2019).

D4) Interpersonal skills are considered an important market signal because they are reported to be required by both employees and employers in digitalized labour markets. It is a somewhat hidden market signal, however, and is usually not listed as a specific entry on applicants' CVs. However, such skills can be communicated within the framework of an application process. Here it is measured using an entry form and a rating form for the final certificate. In Germany, apprentice training companies evaluate the trainee's interpersonal skills in the context of the professional certificate (see above) (IHK 2010). In Estonia, by contrast, interpersonal skills are assessed on the evaluation form when VET students within their vocational education perform compulsory internships at companies. This is a usual procedure for VET schools in Estonia (Tartu Kutsehariduskeskus).

Dimension **D5) Problem-solving skills** are represented in the questionnaire with the results of a (fictitious) test. This type of measurement is rather abstract, but ties in with other forms of employee assessment used in later recruitment phases, such as questions, exercises or tests carried out as part of an assessment centre or trial workdays.

The last dimension **D6) ICT skills** are entered in the applicant's CV (European Union 2020). This is therefore based on self-assessment. ICT skills are considered informal skills because the concept includes not only basic IT skills and knowledge, but also other communication methods and tools for which there is (as yet) no specific curriculum. They do not fall within the curriculum of vocational training and thus express rather technical and media understanding.

The candidate profiles are created on the basis of these six educational indicators. They are presented as fictitious candidates for a hypothetical recruitment process. The indicators are measured in a way that is linked to the usual requirements and application documents of graduates of vocational education and training in both countries. However, because they focus on educational elements, they undoubtedly simplify the diversity of candidate characteristics compared with reality. Therefore, this methodological strategy has the strength of revealing preferences within recruitment processes as if they were under a magnifying glass.

The design of the vignette sample is based on theoretical, methodological and cognitive science research. A middle way has to be found between an overload of respondents with too much complex information, and an information underload that might lead to fatigue effects or learning effects that could be prone to social desirability. Factorial designs with approximately seven dimensions (plus or minus two) have shown promising consistency (Sauer et al. 2011). The six chosen dimensions, therefore, are theoretically and methodologically viable.

Vignette levels and text phrase

Each of these six dimensions can has different levels:

(1) General and (2) vocational education have four levels, showing the applicants' educational level rather than school grades. To avoid judgements and possibly personal associations caused by school grades or by descriptions such as 'good' or 'bad', a neutral formulation of these levels is used: The wording of the text phrase, therefore, is differentiated around the applicants' average: **1 – certificate above average, 2 – average, and 3 – below average**. According to queuing theory (Thurow 1979), the frame of reference in which applicants should be evaluated is specified. The suffix 'within this applicant group' clarifies that the respondents should be compared only within the profiles presented here and not with other (actual) applicants outside the experiment, such as applicants from former years. It minimizes the risk of ambiguity in the answers and is an attempt to reduce other influencing factors which could distort the assessment. Apart from graduates with a certificate, level **4 – without a certificate** is introduced, too.

Applicants are characterized by their (3) VET study field, which is either **1 – exact field of study** with regard to the required job position or **2 – another field of study**.

Dimension (4), interpersonal skills, differentiates between an extensive or a rather basic level. Because **standardized formulations** used by employers or teachers to describe students' interpersonal skills are closer to reality for both countries, they are also presented here. In Germany, it is common for training companies to issue training qualifications with reference to trainees' social skills, using standard formulations that indicate the different levels. In Estonia, employers often assess interns on school evaluation forms by giving direct school grades for their personal skills and behaviour in a work context (Tartu Kutsehariduskeskus). To do justice to these country-specific differences, two different approaches are used to represent the corresponding levels of the dimension ‘interpersonal skills’.

For (5) problem-solving skills and ICT skills, the level of skills defines an extensive (**1 – comprehensive)** or rather basic (**2 – rudimentary)** level.

For example, a hypothetical applicant for an electronics technician position in Germany has a lower than average secondary school diploma (D1 level 3) but no vocational qualification (D2 level 4), despite having been trained in the specific field (D3 level 1). His internship report shows that he has made every effort to establish good relationships with superiors and other employees (D4 level 1). They also have extensive problem-solving skills (D5 level 1), but only rudimentary ICT skills (D6 level 2). An applicant for a job as an IT system administrator has, on average, completed primary school (Põhikool) (D1 level 2) and has above-average vocational school qualifications (D2 level 1), albeit in a different field of training (D3 level 2). He received a level 2 grade in dealing with superiors and working with employees (D4 Level 1) and has extensive problem-solving (D4 Level 1) and ICT (D6 Level 1) skills.

The number of levels is based on methodological considerations. To avoid a ‘number-of-levels effect’, which describes the different degrees of attention paid by respondents to particular dimensions due to their different levels, the six dimensions have a balanced number of levels (Auspurg and Hinz 2015), either two levels or, usually, four levels. In summary: a vignette has six dimensions that randomly take on one of the listed levels. Furthermore, the number of levels forms the vignette universe (= 4*4*2*2*2*2 = 256 vignettes). In total, the experiment contains 256 combinations of the values of the vignette dimensions and leads to 256 different hypothetical applicant profiles.

Blocking the vignette universe into sections

Because confronting respondents with the whole vignette universe would represent extreme overload, 256 different vignettes are split into equally sized packages. In this process, the vignette universe is divided into 32 similarly sized fractions (‘decks’). Each deck consists of eight different vignettes. Hence, the survey respondent answers questions on eight profiles of a hypothetical candidate. To avoid effects in which the decks are confused with the characteristics of the respondents, several respondents answered each deck, resulting in a realised vignette population of 1056 vignettes. (see Appendix B-1).

Another methodological consideration relates to splitting the universe into sub-sections, in other words, how many vignettes are assigned to the various decks and in what order. In this experiment, the vignettes are assigned to the decks by random block formation. Because all vignettes are used, with all 32 decks implemented in the survey, this approach results in a full factorial survey. Compared with using vignette fractions, factorial surveys have the advantage that no information is lost and the design is statistically efficient: it is orthogonal (the dimensions do not correlate with each other) and level-balanced (each level of a dimension is considered with the same frequency) (see Tables 18 and 19) (Auspurg and Sauer 2017).

Table 14: Pair-wise correlation of vignette dimensions (Cramer's V; N = 1056 vignettes)

		1	2	3	4	5	6
1	General Education	1.000					
2	Vocational Education	-0.030	1.000				
3	Studyfield	-0.004	0.020	1.000			
4	Interpersonal Skills	-0.001	0.004	-0.001	1.000		
5	Problem-solving Skills	-0.012	-0.006	-0.036	0.003	1.000	
6	ICT Skills	0.063	0.032	0.009	-0.022	-0.019	1.000

Source: Factorial survey experiment, author's illustration.

Table 15: Frequency of vignette dimensions in the set-up dataset and the realized dataset

			Set-Up		Realized	
			Frequency	%	Frequency	%
1	General Education	1 - above average	64	25.0	259	24.5
		2 - average	64	25.0	266	25.1
		3 - below average	64	25.0	272	25.8
		4 - no certificate	64	25.0	259	24.5
2	Vocational Education	1 - above average	64	25.0	265	25.1
		2 - average	64	25.0	261	24.7
		3 - below average	64	25.0	257	24.3
		4 - no certificate	64	25.0	273	25.9
3	Studyfield	1 - exact	128	50.0	530	50.2
		2 - other	128	50.0	526	49.1
4	Interpersonal Skills	1 - comprehensve	128	50.0	523	49.5
		2 - rudimentary	128	50.0	533	50.5
5	Problem-solving Skills	1 - comprehensve	128	50.0	523	49.5
		2 - rudimentary	128	50.0	533	50.5
6	ICT Skills	1 - comprehensve	128	50.0	523	49.5
		2 - rudimentary	128	50.0	533	50.5
		Vignette Universe	256	100.0	1056	100.0

Source: Factorial survey experiment, author's illustration.

However, random blocking carries the risk that single decks have a lower degree of standardization and statistical efficiency than with targeted blocking techniques (Auspurg and Hinz 2015). This risk of lower statistical efficiency is avoided by ensuring that all decks are answered by multiple respondents. The relatively large sample of respondents allows us to fully apply the entire vignette universe and to have it confirmed several times.

Another aspect of internal validity concerns the respondents sample and their heterogeneity. It is expected that the personnel recruiting the participants will be heterogeneous in terms of age and educational background. However, methodological research has shown good consistency with up to 10 vignettes per participant (Auspurg and Hinz 2015). Sauer et al. (2011) also confirm that heterogeneous (in terms of age and education) groups of participants can fulfil the vignette assessments with a high degree of response consistency. Therefore, the recruiting personnel usually assess several candidates as part of their recruitment processes and compare the characteristics of several applicants. This real-world situation is therefore quite close to the experimental treatment, and no cognitive overload is to be expected.

Dependent variable: employers' hiring intentions

The resulting vignettes are included in the factorial survey and must be evaluated by the respondents. The **intention to hire** (dependent variable) is operationalized by the question: 'If you had to make a decision, how suitable does this candidate appear to you?' The respondent is offered a response scale with the prompt: 'Please rate this candidate using this scale.' The 10-point scale ranges from 1 – not suitable, to 10 – very suitable. The intention to hire someone in the first selection phase means evaluating the candidate as potentially suitable. According to earlier research, HR managers usually sort candidates according to certain criteria in this selection phase. These criteria prompt employers to indicate the suitability of candidates for a job and are the basis for expressing preferences (Gatewood and Field 1987; Protsch 2017). The question-and-answer scales in the study are based on these findings. The wording of the question therefore refers to an assessment and not to a choice between the answer categories Yes or No. The higher the respondent ranks the candidate on the 10-point scale, the more suitable the candidate appears to be. The higher the ratings, the higher the probability of being considered in the next round of recruitment.

In addition to their proximity to recruitment tasks, rating scales have further advantages. Rating on a 10-point scale offers the respondent a wider range than is usually the case with item-based surveys (Diekmann 2004), which allows more freedom when comparing the vignettes. This is an attempt to avoid censored responses. Furthermore, the interval sizes between the scale elements are symmetrical, which allows us to consider the scale as linear.

Online survey design

Factorial survey modules are often integrated into written surveys. In this survey method, participants can read and rate the vignettes themselves, at their own pace. This helps to avoid strong effects of the vignette order and reduces social desirability. As surveys show, most respondents complete the experiment successfully and without further assistance (Auspurg and Hinz 2015). Factorially integrated survey modules can also be integrated into self-administered surveys, such as online surveys (CASI). Another advantage of an online survey is that it can be distributed quickly and inexpensively after it has been created (for example, by email). In addition, most survey tools allow you to track response behaviour, which can provide valuable insights into the average response rate or the point in the questionnaire at which respondents drop out (Diekmann 2004). Good internet skills and communication via email are part of the everyday life of almost every recruiter – the target group of the surveys. An online survey is therefore particularly well suited for examining this specific group.

In this project, the factorial survey modules are part of an online survey. The design takes into account the respective native languages, Estonian and German (two language versions). The survey begins with the experimental factorial survey in the first part, followed by a standardized questionnaire on corporate demographics. The latter records relevant individual and company-related characteristics that serve as control variables for the analysis of recruitment practices. The main elements of the survey are then highlighted. This is the introductory section, the presentation of the factorial survey module and the standardized questionnaire.

Introduction to the experiment

Information about the survey is provided at different times and to varying degrees to ensure that respondents have enough information at a given time. The invitation to participate in the survey is sent by email (see Appendix B-2). It is designed to spark interest in the topic by providing basic information about the goal and nature of the survey. The added value of scientific research is emphasized, and help is requested, which should increase the response rate (Petrovčič, Petrič, and Lozar Manfreda 2016; Kaplowitz et al. 2012). Another important aspect on which the likelihood of participation depends is the time required to complete the survey. It is therefore indicated in the approximate number of minutes. In general, the email text is kept short and to the point (Kaplowitz et al. 2012), and designed in an HTML format that supports the neutral character of a scientific survey, but adds colour highlights to guide the reader to important images, such as the university logo and the 'Start Survey' button. This button integrates the URL link that leads to the survey in a new browser window.

Particular attention is paid to the (then) challenging situation for companies because of the Covid-19 pandemic and their possibly limited ability to participate. Therefore, it is emphasized that the survey is aimed at fundamental research and unrelated to the crisis situation. Finally, attention is drawn to the incentive. According to research on incentives in web-based surveys, higher-value vouchers in particular seem to elicit stronger motivation (Sauermann and Roach 2013). Participants can win one of four vouchers worth €50 and €100 (2 x €50 and 2 x €100). To enter the draw, interested survey participants are redirected to a new browser window at the end of the survey to ensure anonymity.

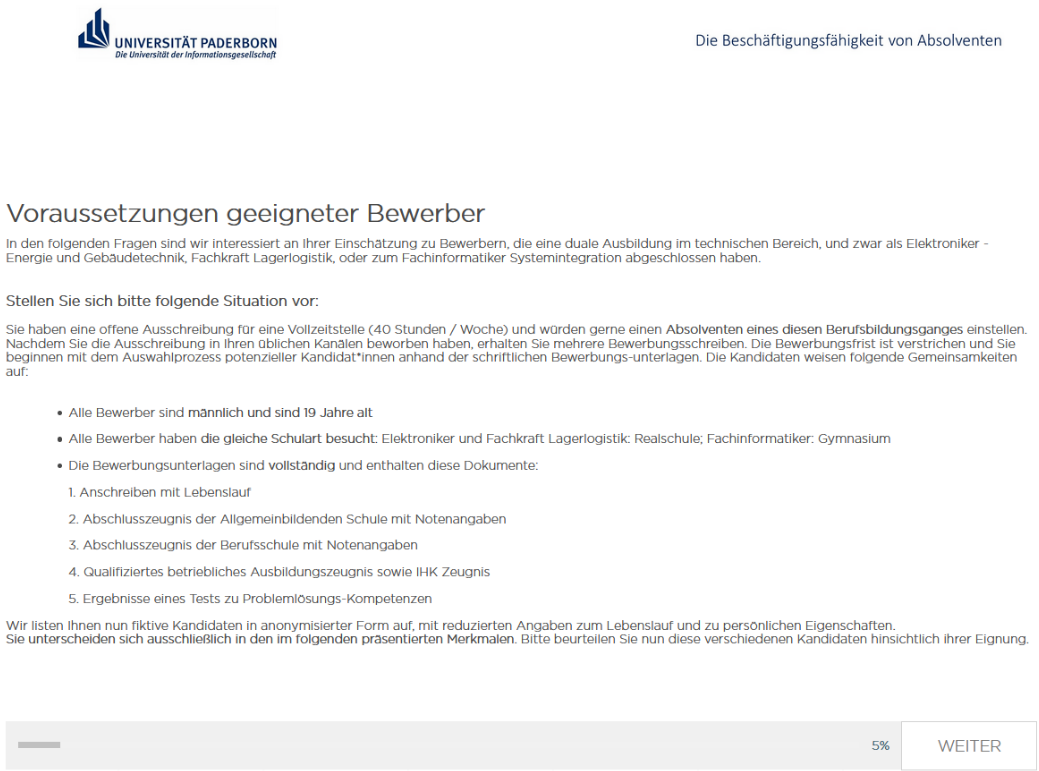
Information provided on the questionnaire start page

Once the interested person clicks the Start Survey button, the survey's welcome page opens. It displays information about the privacy policy, which must be accepted before the survey begins. Privacy is respected by ensuring that respondents' contact information cannot be associated with the survey. The welcome page and the following survey pages reflect the design features of the invitation email, retaining the layout, logos and borders (see Appendix B-2).

Instructions for respondents

The vignettes in the factorial survey experiment refer to specific social objects that describe people or situations (Wallander 2009). Therefore, the vignette assessment task differs somewhat in structure and sequence from the item-based response tasks of standardized surveys that would be expected in a web-based survey like this one. Therefore, participants will receive an introduction to the topic and execution of the experiment below. The instructions should be easy to understand and leave the respondents little room to interpret this initial situation, which would reduce the reliability of the measurements. Therefore, relevant elements are highlighted (Auspurg and Hinz 2015). To avoid repetition, the introduction to the factorial survey modules is presented once at the beginning. However, respondents can return to this introductory page at any time and correct their assessments.

Figure 18: Instructions for respondents: example in the German questionnaire



UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Die Beschäftigungsfähigkeit von Absolventen

Voraussetzungen geeigneter Bewerber

In den folgenden Fragen sind wir interessiert an Ihrer Einschätzung zu Bewerbern, die eine duale Ausbildung im technischen Bereich, und zwar als Elektroniker - Energie und Gebäudetechnik, Fachkraft Lagerlogistik, oder zum Fachinformatiker Systemintegration abgeschlossen haben.

Stellen Sie sich bitte folgende Situation vor:

Sie haben eine offene Ausschreibung für eine Vollzeitstelle (40 Stunden / Woche) und würden gerne einen **Absolventen eines diesen Berufsbildungsganges** einstellen. Nachdem Sie die Ausschreibung in Ihren üblichen Kanälen beworben haben, erhalten Sie mehrere Bewerbungsschreiben. Die Bewerbungsfrist ist verstrichen und Sie beginnen mit dem Auswahlprozess potenzieller Kandidat*innen anhand der schriftlichen Bewerbungs-unterlagen. Die Kandidaten weisen folgende Gemeinsamkeiten auf:

- Alle Bewerber sind **männlich und sind 19 Jahre alt**
- Alle Bewerber haben **die gleiche Schulart besucht**: Elektroniker und Fachkraft Lagerlogistik: Realschule; Fachinformatiker: Gymnasium
- Die Bewerbungsunterlagen sind **vollständig** und enthalten diese Dokumente:

1. Anschreiben mit Lebenslauf
2. Abschlusszeugnis der Allgemeinbildenden Schule mit Notenangaben
3. Abschlusszeugnis der Berufsschule mit Notenangaben
4. Qualifiziertes betriebliches Ausbildungszeugnis sowie IHK Zeugnis
5. Ergebnisse eines Tests zu Problemlösungs-Kompetenzen

Wir listen Ihnen nun fiktive Kandidaten in anonymisierter Form auf, mit reduzierten Angaben zum Lebenslauf und zu persönlichen Eigenschaften.
Sie unterscheiden sich ausschließlich in den im folgenden präsentierten Merkmalen. Bitte beurteilen Sie nun diese verschiedenen Kandidaten hinsichtlich ihrer Eignung.

5%

WEITER

Source: Factorial survey experiment, author’s illustration.

The introductory section lists the training occupations for which ratings are required (electronics technician, logistics assistant, and IT specialist). The respondent is asked to imagine a typical job advertisement and recruitment process, considering only graduates of vocational training. The position is full-time. In Germany, we find high transition rates from vocational training directly into a subsequent position in the same company, with only slight variations in the occupations examined here (Kruppe et al. 2019). Employers who mainly take on their former apprentices may well take on apprentices who were not taken on by their own training company in a second round of recruitment. In Estonia, participation in initial vocational education and training was perceived negatively, which can be traced back to the country's Soviet past (Loogma et al. 2019). However, the image and nationwide interest in vocational education and training have improved steadily in recent years. Its importance is also emphasized in order to meet the future demands of the labour market (Estonian Qualifications Authority 2020; Demmou 2012). In both cases, the risk of a negatively perceived selection effect is counteracted by control questions in the standardized questionnaire.

In addition, non-varying applicant characteristics are explained in the introduction. It is emphasized that the gender of all fictitious candidates is male because the selected vocational training programmes indicate a high level of gender segregation and male dominance within the occupational field. From the perspective of screening theory, discontinuities in the curriculum vitae, which are associated with a higher age at graduation, are an expression of underperformance. Similarly, Imdorf (2012) found empirical evidence of age discrimination in labour markets for job entrants. In his study, the age of the hypothetical candidate is set at 19 years, which indicates a regular number of school years without extended breaks or interruptions (Kaldma, Kiilo, and Siilivask 2019; Cedefop and BIBB 2019). Furthermore, the applicant is presented anonymously in order to minimize room for interpretation and to avoid associations with certain groups. Because the study focuses on education-related suitability criteria for applicants, the strategy here is to anticipate applicant characteristics that are not relevant for the analysis in the introductory text, but to standardize them for during the experiment.

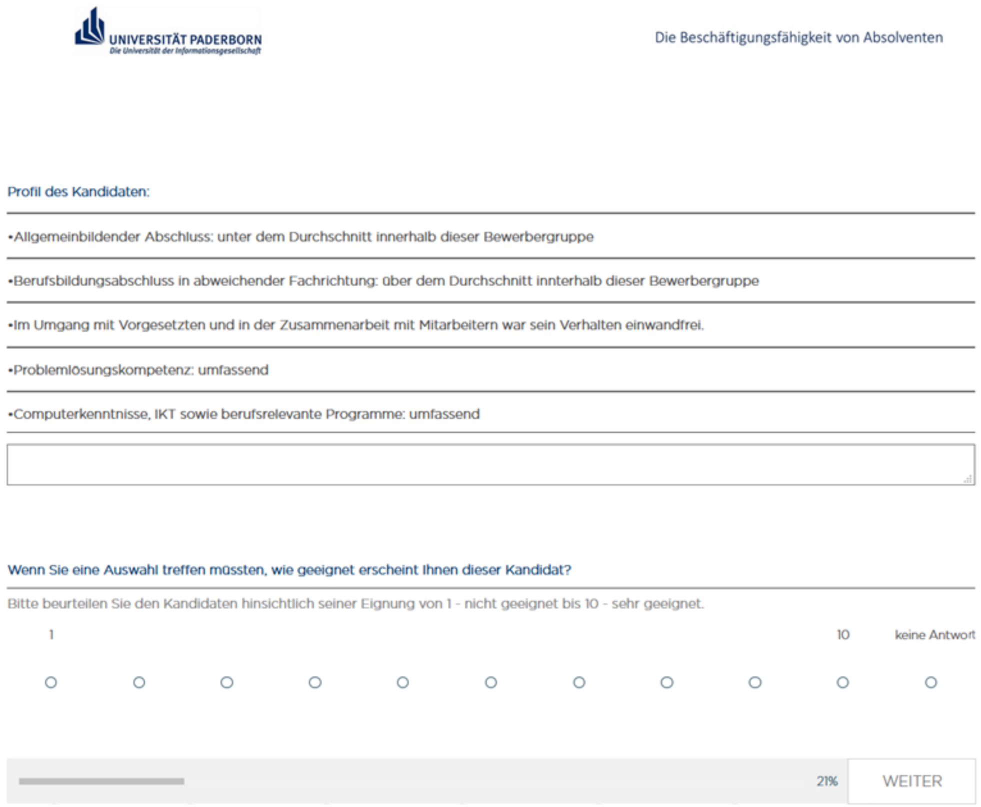
The recruitment processes for graduates are comparable to the strategies for other positions and employee groups. School leavers are usually asked to submit written application documents by email or letter, with larger companies increasingly using their own online application platforms (Protsch 2017). In the hypothetical situation of the recruitment process, the respondent is informed which documents were submitted: a covering letter with an attached CV and the most recent school or internship reports that provide information about the level of education and formal and informal skills. Because recruiters reject incomplete applications (for example, UNFPA 2020), the applicant material in the study is described as complete.

Implementation of the vignette sample in the online questionnaire

To carry out the factorial survey, the vignettes – with their dimensions and levels – are first created and then listed at random using statistical software (Stata) (see Appendix B-1). Because the experimental design is fixed, it is integrated into the questionnaire version of the Unipark survey tool using wildcards (Treischl 2018). The questionnaire shows the various vignettes after the respondent has read the introductory instructions. A randomizer guarantees that, firstly, the decks are randomly assigned to the survey participants and, secondly, that all decks are presented with approximately the same frequency. A tabular version is chosen as the presentation mode: the vignette dimensions are listed because this presentation mode refers to the written application documents (CVs) and is therefore suitable for the sample of respondents and thus for decision-making tasks (see Table 15).

The tabular presentation also mitigates dimensional sequence effects that arise when certain dimensions are displayed at the beginning or end of a text section (Auspurg and Jäckle 2017). Nevertheless, effects can also occur in the tabular display, which is why the listing of dimensions within the vignette varies randomly. However, this arrangement remains the same for each respondent for the duration of the deck, so that no excessive demands are placed on them. At the very least, the deck with the eight vignettes is randomly assigned to the respondent via tokens. This procedure guarantees that it is possible to trace which respondent answered which deck and which vignettes.

Figure 19: Example of the vignette presented in the German questionnaire


UNIVERSITÄT PADERBORN
Die Beschäftigungsfähigkeit von Absolventen

Profil des Kandidaten:

•Allgemeinbildender Abschluss: unter dem Durchschnitt innerhalb dieser Bewerbergruppe

•Berufsbildungsabschluss in abweichender Fachrichtung: über dem Durchschnitt innterhalb dieser Bewerbergruppe

•Im Umgang mit Vorgesetzten und in der Zusammenarbeit mit Mitarbeitern war sein Verhalten einwandfrei.

•Problemlösungskompetenz: umfassend

•Computerkenntnisse, IKT sowie berufsrelevante Programme: umfassend

Wenn Sie eine Auswahl treffen müssten, wie geeignet erscheint Ihnen dieser Kandidat?

Bitte beurteilen Sie den Kandidaten hinsichtlich seiner Eignung von 1 - nicht geeignet bis 10 - sehr geeignet.

1 10 keine Antwort

21% WEITER

Source: Factorial survey experiment, author's illustration.

Standardized questionnaire

The factorial survey module is preceded by a few questions on the labour market for graduates. After the factorial survey module, the follow-up questionnaire asks about the characteristics of the respondent and their work environment, which raises important control questions. The respondents' career paths, their current position, and personal and company-related characteristics are recorded. In addition, the vignette ratings reflect the element-based survey questions for the evaluation of graduates (see Appendix B-2).

6.1.2 Data collection

The target group of the survey are persons with personnel responsibilities in German and Estonian companies. For company surveys, however, it takes longer to establish contacts and to achieve cooperation and participation than for surveys among households or individuals (Paxson et al. 1995 in Lynn and Sala 2004). In particular, smaller companies seem to be difficult to reach (Dennis 2003). In addition, web-based surveys are further removed from the respondent group than other survey forms (Schnell, Hill, and Esser 2011). This means that high non-response rates must be taken into account and great efforts must be made to establish contact with the respondent group. However, the advantage is that a large number of companies can be addressed.

Because the focus is on a selection of firms, the sample consists only of German and Estonian companies in which graduates of the three courses of study could be employed. This limitation requires that the economic field in which a company operates be identified in order to reach the intended group of companies. However, it is a major problem that information about a company's economic activity is difficult to access in existing databases. All existing companies are listed in the official registers in both countries, but the entries are sorted by company name. Other comparable company databases are often not comparable due to different coverage. Therefore, a separate company database is created. It lists all companies that have responded to an automatic online search process based on the criteria of the specific VET programmes and occupational fields. The web searches are carried out in online company directories. A deliberate selection from all existing entries of German and Estonian companies in the electronic, logistics and IT business directories resulted in a sample of 8,488 entries for the survey. The sample therefore does not claim to be representative.

Online business directories provide a suitable sampling source for this project because businesses provide only the information they want to share. Depending on how well known the respective business directory is, businesses may use it as a platform for advertising or networking purposes. Furthermore, access to this business information is free and the hurdles for a business entry are kept low. Although sampling based on business directories is subject to limitations in terms of generalizability, it has been chosen on a small scale in various contexts (Puryear et al. 2008; Cockburn and Wilson 1996; Burton and Wilson 1999). The potential selection bias relates to the range of participating companies because only those can participate who provide an email address to register in the business directory and consider an entry to be useful and beneficial. Companies that attach less importance to external presentation or have less capacity to implement one, or perhaps do not feel confident about creating such an entry themselves, may therefore be underrepresented in the sample. In summary, this pre-selection of cases provides a comprehensive, but not complete picture of all existing economic agents in the target economic sector.

In order to obtain the greatest possible variety of legal forms and the widest possible geographical coverage, well known and widely used business directories are used. In Germany, the business directory *Gelbe Seiten* (Yellow Pages) is one of the largest networks of its kind in terms of the number of participating companies. In Estonia, there are several equally popular platforms. However, many of them are accessible only to a limited extent or are very expensive for companies. The 'äri+' platform is structured similarly to the 'Yellow Pages' and provides a comprehensive picture of companies in Estonia. According to their data access guidelines, the use of a web crawler is not prohibited.

The companies in the database are contacted by email. The first contact is made by means of a personalized message, and a reminder is sent after two to three weeks of the initial request, formulated differently each time. In survey research, there is still too little clarity about which days and times are considered favourable for making contact. Particularly with heterogeneous samples, it is difficult to determine favourable times when participation seems to be highest. Although an email request can be read at a later date, unlike a telephone request, a dynamic strategy in which the invitation and reminders are sent on different working days and at different times of the day can circumvent these uncertainties to a certain extent (Sauermann and Roach 2013).

Because of the Covid-19 pandemic, the originally planned period for data collection was postponed to the third quarter of 2020. As the survey is aimed at HR managers, it was assumed that they would address short-term restructuring processes in their companies, such as writing applications for public subsidies for their employees shortly after the spread of the global crisis. In other cases, automatic replies refer explicitly to the current situation. Some replies pointed out a lack of childcare options that would delay operations, or gave reasons for not replying, such as: '*Hello, I'm sorry, but because of Covid our child is still not in kindergarten, financial burdens, etc., I have absolutely no time. I don't have a second. I'm sorry. Kind regards*.' In general, many answers emphasized that answering would take longer than before, as in this example: '*Thank you for your message! Due to the current situation, we unfortunately need a little longer than usual to process your request. Stay healthy!'* This feedback motivated us to send the reminder after a longer period than planned, after 2–3 weeks, in order to address these people more directly, taking the circumstances into account. Within this period, the invitations vary in terms of day and time to try to overcome the problem of unsuitable times.

The data collection period ended at the end of the third quarter of 2020. Over the weeks, a response rate of almost 2% was achieved. Nevertheless, the sample size of respondents (N=156) allowed for multiple coverage of each deck through random triggering. Each deck is approved between four and six times and meets the requirements for a complete factorial survey experiment. However, the response rate is considered quite low, especially compared with general online employee surveys. Taking into account the lower response rates for company surveys, the changed situation for companies in the then current Covid-19 pandemic could be partly responsible for this result. The European Commission found in a Europe-wide Business Performance Monitor that Estonian SMEs were particularly hard hit by the pandemic, while German companies were only moderately affected by comparison. Among the crisis-related policy measures introduced in both countries, those in Estonia seemed less effective. Stakeholders criticized the restrictions on grants and the comparatively high costs of loans (European

Commission 2021c, 2021d). Furthermore, the approach of conducting an online survey and using general business contacts may have led to this low response rate. This is discussed critically below.

Initially, businesses in business directories mainly provide their general contact address – this is where the invitation was sent in most cases. Although the email invitation is personalized according to the company name, it must be assumed that there will be losses because the initial contact does not come from a personal connection to the company or from a regional connection. Respondents seemed to question the seriousness of the request, even though technical efforts were made to try to assure them that it was both serious and secure, while the content of the email invitation explained the research context and how the contact details were obtained. Whether this reluctance was due to negative experiences or a general increase in awareness of data protection and cyber security cannot be determined. In any case, conducting online surveys seems to require a great deal of effort to explain and establish credibility.

Secondly, many companies reported that they were inundated with similar requests. One logistics company responded as follows: *'Dear Ms. Polloczek, thank you for your question. Unfortunately, we receive a large number of similar enquiries and questionnaires every week, so it is impossible for us to answer all of them, if only for reasons of capacity. For grounds of equal treatment, we have therefore decided to generally no longer participate in such surveys. Therefore, we are unfortunately not able to answer your inquiry. With kind regards.'* Feedback like this suggests that in many other cases, requests are not followed up and do not reach those responsible because the first request is usually sent to a general email address and often has to be forwarded to the person responsible. Therefore, a larger number of contacts are required to achieve the desired response rate. Furthermore, while the approach of using business directories allows a wide range of businesses to be covered, the directories may also include businesses that no longer exist, rendering the queries irrelevant. All of this results in high mail volumes[10] that demand substantial resources but lead to relatively low answer rates. Thus, it illustrates quite clearly the pros and cons of online applications in survey methods.

Respondent sample

A sample of 156 companies was achieved during data collection. Some 11% of these companies are based in Estonia, while 89% are based in Germany. The sample reflects the fact that the total number of companies in both countries also differs: while Germany as a business location had more than 3.5 million companies (in 2019; Statistisches Bundesamt 2020), the number of Estonian companies is many times lower at a total of 133,784 (in 2019; Statistics Estonia 2021a) due to the smaller size of the country and population. Furthermore, the database used for participation shows a similar share of entries from Germany (92%) and Estonia (8%) as the number of companies surveyed. Therefore, the response rate

[10] A comparison of the CO_2 emissions to which the survey invitations gave rise reveals that invitations by email caused around the half of emissions that physical letter invitations would have done (192 kg CO^2) (Co2 Online 2020; RENN.süd. 2020).

is similar in both countries. In factorial surveys, the answered vignettes define the unit of analysis. The 156 companies answered a total of 1,056 vignettes.

The group of respondents in Germany consists of more men, while the study participation in Estonia is gender-balanced. A higher participation rate was expected for this occupational group, as it tends to be dominated by men. The respondents are highly qualified. In Germany, the respondents are mainly master craftsmen (*Meister*), have a master's degree or a qualification from upper secondary education. In Estonia, the respondents have academic degrees (BA, MA) or a post-secondary qualification. The professional background of the respondents matches the target group of the survey: most respondents have personnel responsibilities and work in a department in which they are specialists at a company in the construction and commercial sectors (Estonia: 40%; Germany: 57%), or are managing directors of their company (Estonia: 30%; Germany: 35%). Only a small number of respondents are assigned to an administrative HR department (Estonia: 30%; Germany: 8%). The vast majority thus have extensive experience in personnel selection (over six years) (Estonia: 92%; Germany: 82%), which is related to the fact that most respondents are middle-aged (45–60 years: Estonia: 58%; Germany: 52%) or close to retirement (Estonia: 17%; Germany: 26%). Further characteristics of the companies and the respondents are presented in more detail in Chapter 6.3.2 in the analysis of the characteristics at the meso level. The next section describes how the respondents assess applicants in detail with regard to their suitability.

6.2 Results

6.2.1 Evaluation of graduate suitability

The factorial survey at the outset elicits, using standardized questions and before the vignette presentation, how respondents describe their current vacancy situation and how they evaluate their circumstances when it comes to recruitment. The bivariate results are presented first. This is followed by multivariate analysis of the fictitious applicants.

The recruitment context: a shortage of young talent on the labour market

Most respondents are very concerned about the current situation in the labour market. Respondents are asked to assess their situation in the application market (see Table 16). The majority express concern about a lack of young talent (Estonia: 72%; Germany: 73%) when asked whether the company is having difficulties finding young workers. This is not a new phenomenon. More than four out of ten employers report a regular shortage of labour and a situation in which it has generally been difficult to find talent in recent years. For some companies, this situation is even more difficult, as they repeatedly face bottlenecks (Estonia: 12%; Germany: 10%). Companies in both Estonia and Germany are facing the same situation with regard to young talent, which confirms the results of other studies on this topic. Small companies in particular are having difficulties finding suitable employees. This impression is shared more often in Germany, where the shortage of skilled workers is more pronounced in companies that train electricians than in logistics or computer science. The shortage of skilled workers in Estonia is equally high in all training areas.

Furthermore, the problematic situation outlined above regarding the shortage of skilled workers is evenly distributed in the sample: employers not only have difficulties recruiting employees, but also report a need for comprehensive on-the-job support for VET graduates, beyond the typical induction phase. In Germany, almost all respondents (95%) agree that they need further support and training after being hired, and in Estonia, this figure is just as high at 85% of respondents. This indicates a continued commitment to this group in the labour market, even though they have just graduated. The impression of the employability of young school leavers is rather low from this perspective. When asked whether this has improved or deteriorated over the past few years, there is a clear tendency towards having to provide more support (Estonia: 39%; Germany: 60%). These results suggest that there is continuing concern in the labour market about graduate employability.

Table 16: Respondent evaluation of the current labour market situation

	Estonia	Germany
	in %	in %
Open position		
Yes	41.2	38.1
No	47.1	57.6
No answer	11.8	4.3
Talent shortage		
There is a talent shortage (yes)	71.7	73.2
There is no talent shortage (yes)	6.3	26.7
Frequency of talent shortage		
(Filter if talent shortage = yes)		
Always	11.8	9.6
Regularly in the last years	41.2	45.2
In the last year	4.4	0
Sometimes	17.7	13.7
Emyployability by graduation		
Support needed (yes)	85.1	95
No support needed (yes)	7.5	3.7
Employability changed during the last couple of years		
More frequent support needed than before	38.5	60.3
Less frequent support needed than before	17.6	18
Digitalization at the workplace		
Work changed (yes)	37.8	51.7
work changed how? (multiple answers allowed)		
Filter if work changed = yes		
New technologies	18.9	28.4
Working methods	25.2	26.7
Products and services	6.3	20.7
Contact with partners	6.3	26.7
Preferred candidates and requirements		
VET degree	5.9	6.5
University degree	23.5	6.5
Vet degree and work experience (1-3 years)	47.1	37.4
University degree and work experience (1-3 years)	5.9	5.8
Vet degree and work experience (>3 years)	11.8	23.7
University degree and work experience (>3 years)	0	2.9
No answer	5.9	17.3
Total	100 % (N=17)	100 % (N=139)

Source: Factorial survey 2020, N (company) = 156; author's calculations.

The previous chapters presented the relationship between the shortage of skilled workers and digitalization. To this end, the introductory questions to the factorial survey attempted to capture companies' current situation with regard to digitalization (see Table 16). In Germany, a positive answer to the question 'Have you seen significant changes in the tasks performed by VET graduates in your company over the last five years?' is more frequent (52% agreement) than in Estonia (38% agreement). Over the past few years, the task profiles for employees with vocational training in German companies appear to have changed in the areas of technology application, working methods, and the nature of interaction and contact with business clients or customers. In particular, respondents in companies with significant workplace changes are more likely to note that graduates require further support at the start of their employment. In Estonia, workplace changes are primarily related to working methods.

To get a general sense of the typical profiles that recruiters are looking for, respondents were asked about the skill sets that young job seekers should possess. The question was: 'When you need to fill positions, what type of new employee do you typically look for?' The answers show different emphases in the two countries. The respondents could choose between applicants with vocational or academic training and different levels of work experience (no work experience, one to three years of work experience, more than three years of work experience) (see Table 16). The response patterns show cross-country differences in both dimensions, qualification profile and work experience. Most respondents in technical occupations in Estonia prefer graduates of vocational training (47%) with initial work experience. However, a significant number of respondents also prefer university graduates without work experience for the selected occupations (24%). In Germany, most suitable candidates must have vocational training combined with a little work experience of one to three years (37%), just like in Estonia. In second place are applicants who, although they have completed vocational training, have extensive professional experience (more than three years, 24%). The field of IT training stands out here. The requirements for young applicants tend to include a university degree, while professional experience does not appear to be an important criterion.

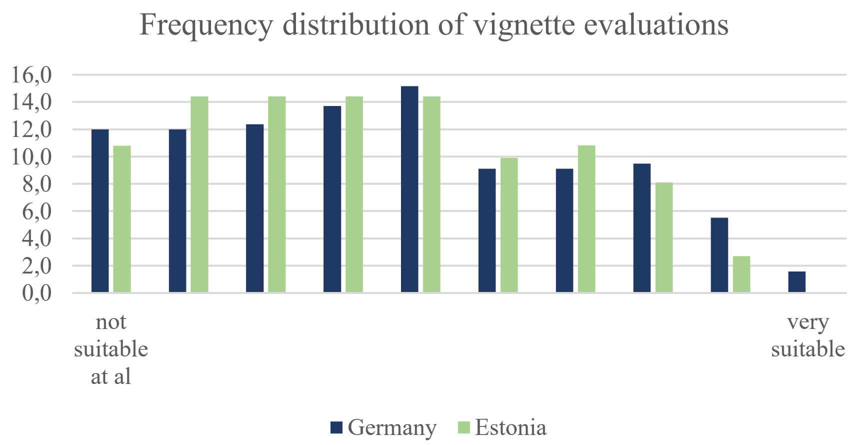
The introduction explained the hypothetical situation of the questionnaire under the pretext of the survey and pointed out that the respondents do not necessarily have to have vacancies to be filled. To ensure quality answers to the fictitious applications, it is important that the respondents understand the introduction and the aim of the study, which is to reflect on usual recruitment practices. The interest is not in evaluating specific applicants or processes in relation to their past or current recruitment practices. A control question is deployed for this purpose. Respondents were asked whether they currently have open positions for which they are seeking applicants. The majority of respondents (Estonia: 47%; Germany: 58%) said no, which indicates an awareness of the hypothetical nature of the questions and the aim of the study.

Estimation method

In terms of multivariate statistics, the impact of the relevant educational factors on candidate preference was estimated using a random effects model with the GLS (generalized least squares) estimator (xtreg command). Respondents' preferences are indicated as a metric variable and the rating indicates the probability that respondents would hire an applicant on a scale from 0 to 10. These employer ratings were regressed on the applicant information (the six educational vignette factors). Assuming orthogonality in the factorial survey, there are no significant correlations between the vignette dimensions and the survey characteristics, so that differences in the vignette characteristics can be attributed unambiguously to experimental variation. This implicitly controls for any employer or firm characteristics, and the results show variation within employers.

Respondents were asked to use a 10-point response scale for their assessments of candidates' suitability. Figure 20 provides an overview of the frequency distribution of the given answers per country. The German respondents used the entire spectrum of answer categories. The respondents in Estonia did not use all the values on the scale. Therefore, they also give more censored answers at the lower end of the response scale than is the case in Germany. The highest proportion of responses from German respondents falls on the (almost neutral) middle category. Estonian respondents often give answers in the lower part, where the candidates are rated as less suitable (see chapter 6.3 Discussion).

Figure 20: Frequency distribution of vignette evaluations in Estonia and Germany (%)



Source: Factorial survey 2020, N (company) = 156; author’s calculations.

In order to integrate the vignette factors into the random effects estimation models, the variables are recoded. The general education vignette, which previously consisted of four dimensions – ‘no degree’, ‘degree below average’ compared with the reference group, ‘degree average’ and ‘degree above average’ – is dummy coded as *general educational attainment* (1 no, 0 yes) and coded as *general educational attainment level* (1 below average, 2 average, 3 above average). The same procedure was applied to the dimension of vocational training, which contains exactly the same previous dimensions, resulting in *vocational training qualification* (1 no, 0 yes) and *vocational training level* (1 below average, 2 average, 3 above average). The *field of study* is coded for 1 suitable field of study and 0 other fields of study as the vocational position. The three informal skills are also coded as dummy variables in relation to *interpersonal* (1 comprehensive, 0 rudimentary), *problem-solving* (1 comprehensive, 0 rudimentary) and *ICT skills* (1 comprehensive, 0 rudimentary). Because the respondent’s educational background is considered important, an interaction term was created for the respondent's education and the general and vocational education vignette factor. In addition, a question about the type of qualification was integrated into the survey. The combined effect of the respondent's professional background could be important for the significance of a job applicant's professional qualifications. Therefore, an interaction term is also introduced into the regression model for this situation.

Results: skills preferences in Estonia and Germany

When conducting the GLS random effect regression using the Stata xtreg command, the output provides the chi-square statistics to determine whether there is a correlation between the estimators. The output confirms the assumption made above that the coefficients are independent of each other. Table 17 shows the results of the multivariate regression models by country. The first model estimates the vignette factors by country. Further variables are included in the following models (see below). In Estonia, the 17 respondents evaluated 127 fictitious respondents. In Germany, the 139 participants evaluated 929 fictitious respondents. The answers indicate which of the vignettes is considered important or less important for the dependent variable of candidate suitability. The standard deviation of the intercept suggests that the assessment of the candidates' suitability varies across respondents to a medium degree, meaning that 39% of the variation in the assessment in Estonia and 43% in Germany can be attributed to the deviation between respondents. The responses are not quite as homogenous among respondents.
A first general overview shows that respondents in both countries indicate certain preferences and dislikes for the same criteria, but the level differs. Respondents evaluate several diverse criteria that were indicated in the applicant profiles. In particular, formal educational signals (general and vocational level and qualifications), as well as some informal skills are used by respondents for evaluation – to a lesser extent, individual factors such as problem-solving skills in Estonia or field of study in Germany. Given that recruiters face the problem of information asymmetry, they have to rely on the information obtained from the application documents in the selection process. This procedure involves the use of the entire range of different criteria. In this project, the criteria are strongly education-related. As suggested in earlier studies, this pattern of behaviour is also observed in the countries studied, Estonia and Germany. Hypothesis H3.1 is confirmed for both countries.

Table 17: Candidate suitability: random effects models by country

	Estonia	Germany
General education level	0.321	0.322***
	(0.2144)	(0.0922)
General education degree (ref. degree)	-0.855*	-0.472***
	(0.4446)	(0.1707)
Vocational education level	0.330	0.686***
	(0.2323)	(0.0915)
Vocational education degree (ref. degree)	-0.710*	-0.605***
	(0.4088)	(0.1707)
Studyfield (ref. not-matching field)	0.2336	0.106
	(0.3194)	(0.1269)
Interpersonal skills (ref. rudimentary)	1.693***	1.466***
	(0.3172)	(0.1271)
Problem-solving skills (ref. rudimentary)	-0.017	0.575***
	(0.3151)	(0.1296)
ICT skills (ref. rudimentary)	-0.342	0.628***
	(0.3400)	(0.1293)
Constant	2.734***	1.815***
	(0.7692)	(0.3226)
Number of vignettes	127	929
Number of respondents	17	139
estimated random-intercept SD (sigma u)	1.239	1.455
estimated residual SD (sigma e)	1.541	1.654
Intraclass correlation coefficient p	0.393	0.436

*p<0.1. **p<0.05. ***p<0.01. Standard deviation in parentheses.

Source: Factorial survey 2020, N (company) = 156; author's calculations.

Differentiating the answers by formal education shows that Estonian and German respondents basically have the same opinion. Their responses point in the same *direction*, but vary in magnitude of effect. Overall, it is important that students have completed some form of education, whether general or vocational. In Estonia, not having a general school leaving certificate has a severe impact on a student's rating as a suitable candidate compared with not having some sort of vocational qualification. This can be illustrated more specifically. In Estonia, not having a qualification is valued 0.855 points lower on the preference scale on average than having a general school leaving certificate. Respondents rate applicants without a vocational qualification 0.710 points lower on the suitability scale on average than applicants with a vocational qualification. In Germany, the disadvantage of not having a qualification is reversed. The vocational qualification counts for more than the general qualification for German respondents, but both have a negative impact on the assessment of suitability when comparing applicants with or without qualifications (–0.472 for general education and –0.686 for vocational education).

Furthermore, education is relevant in terms of grades. In both countries, the direction of preference is similar: the higher the school grade on the CV, the more points on the scale an applicant receives, on average, from the survey participants. In terms of general school grades, Estonian respondents indicate that the higher the education of the applicants, the more suitable they are, but the effect is not significant. In Germany, on the other hand, the signal of vocational training grades is stronger than that of general education grades. In both countries, students are at an advantage if they finish school with good grades. Doing better than the average student in terms of grades brings further benefits because, as the results show, the higher the education, the more suitable the candidate. These results mirror previous findings on the signalling value of education. By identifying which candidate is best suited, formal educational credentials and their levels provide standardized measures for recruiters. Educational attainment at school is rewarded by recruiters – this is the case in both countries. In terms of screening theory (Spence 1975), H3.2 (level of education) and H3.3 (missing degree) are confirmed for both countries.

The effects of the field of study and the type of training are not significant in either country. From the field of study, employers can deduce which particular skills the students acquired during their training. The effect does not vary greatly between the two countries and is rather small. However, the direction is indicated in the result as assumed: for an application in the technical field, training in the exact field of study brings advantages over training in a different field of study that is similar to the job. If the coefficient were significant, this would support H3.4 and the occupational closure mechanisms.

Respondents therefore provide a clearer picture in terms of informal skills. These are considered very important by employers. They seem to have a positive effect on the candidate's suitability assessment, except for problem-solving skills in Estonia (-0.017 points). A very strong signal is associated with the vignette dimension of interpersonal skills in both countries. In Estonia, applicants who provide comprehensive information on informal interpersonal skills score much better than students who provide only rudimentary information. On average, a high level of interpersonal skills contributes 1,693 points on the response scale. The higher the position on the response scale, the better suited a candidate is for the position, according to the respondent. In Germany, interpersonal skills account for 1,466 points among applicants with comprehensive information, compared with applicants with only rudimentary interpersonal skills. The operationalization of this ability in both questionnaires was very closely based on the respective descriptions of the students in CVs or internship reports. In each country, interpersonal skills significantly outweigh their impact on a positive assessment of applicants compared with the other vignette dimensions. In Germany, the vignette dimensions of problem-solving skills (0.575 points for comprehensive compared with rudimentary) and ICT skills (0.628 points) also contribute to the suitability of applicants. After interpersonal skills, ICT skills appear to be particularly important for employers. Problem-solving skills and ICT skills have a slight devaluation effect for Estonian recruiters when the level is comprehensive compared with rudimentary, so that neither coefficient is significant.

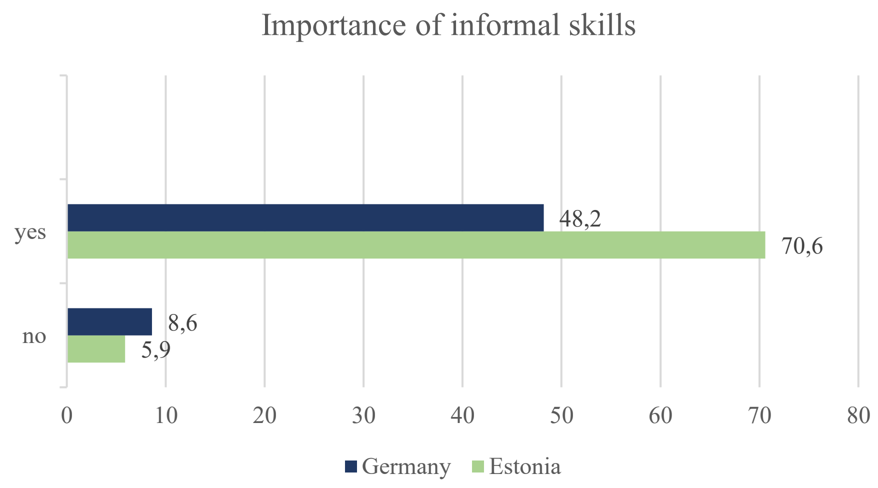
The answers given in the section on informal skills, particularly in Germany, support hypothesis H3.3. The mention of various informal skills is intended to give the personnel manager a more comprehensive picture of the applicant, taking into account not only productive measures of the applicant's suitability but also social skills for the work context. Imdorf (2011) notes that applicants would have to demonstrate that they have a broader range of skills in order to fit into the company. In terms of three dimensions, he took into account different logics and corporate worlds. The logics relate to being productive in terms of performance, but also to not disrupting workflows or processes, fitting into the social context of the company and supporting it in coordination tasks with customers or clients. Therefore, the three informal skills were included in the survey. The hypothesis states that employers do not consider just one point to be important, but generally measures that apply to the three worlds as a whole. This is observed for Germany, so H3.4 is partially confirmed. But the influence of interpersonal skills receives the highest scores in both countries in terms of contribution to the response scale. This is very interesting as it balances formal education criteria and supports the general direction of this project in terms of digitalization, where extra-curricular skills are more emphasized during work. An indication of this can be seen in this participant evaluation and is also discussed in Chapter 6.3.

Measurement validity test: the relevance of informal skills

The project assumes that employers look for a range of skills. Since the project is particularly seeking to integrate the effects of digitalization, informal skills are emphasized. As the results so far show, presenting formal and informal skills within an experimental framework leads to interesting results that can be built upon.

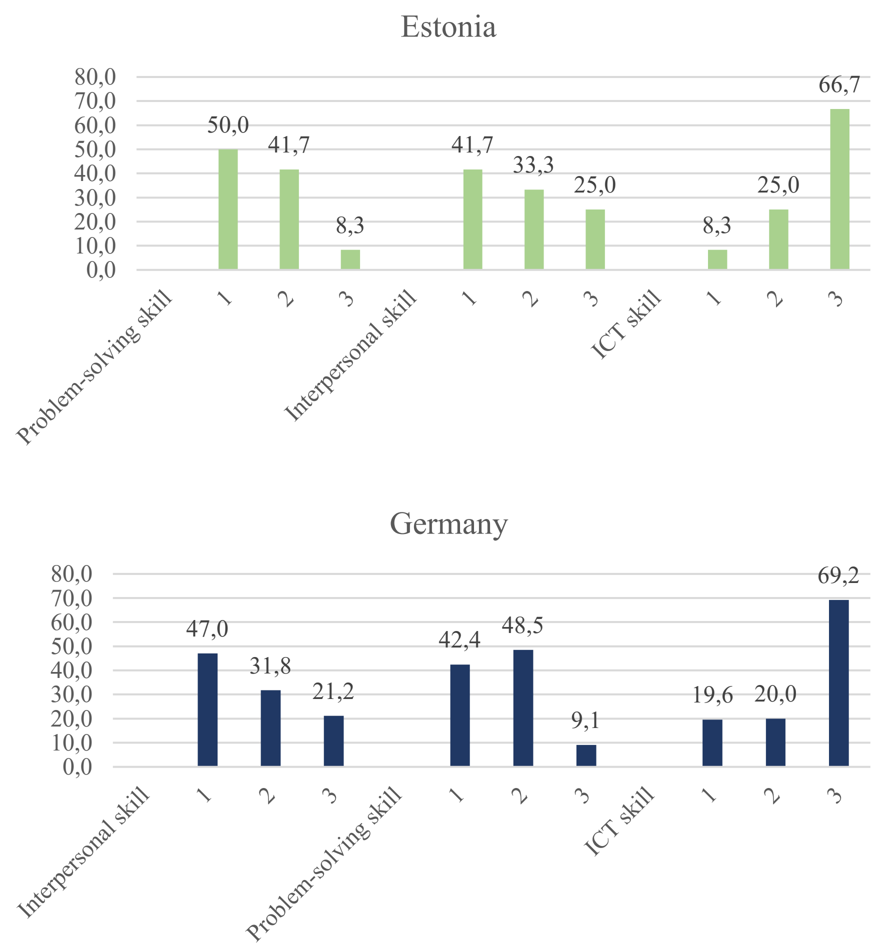
To illustrate the results of the multivariate statistics, the respondents were asked two further questions after the experimental treatment. This strategy was used to determine more clearly whether informal skills are also considered to be signals of productivity and suitability for employers. The recruiters were asked directly about their opinion on the importance of informal skills using an item-based operationalization. The answers to the first question ‘Would you say that informal skills such as interpersonal (e.g. teamwork), problem-solving or ICT skills are important criteria for measuring the performance of VET graduates?’ were ‘yes’, ‘no’ and ‘no answer’. Secondly, employers were asked to rank these three points according to their personal preference. As shown in Figure 16, the ratings of respondents in Estonia and Germany vary. Awareness and consideration of importance was much higher in Estonia (70.6%) than in Germany (48.2%).

Figure 21: Importance of informal skills to recruiters in Estonia and Germany (%)



Source: Factorial survey, N (company) = 156; author’s calculations.

Figure 22: Ranking of informal skills in Estonia and Germany (%)



Source: Factorial survey, N (company) = 156; author’s calculations.

When respondents consider informal skills to be important, they are asked to rank these skills in order of importance according to their personal preference. The ranking patterns are similar in Germany and Estonia regarding ICT skills. It is the least relevant of the three skills. It is clearly in third place (Estonia: 66.7% of employers see ICT skills in third place; Germany: 69.2%). In Estonia, problem-solving skills take first place. Here, 50% of respondents believe that this is the most important of the three options. By contrast, respondents in Germany put interpersonal skills in first place, followed by problem-solving skills in second place.

These results cannot be directly linked to the results of the vignette study, as the methodological approach is quite different. However, the direct measurement of importance also shows that the respondents distinguish between individual informal skills and between more technically oriented (ICT skills) and more business or socially oriented skills. Overall, the results of the experimental design and the results of the direct measure provide further validation of the operationalization of informal skills within the experimental treatment after comparing the alternative indicators, since these skills were partially described in the experiment and related to the information in the CV.

6.2.2 Corporate environment of recruitment behaviour

In this section, the recruitment strategies are reflected in their business environment. Based on business statistics on digitalization and theoretical assumptions and studies on the effects of business characteristics, the aim of this chapter is to identify differences. The theoretical background and assumptions regarding these differences are presented at the beginning, followed by the results of the factorial survey.

Digitalization affects companies differently. In particular, SMEs have yet to take full advantage of the opportunities to integrate new digital technologies compared with larger companies (European Commission 2020b;). SMEs also have more difficulty offering continuing education programmes than larger companies. This pattern can be observed in all European countries and therefore applies to both Estonia and Germany. Factors limiting companies' participation in further training are limited resources (time, personnel, finances), but also the fact that they prefer to hire people with the required skills rather than train employees internally (Eurostat 2022). In this context, it becomes even more important for companies when hiring employees to achieve a perfect match between employee and job. But in addition to ongoing digital transformation, companies are reporting difficulties in filling vacancies. They report a shortage of skilled labour and seem to have problems finding applicants with the right skills for their jobs, especially at the junior level (Eurofound and Cedefop 2020; Musset et al. 2019b).

In the context of digitalization, Struck (2001) emphasizes that companies actively structure the recruitment process, which provides an insight into specific decision-making structures in the firm. In this context, companies appoint people to be responsible for decision-making processes. Struck calls them gatekeepers. They represent the respective organizational and institutional contexts. Because gatekeepers act in the interest of and for the organization and legitimize their decisions to the company, they reflect the embedding of recruitment in the corporate environment. In this respect, company size is relevant. The different capacities that companies ascribe to HR management processes in general and recruitment processes in particular are related to their size and the number of employees. Generally speaking, large companies with a large number of employees have extensive internal HR departments. They have the capacity for strategic personnel planning and the evaluation of future qualification requirements, while smaller companies are often unable to do so due to capacity and resource constraints (Jaspers and Westernik 2008). It is therefore assumed that the corporate environment, in particular the size of the company, has an impact on hiring decisions:

Hypothesis H4.1: Recruiting decisions differ in terms of the respective gatekeeper's corporate environment regarding enterprise size.

At the same time, gatekeepers have special knowledge in terms of strategic management considerations, as well as special expertise. As long as gatekeepers are able to justify their recruitment decisions, the decisions will be accepted. In doing so, gatekeepers can draw on their expertise or contribute their own experiences. Therefore, personal characteristics are important in determining gatekeepers' recruitment behaviour. Above all, professional experience is related to suitable prerequisites for gatekeepers' legitimation strategies for decisions. Their educational background is closely linked to their professional experience, but they also transpose their own views onto the job profile of the vacancy. Following Struck, hypothesis H4.2 assumes:

Hypothesis H4.2: Recruiting decisions differ in terms of the respective gatekeepers' personal characteristics regarding work experience and educational background.

To address the assumptions regarding the business environment, these characteristics are operationalized and included in the standardized questionnaire. These questions come after the experimental treatment. At this point, the survey had a high dropout rate, which can be seen in Tables 23 and 24. First, the business and personal characteristics are presented.

Several indicators specify the business context. By integrating these characteristics into the analysis of recruitment decisions, they are considered in the context of factors at the meso level. Although small and medium-sized enterprises are considered difficult to reach (Dennis 2003), the project achieves good coverage of small businesses with fewer than 10 employees (Estonia: 35%; Germany: 30%) and medium-sized businesses (11–50 employees: Estonia: 23%; Germany: 17%). Large companies are underrepresented. The lower likelihood of smaller companies participating could generally be linked to the fact that they do not have enough capacity or staff for extra-curricular activities. Participation in the study also depends on the company's economic situation. This could mean that – in the context of the pandemic – the sample of companies is more likely to consist of economically more stable entities. On the other hand, the good coverage of SMEs in this sample suggests that access to companies via an online business directory brings advantages in terms of reaching this target group. It seems that such platforms are also very likely to be used by smaller companies for advertising and networking, and the request may end up more directly with the required responsible person than would be the case with larger companies.

SMEs play an important role in the economic structure of both countries. Apart from a handful of larger companies with 250 or more employees, the bulk of economic activity in Estonia takes place in SMEs. In 2019, Estonian SMEs employed more than 79% of the workforce (European Commission 2021c). Some 94% of companies are micro-enterprises with fewer than 10 workers. In Germany, SMEs have similar importance: 87% of all companies are micro-enterprises with fewer than 10 employees. The share of larger companies in all German companies is comparable to that in Estonia, although German SMEs employed around 59% of the workforce in 2019 (European Commission 2021d). The size of companies is related to economic activity: in both countries, most companies are active in wholesale and retail trade, followed by scientific and technical services and construction. In addition to small retail stores or traditional craft businesses, Estonia offers a founder-friendly and well-developed environment in terms of digital business services. Setting up a company or a start-up is particularly common in this ecosystem and can be done with a small team of colleagues (Statistics Estonia 2021a; Statistisches Bundesamt 2020). In this context, electrical installations play a key role in the growing construction sector, while the logistics and information and communication sectors are important key areas of economic activity for the wholesale and technical services sector to provide (IT) infrastructure, innovation and maintenance.

A similar picture emerges in the sample. The sampled companies are generally micro-companies with fewer than 10 members, with the sample including slightly more companies that provide training in the field of electronics than in the fields of logistics and IT (see Table 18). Smaller companies may not have sufficient capacity or staff for extracurricular activities. Therefore, the likelihood of participation could depend on the company's economic situation. This could mean that – in the context of the pandemic – the sample of companies is more likely to consist of economically more stable companies. On the other hand, the good coverage of SMEs in this sample suggests that accessing companies via an online business directory brings advantages for reaching this target group. It seems that such platforms are also very likely to be used by smaller companies for advertising and networking, and the request may reach the required responsible person more directly than would be the case with larger companies.

The sample furthermore achieved widespread regional coverage in both countries. Thus, in Germany, respondents are located in large-area, densely populated and industrially robust federal states, such as North Rhine-Westphalia and Bavaria. In Estonia, more respondents are based in the northern part of the country, which is related to the situation of the capital and also the harbour around Tallinn.

Table 18: Company characteristics

	Estonia	Germany
	in %	in %
Company size		
Up to 10 people	35.3	30.2
11-49 people	23.5	16.5
50 and more	23.5	9.4
No answer	17.6	43.9
Training fied		
(multiple answeres allowed)		
Electronics	23.4	28.1
Logisitics	21.4	19.5
Informatics	21.4	13.4
Other field	50.0	52.44
Region		
Baden-Württemberg	-	1.4
Bayern	-	10.1
Berlin	-	1.4
Brandenburg	-	0.7
Bremen	-	1.4
Hessen	-	12.2
Mecklenburg-Vorpommern	-	1.4
Niedersachsen	-	2.9
NRW	-	13
Rheinland-Pfalz	-	4.3
Saarland	-	2.2
Sachsen	-	2.2
Schleswig-Holstein	-	1.4
Thüringen	-	2.2
Põhja-Eesti	29.4	-
Lääne-Eesti	17.7	-
Kesk-Eesti	11.8	-
Lõuna-Eesti	11.8	-
No answer	29.4	43.2
Total	100 % (N=17)	100 % (N=139)

Source: Factorial survey 2020, N (company) = 156; author's calculations.

In terms of personal characteristics (see Table 19), the sample contains more male than female respondents (in Germany). The age range of respondents is concentrated mainly in a middle age group (45–60 years), but younger (30–45 years) and older (over 60 years) recruiters are also represented. The age of the respondents tallies with their personnel experience: the majority of the recruiters are experienced in the task of talent acquisition. This shows that the sampling strategy has reached the group required for the task of evaluating applicants. Professional experience and education are the points of particular interest for testing the hypothesis about the impact of personal background. The educational profile of the respondents varies between Estonia and Germany. In Estonia, the respondents more often have academic degrees (BA, MA), while in Germany the post-secondary qualification ‘Meister’ is the most common, and recruiters with a secondary school leaving certificate are also well represented. This result shows that in the German sample, as in Germany in general, further training in post-secondary vocational training is often chosen.

Table 19: Respondent characteristics

	Estonia	Germany
	in %	in %
Gender		
Male	35.3	46.0
Female	35.3	10.1
No answer	29.4	43.2
Age		
< 30 years	5.9	2.9
30 <= 45 years	11.8	9.4
45 <=60 years	41.2	28.8
>60 years	11.8	14.4
No answer	29.5	44.6
Personnel experience		
1 year	0.0	1.4
2 to 5 years	5.9	8.6
More than 6 years	64.7	46.8
No answer	29.4	43.2
Education		
Lower secondary	0.0	2.1
Upper secondary	0.0	11.5
Meister/ Post-secondary	11.8	15.1
Bachelor	29.4	9.4
Master	17.7	12.2
PhD	5.9	5.8
No answer	35.3	43.9
Field of Educational		
Manufacturing , Engineering	30.8	25.0
Business Administration	30.8	35.3
other fields	38.4	39.7
Total	100 % (N=17)	100 % (N=139)

Source: Factorial survey; N (company) = 156; author’s calculations.

The hypotheses are tested by integrating the characteristics of the respondents and the company into the regression model with random effects. First, the company size is considered relevant for H4.1. Therefore, the *company size* variable is coded as a dummy in relation to medium-sized companies (1 yes, 0 no) and a dummy variable for large companies (1 yes, 0 no) in relation to small companies. The personal characteristics of the respondents are also transformed. In particular, it is taken into account that micro-businesses have the least resources available for comprehensive human resource management and talent acquisition. A difference is assumed between SMEs and micro-businesses, and between large companies and micro-businesses.

Table 20: Candidate suitability and the corporate context: random effects models by country

	M1	M2	M1	M2
	Estonia	Estonia	Germany	Germany
General education level	0.321	0.407**	0.322***	0.365***
	(0.2144)	(0.2027)	(0.0922)	(0.0980)
General education degree (ref. degree)	-0.855*	-0.790*	-0.472***	-0.413**
	(0.4446)	(0.4041)	(0.1707)	(0.1810)
Vocational education level	0.330	0.596	0.686***	0.672***
	(0.2323)	(0.2134)	(0.0915)	(0.0973)
Vocational education degree (ref. degree)	-0.710*	-0.356**	-0.605***	-0.648***
	(0.4088)	(0.3745)	(0.1707)	(0.1815)
Studyfield (ref. not-matching field)	0.2336	0.050	0.106	0.135
	(0.3194)	(0.2885)	(0.1269)	(0.1365)
Interpersonal skills (ref. rudimentary)	1.693***	1.849***	1.466***	1.416***
	(0.3172)	(0.2875)	(0.1271)	(0.1371)
Problem-solving skills (ref. rudimentary)	-0.017	0.237	0.575***	0.637***
	(0.3151)	(0.2895)	(0.1296)	(0.1386)
ICT skills (ref. rudimentary)	-0.342	-0.249	0.628***	0.738***
	(0.3400)	(0.3076)	(0.1293)	(0.1382)
company size SMEs		0.204		-0.117
		(0.7102)		(0.3930)
company size large		0.491		-0.213
		(0.6506)		(0.3763)
Constant	2.734***	1.651**	1.815***	1.726***
	(0.7692)	(0.7647)	(0.3226)	0(.3763)
Number of vignettes	127	127	929	929
Number of respondents	17	17	139	139
estimated random-intercept SD (sigma u)	1.239	0.808	1.455	1.404
estimated residual SD (sigma e)	1.541	1.226	1.654	1.612
Intraclass correlation coefficient p	0.393	0.302	0.436	0.431

*p<0.1. **p<0.05. ***p<0.01. Standard deviation in parentheses.

Source: Factorial survey 2020, N (company) = 156; author's calculations.

The results from M2 suggest that the significance of the coefficients in Estonia increases with the inclusion of the firm size variable. In Germany, there is no change. In theory, the variable suggests that applicants in medium-sized firms receive, on average, 0.204 points on the response scale in reference to small-sized firmes, meaning that they are rated better simply because of the firm background. In larger companies, this effect would be even more pronounced. One explanation could be that medium-sized firms and, in particular, larger companies have more resources available for the task of company recruitment and have a wider range of recruitment instruments, procedures and selection techniques at their disposal to determine the respective applicant qualities. In Germany, the effect is reversed; and applicants would score lower on average on the candidate suitability scale. However, in both countries, the variable has no significant effect. But with the addition of firm size, some effects are amplified. This applies, for example, in Estonia to the concept of interpersonal skills, general education (level and qualification) and vocational training (qualification). In Germany, the introduction of the company variables also increases a number of factors, which means that respondents see greater advantages in certain criteria for the suitability of candidates, namely in general education (level), vocational training, problem-solving skills and ICT skills. But as already mentioned, the variables are not significant, which leads to a rejection of hypothesis H4.1.

To test the last hypothesis H4.2, the variables on the personal background of the respondent are transformed. The *educational level of the respondent* is coded using the variables educational background in relation to a low educational level (no education, primary school or lower secondary school), medium educational level (upper secondary school or post-secondary non-tertiary education) and higher educational level (bachelor, master or PhD). The educational background of the respondent is particularly important when sourcing VET graduates. Therefore, the variable *Type of education of the respondent* is coded to determine the vocational nature of their qualification. It is coded with 1 for a vocational qualification and 0 for a non-vocational qualification as a dummy code. *Professional experience* is recoded into dummy codes as follows: 1 high level of HR expertise (more than 6 years) and 0 low level of HR expertise (less than 1 year, 2-5 years).

For the estimation, the respondents' educational variables are first introduced as normal variables (see Table 21), and in a second procedure the variables were calculated as interaction terms with vignette dimensions. In Estonia, educational background showed a significant effect, supporting the other coefficients as their significance level increased. This means that the respondents rated the fictitious applicants under evaluation 1.499 higher on average than the respondents from the reference group (respondents with a lower level of education). At the same time, the value of the vocational training level doubled and the penalty effect of a lack of general education increased significantly, rising to a value of –1.507 on average on the response scale. This means that the respondents are very sensitive to a lack of general education and attach considerable importance to vocational training. This result even confirms the assumptions of the screening theory. A similar pattern can be observed in Germany when the vignette values increase (and remain significant), but the characteristics of the respondents are not significant. At the same time, the standard deviations for the variables of the respondents are quite high.

This leads to the consideration of whether a more targeted measure in terms of the impact on the respondents improves the model. In line with Struck's organizational concept of gatekeeping, it is assumed that recruiters act within the framework of their own (educational and professional) background. Furthermore, they take into account the educational background of the workforce in the company for orientation and to legitimize their decisions. Therefore, the project argues that the interaction of the vignette variables ‘general educational level’ is particularly relevant for the respondents, more precisely for the highly educated respondents, when considering their own educational biography and the legitimation of hiring decisions in the workforce in which the applicant is hired. Since the lack of a qualification would be difficult to justify, we opted for a higher level of education, which is easier for the recruiter to justify. As the results show, a higher than average level of education is a clear sign of aptitude for highly educated respondents in both countries than a below-average general education. This result emphasizes Struck's notion that personal biography contributes to hiring decisions. Secondly, an interaction term for the professional background of the respondents was created. From this, it can be deduced that one's own experience with a vocational qualification leads respondents to consider that vocational training is important for the occupations studied. The results of this term are inconsistent and misleading. Again, both models in Estonia and Germany fail to achieve statistical significance. This leads to the rejection of hypothesis H4.2 in Germany. For Estonia, the influence of education is established. Therefore, H4.2 is supported for Estonia.

Table 21: Candidate suitability and personal respondent characteristics: random effects models by country

	M1	M3	M4	M1	M3	M4
	Estonia	Estonia	Estonia	Germany	Germany	Germany
General education level	0.321	0.23	0.107	0.322***	0.315***	0.114
	(0.2144)	(0.3002)	(0.5846)	(0.0922)	(0.0992)	(0.5301)
General education degree (ref. degree)	-0.855*	-1.507***	-0.811	-0.472***	-0.503***	-0.338
	(0.4446)	(0.5481)	(0.5448)	(0.1707)	(0.1825)	(0.217)
Vocational education level	0.330	0.699**	0.570	0.686***	0.701***	0.764***
	(0.2323)	(0.3058)	(0.3237)	(0.0915)	(0.0986)	(0.1821)
Vocational education degree (ref. degree)	-0.710*	-0.272	0.310	-0.605***	-0.681***	- 0.739***
	(0.4088)	(0.5576)	(0.5357)	(0.1707)	(0.1843)	(0.2273)
Studyfield (ref. not-machting field)	0.2336	0.562	-0.069	0.106	0.217	0.266**
	(0.3194)	(0.4212)	(0.3971)	(0.1269)	(0.1378)	(0.1598)
Interpersonal skills (ref. rudimentary)	1.693***	1.981***	1.879	1.466***	1.428***	1.260***
	(0.3172)	(0.413)	(0.3867)	(0.1271)	(0.1393)	(0.1602)
Problem-solving skills (ref. rudimentary)	-0.017	0.011	0.410	0.575***	0.627***	0.763***
	(0.3151)	(0.4018)	(0.3723)	(0.1296)	(0.1393)	(0.1614)
ICT skills (ref. rudimentary)	-0.342	-0.087	-0.346	0.628***	0.747***	0.803***
	(0.3400)	(0.432)	(0.3872)	(0.1293)	(0.1394)	(0.1585)
Resp. education middle-level		1.499*			0.367	
		(0.7040)			(0.9822)	
Resp. education high-level		/			0.587	
					(0.9240)	
Resp. personnel experience		/			0.240	
					(0.481)	
v.general education level X resp. education high						
average			-1.533			-1.374
			(1.0937)			(0.885)
above average			0.500			0.238
			(1.301)			(1.079)
v.vocational edu level X resp. vocational edu						
average			-1.359			0.403
			(1.3406)			(0.4308)
above average			0.379			-0.365
			(1.158)			(0.4165)
Constant	2.734***	1.614*	0.702	1.815***	0.898	0.843
	(0.7692)	(0.9732)	(1.401)	(0.3226)	(0.9898)	(1.29)

Number of vignettes	127	127	127	929	929	929
Number of respondents	17	17	17	139	139	139
estimated random-intercept SD (sigma u)	1.239	0	0	1.455	1.452	1.446
estimated residual SD (sigma e)	1.541	1.119	1.145	1.654	1.602	1.627
Intraclass correlation coefficient p	0.393	0	0	0.436	0.451	0.441

*p<0.1. **p<0.05. ***p<0.01. Standard deviation in parentheses.

Source: Factorial survey 2020, N (company) = 156; author's calculations.

Summary

The question of what skills employers expect from vocational training graduates was answered using a factorial survey experiment. Using real data collected in both countries via an online survey, the project found that the skills shortage is a real problem for employers in both countries. When asked whether respondents consider vocational training graduates to be employable, a large majority believe that further engagement on their part is necessary. These results initially confirm that it makes sense to take a closer look at the understanding of and demand for different skills in this target group. As part of the experiment, respondents were presented with several fictitious applicants for evaluation in a hypothetical recruitment situation. In this way, the project modelled an initial recruitment task in which it was important to reduce the pool of respondents. The vignette ratings show that several criteria are used and are important to employers. The combined effect of the educational dimensions leads to differences in the value levels that contribute to the response scale. For the respondents, applicants are better qualified the higher their educational attainment (level) and depending on whether they have an educational qualification. Employers in Estonia pay more attention to general education, while German employers emphasize the importance of vocational training. Another important finding is that the vignette value of interpersonal skills is high in both countries compared with the other values. The results and the methodological approach are discussed in the conclusion below.

6.3 Discussion and conclusions

The shortage of skilled workers must be taken seriously. The project investigated whether the shortage of skilled workers in technical sectors, as reported in the European Company Survey, also exists in Estonia and Germany. The general statement that 77% of European companies in 2019 had difficulty finding talent with the required skills was confirmed by the responses to the factorial survey experiment. The lack of talent and skills is felt equally strongly by respondents in both countries. The majority of employers generally have difficulty attracting and finding talent, with SMEs facing this challenge more often than larger companies. It is striking that companies' problems in finding young talent is not just a short-term or cyclical situation. More than 40% of respondents report that they have regularly faced bottlenecks in recent years. Furthermore, the employability of most of the vocational training graduates hired by the respondents is rather low, and there is a need for engagement and investment in training.

The shortage of skilled workers is linked to developments in the digital transformation in two ways. The findings of the survey participants relate to earlier studies on this connection, firstly, that the shortage of skilled workers is more common in companies that are less digitalized (Eurofound and Cedefop 2020; Manpower Group 2020). These studies found that recruitment difficulties are more common in companies with limited digitalization than in those with extensive digitalization, and that this situation is more common in Germany than in other European countries. The project survey found that in Germany, the perception of a talent shortage is higher, as is the level of impact of digitalization on the workplace, than in Estonia. However, the problem of a skills shortage equally affects companies that are experiencing changes in the workplace (as an indicator of the impact of digitalization) and companies that are not. The distribution tends to be the other way around, as companies that are experiencing serious changes have more trouble finding talent than other companies.

Secondly, the survey results can identify the extent and direction of the impact of digitalization on workplace tasks and the requirements for employees with a vocational training profile. This question is answered differently by Estonian and German respondents. In the fields of electronics, logistics and IT, more serious changes in the workplace have been observed in Germany over the past five years than in Estonia. The direction of change refers to new working methods, which include work processes, workplace design and tools. In Germany, the technological aspect and communication are also considered in a similar way. Looking at workplace studies, the project results show a similar picture. Workplace restructuring affects current employees' immediate work capacity, but, as the results show, it also applies to vocational training graduates. Taking such major workplace changes into account is therefore important for analysing employment opportunities for future personnel.

This discrepancy between Estonia and Germany in terms of the task shifts of job profiles in technical VET could be related to their different levels of digitalization. From previous studies, it is known that Germany lags behind other European countries, particularly in the integration of new technological advances and of e-services and e-commerce options, although computer use is widespread (European Commission 2022a). As indicated by cross-country surveys on the use of various technological tools and services, the differences between Estonia and Germany also relate to robotics applications, which are more prevalent in companies operating in the logistics and industrial sectors (Eurofound and Cedefop 2020). The increased movement in recent years reported by respondents to the survey may indicate that companies are catching up in their integration of digital technologies.

The changes in the section on working methods refer to the operational level and the context of tasks within the company and are interpreted as a shift in tasks that is closely related to organizational restructuring. Following Hirsch-Kreinsen (2016), developments in digitalization must be considered in their organizational and social embeddedness. He speaks of a socio-technical system characterized by networking and interdependence between people and technology in an organizational environment. Such a relationship creates concrete interactions in terms of company activities and work tasks. With this understanding of digitalization as an interdependent process between technology, organization and working people, a connection is made to an increased change in the respondents' working methods in both countries. Furthermore, findings from the literature emphasize that the progress of digitalization is accompanied by new possibilities for networked production, modified or new business models that involve restructuring and shifting towards more service- or customer-related tasks, or other forms of collaboration and project-based value creation. In the area of manufacturing, the new character of digitalization is evident only in the development of product-based innovations or the application of different means of production, but also in services and their management. Because the surveyed companies confirmed the impact of digitalization particularly on vocational training profiles, the study of the relevance of skills required for dealing with new technological developments, for performing communication tasks and for changing workflows gains ground and draws attention to the actual evaluation of such skills in the recruitment process.

The vignette dimensions shed light on which educational criteria and skills are relevant for employers. The results confirm earlier statements in the social stratification literature that employers use multiple, diverse skills when searching for talent, in other words, formal educational skills and informal skills alike (Humburg and van der Velden 2015; Protsch and Solga 2015; Di Stasio and van de Werfhorst 2016; Piopiunik et al. 2018). It is interesting to note which educational signals recruiters receive in formal recruitment processes. Because their information is limited, recruitment is initially limited mainly to the tasks of reducing the applicant pool to a smaller number of applications. This happens in the first phase of the recruitment process and is related to decision-making. In theory, therefore, various mechanisms presented in the project could be applied. Education could be an indicator of productivity. Furthermore, education could serve as an entry ticket if recruiters have certain preferences regarding professional background, although there are no legally binding rules defining such professional requirements (occupational closures). Or, in a broader sense, education could signal a candidate's suitability in terms of the company's logic (and a reference to social closure).

The results of the factorial survey are summarized briefly and linked to the relevant mechanism. In the survey, formal education provides a suitable measure for the suitability of respondents, and the penalty for not having a degree is seen in the data to be severe. This means that it is important for employers that applicants have a certificate of education, and the higher the better. The finding is similar in both countries. The use of a range of different signals, as well as the assumption that better-educated applicants are better suited, is closely related to screening theory (Stiglitz 1975). Therefore, the project has found evidence that in Estonia and Germany, education provides recruiters with indications of how a candidate is likely to contribute to their productivity. This is an argument in favour of the mechanism of education as a means of achieving productivity.

From the results on the importance of a person's field of study, it is not clear whether the professional background has a significant influence on the perception of an applicant's suitability. Therefore, it is unclear whether education is considered to be a ticket to employment in Estonia and Germany. Segmentation theory and occupational closure assume that evidence of a suitable vocational education is very important in countries with a highly segmented labour market. Therefore, at least in Germany, clear results would have been expected. Nevertheless, this result can be linked to another one in the control section of the factorial survey. In Estonia 86% and in Germany 95% of respondents state that graduates of vocational training require further training after joining the company. This leads to considerations regarding job position that recruiters should take into account. The survey targeted entry-level positions after graduation. In this situation, it is apparent that graduates do not come with the full range of desired skills and abilities. In terms of the fact that recruiters are willing to invest in training and in VET graduates, the field of study in which employees develop and specialize is less relevant for entry-level positions. However, the relevance of a suitable professional background could be greater in other employment positions when employees take over the management of specialized departments or take on management roles.

Imdorf developed the concept of education as a signal of suitability in several areas. He suggests that recruiters assess applicants' suitability in three central dimensions within a company: industrial, domestic and project-oriented. Through these considerations, education not only serves as a means of assessing potential productivity, but also integrates social and entrepreneurial dimensions. Suitability reflects these considerations best and provides to take social closure mechanism into account. In this context, the project has provided evidence (in Germany) that all three informal skills are important to employers, and not just one. In Imdorf's sense it is not important to have only very good problem-solving skills but no interpersonal skills at all. Whether the various characteristics of the applicant match the requirements of the workplace is linked to the fact that he is reasonably competent in all three skills. For a more sophisticated measurement than the dualistic approach (rudimentary vs comprehensive), one could perhaps recognize such a concept on more than just two dimensions. Furthermore, the operationalization of Imdorf's model could be reconsidered. Logic in the project-oriented world prompts recruiters to take into account the assumptions, values and perceptions of clients, customers or partners.

In this sense, problem-solving skills are an important advantage in the event of conflicts. It might be interesting to consider whether communication skills are not also a good measure for this logic because they reflect tasks and situations before problematic issues develop.

In the area of informal skills, interpersonal skills stand out. It is therefore very important for recruiters that applicants demonstrate teamwork skills in the first round of the application process. In addition, the clear distance from other vignette dimensions in terms of their average contribution to the candidates' suitability shows their significance. In their employer study, Humburg and van der Velden (2015) also found that interpersonal skills were very important. However, this effect became apparent only in the second step of the recruitment process, when they analysed employers' hiring behaviour. Further insights are needed into whether interpersonal skills are important for the real work situation with colleagues (hiring) or whether they provide HR managers with more general information about social skills. Furthermore, this result could also suggest increased attention on the part of employers in line with the increasing understanding of work tasks in the digital transformation. The results are thus largely consistent with those of Protsch and Solga (2015), who analysed the recruitment process of German employers in the training market, also in the technical field. Their main finding was that employers use both types of skills as applicant filters, formal and informal. However, they give higher priority to informal skills than to formal ones.

In general, more research is needed to illustrate the signalling value of informal skills. It would be interesting to better understand employers' attitudes towards teamwork and how this relates to the social domain (social conditions for establishing teamwork or under what conditions employers emphasize teamwork skills). In this factorial survey, the fictitious applicants are presented as male and young, which corresponds to the majority of VET graduates in these fields. It would be very interesting for further sociological research to disentangle the social, cultural and religious aspects.

Overall, the estimation models would benefit from a more thorough engagement with interaction terms and a second, more careful look at the differences between the German and Estonian responses. The second aspect relates to the fact that in the outline presented here, the coefficients cannot be compared directly between Estonia and Germany in terms of their vignette values. To obtain more specific and comparable estimates of the signal value of individual vignettes for respondents in both countries, and to determine whether the effects vary considerably between the countries, a pooled model could be estimated with interaction terms between the vignette factors and a dummy-coded variable for the countries.

Although studies have shown that the stated preferences for candidates approximate actual behaviour, the hypothetical situation of the experimental approach must be taken into account and cannot be completely ruled out (Murphy et al. 2005). However, the study provided prerequisites for reducing hypothetical bias, which, for example, lies in the presentation mode of the factorial survey. Furthermore, the treatment involved a rather general assessment of a range of educational signals and abilities with regard to applicants' general employability, rather than direct measures of discriminatory behaviour that may be further removed from aspects of social desirability.

One aspect of the operationalization of the study could result in limitations in terms of prediction. This concerns the dependent variable, which is modelled as a preference and measured on a scale. This measurement refers to the first phase of the recruitment process and cannot make any predictions about actual hiring, because the recruitment process usually involves more than one phase. Furthermore, the given response patterns show that the respondents tend to perceive the presented applicants as unsuitable for their jobs. The Estonian respondents answered more often than the German respondents at the lower end of the answer scale and completely rejected the answer category 'very suitable'. This shows that the respondents, especially in Estonia, do not seem to know exactly whether these applicants are suitable. Because all respondents have at least some experience with recruitment and hiring processes, they find it difficult to recognize suitability given the criteria provided. One explanation could be that employers cannot relate the given criteria to the information they usually receive with applicant profiles, or that they predominantly use different selection criteria when hiring VET graduates. From the control variables, it is known that employers in both countries place more emphasis on work experience. The question of what requirements they usually ask for shows that, in particular for a VET qualification, the combination with initial or even greater work experience seems to be crucial. The factorial survey lacks information on work experience, which may make the assessment of VET graduates less suitable.

Overall, the project provided another example of a factorial comparative survey proving that the factorial comparative approach is a suitable method for investigating aspects of the recruitment process. By considering other factorial surveys or experimental treatments in the social stratification literature, the survey reached a larger number of survey participants, which made it possible to conduct a full factorial survey. The difficulty was to address companies in both countries to an extent that would allow a comparison of the results. The response behaviour was similar in both countries, but given the rather different number of companies in both countries, the group of respondents varies considerably between Estonia and Germany. Despite further efforts to increase the participation of Estonian companies, this major difference could not be compensated for.

The reason for this lies in the fact that the sampling approach via the business directories is seen as a promising way forward. However, many entries in this database may be outdated or the invitation to the survey may not be noticed or forwarded to the relevant HR department beyond the general first postal address. The data in the company directories is not actively maintained by anyone, unless the companies themselves keep their profiles up to date. This resulted in a high volume of information with a fairly low response rate. An alternative approach for experimental surveys would be to use company databases from which one can obtain contact details for a fee. These seem more suitable but more expensive. Another alternative that is frequently used is to apply randomized treatment in field studies when responding directly to current vacancies and sending fictitious applications directly to the company (Protsch and Solga 2015; Hipp 2020). For ethical reasons and given that employers already receive too few applications, the project decided to investigate their preferences and obtain their consent to participate in an experimental study. Only email addresses were used to contact the companies. For further approaches, it would be worth considering whether more personal initial contact would pay off. Furthermore, the lower response rate is associated with the signalling value of the study invitations. Although the research context, the university and the general areas of interest were clearly emphasized in the invitation email, the University of Paderborn is relatively unknown in Estonia.

Another critical point in the survey is the high dropout rate after the experimental treatment. When designing the survey, the recommendations made during a methodological workshop were integrated into the project, taking into account the current state of the art for the length and scope of the information provided to employers (Auspurg and Hinz 2015). The survey participants were asked to respond to eight different candidate profiles. The presentation of the profiles took the form of key information as it might appear in a CV. Compared with other studies that use 10 profiles (for example, Linden 2020) or 18 profiles (for example, Di Stasio and Gerxhani 2015; van de Werfhorst and Di Stasio 2016), the number of applicants presented seemed theoretically feasible. However, the respondents' reactions suggest that the questionnaire was too long.

7. Conclusion: skill supply and skill demand in digital labour markets

The project's starting point is the skills gap. It expresses the mismatch between employees and their jobs in terms of existing and missing skills. Skills gaps are a phenomenon observed in existing employment relationships, but they may also occur for younger employees after they have completed their training. The project posits that digitalization is a causal factor in skills gaps. It is obvious that digitalization will also accelerate structural change in the economy as a whole, towards the development of a service economy. Therefore, the project focuses on integrating digitalization as an unavoidable contextual factor into the analysis of the effects of digitalization on skill formation and labour market opportunities. The success of the project lies in promoting a broader understanding of the characteristics and possible causes of skills shortages.

The problem of skills shortages occurs when the link between education and employment becomes unbalanced. Educational institutions must ensure that they are equipping graduates with the skills they need to enter the labour market. Vocational training institutions play an increasingly important role in providing the skills that workers need to benefit from constant innovation, as countries develop skills through vocational training that are relevant to specific labour market segments. On the other hand, skills shortages may also be linked to uncertainties on the part of employers. They are unsure about the skills they should define as job requirements and which skills they should obtain through recruitment processes.

The project therefore took an empirical approach that connects both sides of the emergence of mismatches. The analytical framework addresses how digitalization in different country contexts feeds into skill formation (supply) and how digitalization affects firms and their recruitment behaviour (demand). Digitalization was systematically embedded in this relationship because the change triggered by the digital transformation is of fundamental importance for the future development of the labour market. The research question 'How do skills supply and skills demand behave in different institutional contexts?' is answered and discussed as follows.

A comparison of skills supply and skills demand

In order to explain the conditions of skills shortages, the processes of skill formation in light of the digital transformation were illustrated in Chapter 5. This chapter provides a detailed description of the institutional references for the provision of qualifications where mismatches can potentially develop. This is a first contribution to considering countries' institutional environment as an explanatory factor for skills shortages. The results of the analysis of skill formation are summarized again, firstly with regard to the diversity of skills specificity and secondly with regard to the extent of informal skills transmission.

Skill formation leads to skills that are more recognized in Germany than in Estonia. The comparative analysis of educational processes and content shows that the institutional conditions of vocational training lead to differences between the two countries. The project's findings confirm the findings of Bol and van de Werfhorst (2011), but are based on current figures from indicator-based education monitoring from 2019–2021. The reference study has established indicators of institutional differences in education that are used to measure and compare countries based on the most important characteristics of their VET systems. From this perspective, Germany has a more vocationally-oriented education system than Estonia, with more students choosing to pursue vocational pathways.

Furthermore, Germany and Estonia differ in terms of vocational specificity. In addition to the number of students in vocational training programmes compared with the general education system, the depth and type of skills developed in vocational training are also relevant for specificity. Due to this difference, it becomes clear that vocational training in Germany mainly takes the form of apprenticeships. The school and the company are learning venues that train students equally. In Estonia, the apprenticeship system is a high political priority, but is less in demand among students. Estonian students receive their vocational training mainly in the school system, with workplace learning accounting for between 35% and 50% of training.

This variation in occupational specificity leads to the conclusion that skills are more specific in Germany than in Estonia. The analysis of training regulations has shown that the importance of occupation-specific skills is more pronounced in Germany because of the scope of the different skills in the curriculum. In the meantime, general skills in the areas of reading, writing, arithmetic and languages are also promoted in Estonian vocational training. This finding highlights the respective orientation and complementarity with other labour market institutions in the sense of the ‘variety of capitalism’ approach in the field of training: vocational qualification specificity in Germany is encouraged and strengthened by the labour market actors and social partners, as highly specific qualifications are related to the robust occupational structure and the divergence of labour market segments. The strong reliance on the establishment of such specific skills during formalized training processes makes the skills ‘transparent’ and allows trainees to transition into an employment relationship without further training or instruction. As a result of this institutional structure, the project finds evidence that the link between education and employment is considered comparatively narrow when designing vocational training.

In contrast, the skills acquired in the Estonian school-based VET system are not as deeply specific and therefore have a lower signalling effect. However, the form of VET also complements the outline of the Estonian economy, which promotes coordination around market mechanisms. Employers do not frequently engage in VET, but are willing to instruct and train new employees in terms of on-the-job preparation. Investments in such training are very company-specific, which makes it difficult to transfer these acquired skills and knowledge to other companies or sectors. The structural link between the education system and the employment system is therefore rather weak. Whether employers also recognize and refer to such skills along these institutionally predetermined lines is discussed below.

A second important aspect when comparing skill formation systems in the face of digitalization is the emphasis on informal skills during training. The project found evidence that informal skills are more relevant in VET in Germany than in Estonia (in the newer training curricula for electronics and IT). The analysis of the training regulations showed that although digitalization has been increasingly incorporated into training content in both countries in recent years, informal skills are listed as learning content in the observed occupations with greater variation and frequency in Germany than in Estonia. A second key finding is that in Germany, these informal skills are more often assigned to overarching and interdisciplinary learning units, for example, in the context of the new occupational profile 'Digital Work', while in Estonia the development of informal skills is assigned to modules and fields of work that are purely formal.

The difference in skill evaluation supports Streeck's assumptions (2011). He emphasizes that skills can be transferable to varying degrees. He relates the importance of transferability not only to the ability to use skills between companies, as explained above. Taking into account the structured development of occupation-specific skills and also the acquisition of informal skills during training, he argues that these informal skills are also transferable, even though they are specific. This principle works in Germany because of the curricula for workplace learning, the predictability of these learning contents and the high comparability and standardization of training throughout the country. In Estonia, however, the strategy, as explained above, is to teach company-specific and occupation-specific skills for the respective situations and positions. In addition, vocational schools in Estonia have greater autonomy and decision-making power. Therefore, occupation-specific skills are less transferable in Estonia. However, this approach makes it possible to consider informal skills to be transferable as well.

The results of the cross-country comparison at the programme level confirm that digitalization is gradually being introduced into VET and existing occupations. As the analysis of the structural conditions of VET systems over a period of 15 years has shown, both countries have retained their respective system logics. The qualification strategy in Germany therefore continues to focus on reflecting significant changes in the area of formal training regulations, for example in cross-occupational VET positions, and implementing the respective occupation-specific requirements of digitalization in practical teaching. This approach exemplifies the strategy of a system that relies heavily on coordination and alignment: changes are first discussed at length and their necessity is intensively reviewed before they become mandatory for a wide range of training programmes. In this context, however, efforts made and measures taken to accelerate the process are proof that the level of development and application of digital skills needs to be strengthened. However, this is not a problem that specifically affects vocational training, but rather the German education system in general.

Germany is pursuing a path-dependent approach with such strategies. This is because the available room for manoeuvre has already been constrained by previous structural reform steps and trajectories. This implies that new constellations and new needs for action in response to the challenges of digitalization could form new institutional responses, but they would be 'isomorphobic' (Thelen 1999: 386) with respect to previous institutions. An example of such institutional reproduction would be if comprehensive structural developments were set in motion that enable learners to make a more appropriate transition between initial vocational training and (academic) higher education, but the mode of coordination and the logic of change would remain in place.

In Estonia, the strategy is different. Skill formation is updated more frequently in national monitoring rounds, but it offers more opportunities and autonomy for vocational education implementation. Estonia's historical background is strongly shaped by the decline of the Soviet Union and independence. As a result, the Estonian education system, together with the entire institutional architecture, has undergone discontinuous, abrupt institutional change, leading to institutional collapse (Streeck and Thelen 2005). It faced the necessity of completely reorganising the education system and establishing a new prototype education system. Since then, further developments in the education landscape have been gradual. In terms of digitalization, however, Estonia has a comparative advantage because it was able to break away completely from previous conditions and obstacles. In the early 1990s, new structures were created, for example in administration and education. This is an advantage for the country when it comes to developing citizens' digital skills and applying them in business. In view of this, it can be deduced that Estonia is able to respond more quickly to challenges and also offer new occupations in the training market more quickly in order to respond to disruptive developments. However, in view of the historical legacy, cultural aspects and norms in Estonia are still evident in the demand for the apprenticeship training system.

As a result, both countries are responding to change in different ways, in terms of both timing and the technical strategy for skills development and training. Skills development is a key element for companies to ensure that they have a workforce with the right skills. Because skills development is linked to other institutions through institutional complementarities, companies are involved in skills development in different ways. Whether this principle applies in Estonia and Germany and influences their recruitment strategies is summarized below.

When it comes to skills demand, the experimental method of a factorial survey provided insights into recruitment processes and preferences in Estonia and Germany. Studying recruitment processes in a survey makes it possible to compare a range of aspects. First, the results of the vignette study emphasize that employers in both countries are accustomed to using a range of applicant information to assess the suitability of applicants for a job. According to the HR literature, this is a common procedure to reduce the applicant pool and set preferences for certain characteristics that are important to the company. The survey found that formal education provides suitable metrics for the suitability of respondents. Not having a qualification is severely penalized and clearly evident in the data, indicating candidate productivity.

When looking for the most suitable candidate, recruiters also rely on information about the level of education. Applicants have an advantage if their educational attainment is better than the average of other students. Detecting this pattern in the factorial survey results leads to consideration of screening theory as a suitable theoretical concept. Employers also reward informal skills, particularly interpersonal ones. Comprehensive acquisition of such skills predicts employee suitability for high-level positions compared with other educational measures. This applies equally to both countries and underlines the need to consider informal skills as important as the formally known and extensively studied formal skills, such as literacy or numeracy.

When considering the results of the respondent assessment by country, differences can be seen. Although the project did not calculate the direct measures that would be required to compare the coefficient effect in both countries, country-specific recruitment patterns can be seen when looking at the models and their emphasis on different abilities. One can see that recruiters in Estonia pay more attention to general education signals than in Germany, where attention and penalties for a lack of education are stronger in the absence of vocational training.

These results emphasize the importance of the institutional context for recruitment processes. The identification of respondents' preference patterns, separated by country, points to the institutional alignment of action situations described in the comparative institutional literature. Firms are embedded in a specific institutional architecture that differs from country to country. It is characterized by different modes of production and logics of cooperation. Organizations are embedded in this environment and their actions to foster skill formation yield different results (see above). Furthermore, this literature argues that their actions aimed at recognising and sourcing skills differ. In Estonia, recruiters place more emphasis on the general education certificate than on the vocational education certificate, which fits with the economic model of production. As a liberal market economy, Estonia provides incentives to acquire general rather than specific skills.

By contrast, employers in Germany operate within a coordinated market economy (CME) and are motivated to engage in training. In theory, this production process and the embedding of the company would provide incentives to provide and demand very specific skills. This can be confirmed by the results of the fact-finding survey. Applicants in Germany are considered less suitable for a job if they cannot provide proof of an educational qualification – however, the disadvantage is greater if they do not have a vocational qualification either. In other words, the German education system is highly skill-transparent for employers. Through the formal educational pathways, vocational training in the form of apprenticeships and strong company involvement, employers have a good overview of acquired and established skills and knowledge. This carries over into the recruitment process and they recognize vocational training graduates and align their preferences more closely with vocational training signals than with general education signals. This result provides a basis for Streeck's (2011) views. According to his logic, skills are transferable and portable, even though they are highly specialized. Because employers tend to evaluate vocational skills rather positively when hiring new employees, this also points to the portability of skills. This is related to the qualification profile in Germany, which, although developed within the apprenticeship system, is highly standardized because of its institutional coordination structure. Vocational skills are therefore transparent to and acknowledged by employers in Germany.

By analysing recruitment processes comparatively, the project helped to shed light on labour market demand patterns. The research question is related to the demand side by asking what the demand for skills looks like in different institutional settings. The different preferences have been outlined above. The relationship between supply and demand is of interest when it comes to answering the research question. In Estonia, the relationship between VET and the skills highlighted by employers is consistent. This means that there is evidence of an assumed complementarity of the institutional context. In Germany, too, the demand for skills responds in the same way to the production of skills when recruiters put more emphasis on vocationally trained skills. The two countries are constantly responding to changes in the digital transformation by further developing the content of skills development. It was assumed that a larger number and a greater variety of informal skills are being taught in Germany than in Estonia. However, as the factorial survey experiment showed, in both countries, informal skills, especially interpersonal skills such as teamwork, play a central role in the assessment of applicants during the recruitment process. This argues for a general recognition of applicants' informal skills as an important prerequisite for employability.

These findings are highly relevant for career guidance organizations or for career counselling during school years. Knowing which skills to emphasize in a CV is essential for the first round of the job application process. The findings on the relevance of educational credentials could also support education policy in both countries when establishing or continuing programmes to increase graduation rates or prevent dropouts, particularly in vocational training programmes. Furthermore, the findings on employers' recognition of informal skills, particularly teamwork skills, argue for even greater attention to skills development and validation in a cross-country perspective. It is important not only to enhance research analysing interpersonal skills during skill development, but also to examine under which conditions students are successful in demonstrating good interpersonal skills – and to test for social context (for example, social exclusion, ethical discrimination). A better understanding of how students can demonstrate a high level of education would help students as they enter the world of work. In this sense, the project contributed detailed insights into the skills shortages in Estonia and Germany.

Outlook

The study results are particularly relevant for further development with regard to the establishment, activation and recognition of informal skills. They are supported by other recent observations in the sociology of work that indicate an increase in the importance of informal skills for employment as a result of digital change. Informal skills are becoming more and more important for coping with changes in the workplace, in work processes and in work tasks. In the processes of skill formation, they are increasingly being integrated and considered an important field of learning. Because informal skills are required to perform work tasks, a match between workforce skills and job requirements strengthens work capacities, but also autonomy and active participation. If these skills are not present, training and further education are urgently needed to impart them. Further research could be useful to improve the conceptual and methodological clarity of soft skills, gendered perceptions or also cultural contextualization, which is important if they are to function as transferable measures in various cross-country comparative studies. The ESJS contributes measurements on a range of soft skills, although the differences between communication skills and customer service skills, for example, remain somewhat blurred.

Another aspect of informality is that informal skills tend to be undervalued. One idea for raising awareness and attention would be to describe informal skills such as digital literacy, teamwork, problem-solving or learning skills as a bundle of necessary ‘transformation skills’. At the same time, these skills could be made more manageable by employers as part of the activation of skills, for example, when employees present a job application in terms of concrete work experiences within the framework of a digital transformation and describe their transformation skill set. Such insights into exemplary work situations and the transparent application of skills would create awareness of the fact that continuous monitoring of skills and qualifications is essential and a central task of corporate HR departments in order to be well prepared for change.

Another way to increase the transparency of informal skills is related to their validation and certification. Validation integrates ways of making non-formal and informal learning in educational, social and working life visible and certifiable. It is important that workers can prove what they have learned, even beyond formal schooling. Current efforts at the European level, as well as research results, emphasize the need to promote their validation and provide examples of what a methodological approach for European countries might look like (Cedefop, European Commission and ICF 2019; Harteis, Goller and Fischer 2019). Countries are currently developing national strategies for the creation of validation arrangements, but they are progressing at different speeds. Nevertheless, experience with different forms of learning, including non-formal methods, helps to enhance employees' careers and their motivation and participation in further education and training. Greater acceptance of these forms of learning also benefits the use of informal skills in the workplace. The validation and recognition of informal learning and experience is associated with further education and training, which are strongly encouraged and needed in the context of lifelong learning strategies.

When it comes to transformation, the current challenge is clear: Germany needs to catch up in terms of digitalization, while Estonia should strengthen its vocational profile. In a country comparison, the big opportunities lie in recognising and illustrating particular (institutional) advantages, or promoting ways of eliminating disadvantages. Germany offers vocational students a smooth transition into the labour market and serves well in coordinating vocational training in certain occupations. Despite all the critical developments in the field of vocational education in Germany, there are still many employment opportunities for vocational training graduates that offer good career and income opportunities in the currently favourable (ageing) demographic environment. In view of these positive developments and the demand for vocationally trained specialists, Estonia is strongly committed to improving the level of and demand for apprenticeships in particular and vocational training options for students in general. The comparison between Estonia and Germany shows that Germany has great potential to learn from Estonia. In addition to the expansion of broadband, German society, economy and administration are lagging alarmingly behind in many key areas, while Estonia is considered a digital pioneer in many respects, as has been demonstrated in the field of education, for example. German Minister for Digital Affairs and Transport Volker Wissing recently reached agreement with the Baltic countries of Estonia, Lithuania and Latvia to form an 'innovation club' (Federal Ministry of Digital and Transport 2023) to make it easier to disseminate progressive digital ideas in Germany. Another goal is to develop standards for a unified European digital single market.

As connectivity, digital usage and technologies advance, it is also essential for European countries to become greener. One goal in many countries is to achieve a socially just green transition that enables the working population to participate in change processes and keep pace with major and fundamentally disruptive transformations. There is great potential in the link between the green transition and relevant skills taught by education systems. Education for Sustainable Development (ESD) emphasizes that formal and non-formal learning environments should be included. In the field of vocational education and training, learning content is already geared towards examining the impact of work activities on the environment. Nevertheless, in many cases this is dealt with only superficially. For this reason, initial initiatives inspired by Fridays for Future, such as 'Azubis for Future e.V.' in Germany, are emerging and attempting to integrate environmental education and sustainability more systematically into vocational education and training curricula.

In terms of skills supply, the results show that a cross-national research perspective on the demand for skills makes it possible to identify the skills strategies of different countries. In this sense, the project suggests that recruitment practices should remain an important field of research on social stratification. The method of a factorial survey adopted in this project focused on recruiters' hiring intentions. It was not possible to determine the extent to which their qualification preferences are also decisive for actual hiring decisions. The analysis remains focused on the screening mode of applications and thus provides information about which skills the recruiters consider important for particular positions. Furthermore, generalisability is limited due to the occupations studied (electronics, logistics, IT) and the target group (VET graduates). Integration of such a factual survey into a broader study that contains applicant information or that integrates information on recruiters' previous hiring processes and decisions would be helpful in pursuance of a better evaluation of the research results of this project.

Generally speaking, if the project has a weakness, it is that while it provides a discussion of the relationship between skills supply and demand, it has not been able to fully validate this empirically. Firstly, this limitation is due to the underlying data situation. To obtain a more meaningful assessment of supply and demand, an integrated employee-employer dataset for both groups would be required, but this is not available in all countries for the various skill types examined in the project. Secondly, it seems reasonable to check the results of the use of skilled workers not only in the first wave of the ESJS from 2016, but also in the more recent second wave from 2021. Insights into more recent measurements are helpful to identify more current conditions and characteristics of digitalization in the world of work. They provide an opportunity to discover new skills requirements that have already been integrated into vocational training as a result of innovations in recent years. Overall, employees in the relevant occupations already took the view in 2016 that requirements with regard to informal skills were quite high, leading to the assumption that skills demand in the labour market and the skills targeted in vocational training are probably even more mismatched than before.

In summary, the project provides an exemplary research framework for examining digitalization processes from a country perspective and in terms of the relationship between supply and demand. As already mentioned, it provides a basis for discussion on improvements in relation to data and measurement, but also encourages the continuation of comparative efforts in social stratification research. It would be interesting, for example, to make further comparisons with equally successful economies in Northern Europe in terms of digitalization, such as Finland or Sweden. These countries have been successful in establishing a high level of digital skills in their societies, in spreading digital administrative processes and in integrating new digital technologies into the economy. But their VET systems also show interesting developments. Finland has recently started to promote a very skills-oriented VET model that focuses on individual skills development plans and better recognizes skills or abilities that have already been acquired. The Swedish VET system has been significantly restructured to promote workplace learning, encourage apprenticeship training and introduce reforms that increase the involvement of social partners in VET. Currently, Sweden is struggling with decentralized provision and the small number of vocational schools throughout the country. Similar challenges can be observed in Germany, where overarching training centres or training alliances between several companies are being discussed, or in Estonia, which is trying to strengthen the apprenticeship system. Further comparisons in the context of digital transformation and different institutional conditions in VET could ultimately be interesting for the purpose of identifying and discussing similarities and good practices as blueprints for successful reforms in the education sector.

Appendix

Overview

Appendix A: VET Systems, Skills Profiles, and Changing Labor Markets

Appendix A.1: VET and Labor Market Conditions

Table A.1-1: Employee's evaluation of changes in the work situations by field of work, 2000-2015

	2000 EU %	2005 EU %	2010 EU %	2015 EU %
Does your job involve working at very high speed? *Answer categories: all and almost all of the time*				
All occupations	24.0	25.5	23.5	24.0
Craft and related trades workers (ISCED-7)	30.8	32.7	29.3	29.3
Clerical support workers (ISCED-4)	20.6	23.5	22.7	22.2
Technicians and associate professionals (ISCED-3)	21.2	22.5	22.0	22.1
Does your job involve working to tight deadlines? *Answer categories: all and almost all of the time*				
All occupations	26.7	28.1	25.4	25.7
Craft and related trades workers (ISCED-7)	33.1	38.2	32.5	33.4
Clerical support workers (ISCED-4)	22.2	35.7	25.2	25.2
Technicians and associate professionals (ISCED-3)	26.0	26.4	26.3	26.2
Does your job involve solving unforeseen problems on your own? *Answer category: yes*				
All occupations	81.6	80.0	79.2	81.8
Craft and related trades workers (ISCED-7)	81.8	77.8	79.7	81.3
Clerical support workers (ISCED-4)	80.8	80.6	78.5	81.5
Technicians and associate professionals (ISCED-3)	90.9	88.1	85.8	89.0
Does your job involve complex tasks? *Answer category: yes*				
All occupations	54.3	59.6	54.6	58.5
Craft and related trades workers (ISCED-7)	63.5	66.6	64.9	69.1
Clerical support workers (ISCED-4)	55.9	61.0	54.5	60.3
Technicians and associate professionals (ISCED-3)	68.3	72.8	70.2	74.1
Does your job involve learning new things? *Answer category: yes*				
All occupations	70.6	70.3	66.4	68.5
Craft and related trades workers (ISCED-7)	71.5	69.2	68.0	70.8
Clerical support workers (ISCED-4)	75.0	75.7	70.9	71.9
Technicians and associate professionals (ISCED-3)	85.5	86.2	82.4	85.5

(table continued)

During the last three yeas, has there been a restructuring or reorganisation of workplace? *Answer category: yes*				
All occupations			30.1	21.2
Craft and related trades workers (ISCED-7)			26.5	15.7
Clerical support workers (ISCED-4)			38.7	25.5
Technicians and associate professionals (ISCED-3)			39.9	29.1
During the last 12 months has your work changed in any of the following ways? **Changes in work situation: tasks and duties (responsibilities)** *Answer category: increased*				
All occupations				32.2
Electronic technicians (ISCED-74)				27.2
Logistics assistants (ISCED-43)				35.5
Tasks and duties (ISCED-35)				41.1

Note: Figures express the given percentages of the noted answer categories only. The full set of answer categories: (1) all of the time, (2) almost all of the time, (3) around 3/4 of the time, (4) around half of the time, (5) around 1/4 of the time, (6) almost never; (1) yes, (2) no; (1) increased a lot, (2) increased a little, (3) no change, (4) decreased a little, (5) decreased a lot;

Source: European Foundation for the Improvement of Living and Working Conditions. European Working Conditions Survey (EWCS) 2000, 2005, 2010 and 2015; own calculations.

Figure A.1-2: Educational attainment in Estonia and Germany in%, 2011-2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
maximum lower-secondary education (ISCED 0-2)										
EE	10.9	10	9.4	11.8	11.3	10.9	11.2	10.8	9.8	9.3
DE	13.4	13.4	13.3	13.1	13.2	13.5	13.5	13.4	13.4	14.3
upper-secondary, post-secondary non-tertiary education (ISCED 3-4)										
EE	52.1	52.3	53.2	50.6	50.5	50.2	49.1	48.1	48.7	48.5
DE	59	58.4	58.1	59.8	59.1	58.2	57.9	57.5	56.8	54.4
tertiary education (ISCED 5-8)										
EE	36.9	37.6	37.4	37.6	38.1	38.9	39.7	41.2	41.4	42.3
DE	27.7	28.2	28.6	27.1	27.6	28.3	28.6	29.1	29.9	31.3

Source: Eurostat 2021, Labor Force Survey lfsa_edat. Population by educational attainment in% aged 25-64 and in ISCED-11 groups.

Appendix A.2: VET Curricula and Skills Profiles

Table A.2-1: Skills profile of the electronics technician, Estonia

Overview: Skills profile	**in%**	**number of skills in the curriculum**
Informal skills	**7%**	**6**
Interpersonal	6%	5
ICT	1%	1
Formal skills	**93%**	**79**
Implementation of electronic installations	14%	12
Planning of installations	2%	2
Electrical/energetic housing technics	12%	10
Security and quality measures	5%	4
Automation processes	6%	5
Working techniques	9%	8
Natural sciences	14%	12
Languages	19%	16
Arts and social subjects	12%	10
in total	**100%**	**85**

Detailed: Skills in the curriculum	**Skills categorization**
Occupational modules	
Basic knowledge of interior electricity	
• has an understanding of the Estonian energy and electricity system, its components, and its interaction with the consumer's electricity supply	Electrical housing technics (1)
• knows the normative documents regulating the field to the extent necessary for further duties	Electrical housing technics (2)
• understands the regularities of electrical engineering and their practical use opportunities for electrical work	Electrical housing technics (3)
• has an overview of the building design and its electrical installations, including technical drawings, drawing requirements, and graphical information	Electrical housing technics (4)
• knows different presentation options	Electrical housing technics (5)
• select and use appropriate measuring instruments and measuring methods for measuring electrical quantities at constant and AC circuits	Electrical housing technics (6)
• is familiar with the requirements of work safety, electrical safety, and fire safety electrical work and can provide first aid	Security and quality measures (1)
Building automation and installation of low-voltage equipment	
• plans and organizes the work process based on the given project	Planning of installations (1)
• performs proper installations of cabling and actuators for automation and low-voltage equipment in the workplace	Automation processes (1)
• installs and connects the cabling and actuators of the building's automation and low-voltage equipment, taking into account the installation method specified in the construction project	Automation processes (2)
• performs the necessary inspection activities after the installation of the building's automation and low-voltage equipment	Automation processes (3)
• documents the work performed in accordance with the prescribed requirements	Automation processes (4)
• works by the requirements set out in the normative documents of the profession	Automation processes (5)
• works responsibly and safely when performing installations	Security/quality measures (2)
• together with the supervisor, analyzes their activities in the installation	Interpersonal skills (1)
Construction of electrical installations in the building	

• plans and organizes the work process based on the given project and as required for the construction of electrical installations in the workplace	Planning of installations (2)
• installs and connects electrical installation accessories, wiring, and equipment, taking into account the type of installation specified in the construction project and professional requirements	Implement installations (1)
• builds the earthing installation of the building and installs lightning protection devices, proceeding with the guiding system used any following the given project outline	Implement installations (2)
• performs the necessary inspection of the electrical installations	Implement installations (3)
• documents the work performed by the prescribed requirements	Implement installations (4)
• works along guidance by requirements set out in the normative documents of the profession	Implement installations (5)
• works responsibly and safely in the construction of electrical installations	Security/quality measures (3)
• together with the supervisor, analyzes their activities in the installation	Interpersonal skills (2)

Operation of electrical installations in the building

• understands the nature of the operation of the building's electrical installations and electrical appliances	Electrical housing technics (7)
• understands the roles and responsibilities of the different parties in this process	Electrical housing technics (8)
• conducts regular inspections on the electrical installations and appliances in the building	Implement installations (6)
• run operations according to a predetermined operating plan	Implement installations (7)
• documents the work performed by the prescribed requirements	Implement installations (8)
• works along guidance by requirements set out in the normative documents of the profession	Implement installations (9)
• works responsibly and safely in the construction of electrical installations	Security/quality measures (4)
• together with the supervisor, analyzes his / her activities in the installation	Interpersonal skills (3)

Career planning and business fundamentals

• understands their responsibility to make informed decisions throughout their lives, the career planning process	Working techniques (1)
• behaves in a manner that supports interaction	Interpersonal skills (4)
• understands their rights and obligations when operating in the work environment	Working techniques (2)
• understands the nature of the economy and the functioning of the economic environment	Working techniques (3)
• makes sense of its own role in the business environment	Interpersonal skills (5)

General study subjects

Natural sciences

• understands the interrelationships and peculiarities of natural objects and understands the importance of models in describing real objects	Natural sciences (1)
• understands and uses the knowledge acquired in natural sciences to explain and value phenomena in the environment and in solving problems of everyday life	Natural sciences (2)
• understands the impact of scientific and technological achievements on the natural environment and humankind	Natural sciences (3)
• understand the impact of the surrounding environment on human health	Natural sciences (4)
• independently finds reliable scientific information and uses it to solve various tasks	Natural sciences (5)
• uses the learned mathematical knowledge and skills in new situations and in solving vital tasks, analyzing, and evaluating the truthfulness of the results	Natural sciences (6)
• uses different sources of information when needed and understands different ways of presenting mathematical information	Natural sciences (7)
• connects mathematics with other subjects and uses their mathematical knowledge and skills in learning them	Natural sciences (8)
• presents their mathematical thoughts logically, expresses their thoughts clearly and precisely both orally and in writing	Natural sciences (9)
• uses the possibilities of mathematics to assess the profitability and sustainability of one's own and others' activities	Natural sciences (10)

Languages

• expresses himself/ herself clearly, purposefully, and by the norms of general written language in both oral and written communication	Languages (1)
• discusses thematically and reasonably based on the text read, viewed, or listened to	Languages (2)

• compiles different types of texts, using informational and fiction texts as well as other sources as critical sources, critically evaluating them	Languages (3)
• reads and understands unbound texts (table, graph, diagram), evaluates the information presented in them, draws conclusions, and creates new connections	Languages (4)
• values reading, relates what he has read to himself and modern life phenomena, to his homeland	Languages (5)
• interprets and analyzes literary works, links this era with societal and cultural events	Languages (6)
• communicates independently in everyday language, both spoken and written, in the foreign language they are learning as a language user, presents and protects various views in discussions/communication situations	Languages (7)
• describes in a foreign language oneself, one's abilities and interests, thoughts, intentions, and experiences	Languages (8)
• uses foreign language learning appropriate for the development of foreign language skills strategies and sources of information	Languages (9)
• understands the living environment and culture of Estonia and other nations and takes them into account when communicating in a foreign language	Languages (10)
• is aware of the international opportunities for further study and applying for the labor market	Languages (11)
• prepares the application documents in foreign languages necessary for employment	Languages (12)
• linking foreign language learning with lifelong learning	Languages (13)
Arts and social subjects	
• distinguishes between art forms and music genres based on examples	Arts and social subjects (1)
• knows essential works of world and Estonian art and music and connects them with history	Arts and social subjects (2)
• introduces the peculiarities of Estonian art and music and masterpieces	Arts and social subjects (3)
• analyzes its relationship with culture and creativity through direct experience	Arts and social subjects (4)
• uses art and music to improve the quality of life and develop personality	Arts and social subjects (5)
• expresses himself through creative activity	Arts and social subjects (6)
• has adequate self-esteem and knowledge, skills, and attitudes that support the development of a holistic and health-conscious person	Arts and social subjects (7)
• understands the phenomena, processes, and conflicts in society and their connections and interactions	Arts and social subjects (8)
• understands the importance of cultural diversity and democracy and its protection, and the need for sustainable development, accepting differences;	Arts and social subjects (9)
• values universal values such as freedom, human dignity, equality, honesty, caring, tolerance, responsibility, justice, patriotism and respect for oneself, others, and the environment	Arts and social subjects (10)
Selective study modules	
• learning skills development	Working techniques (4)
• computer science	ICT skills (1)
• locksmith work	Implement installations (10)
• general physical education	Natural sciences (11)
• foreign language	Languages (14)
• professional foreign language (Russian)	Languages (15)
• national defense	Working techniques (5)
• work habits	Working techniques (6)
• small business	Working techniques (7)
• participation in the entrepreneurship project	Working techniques (8)
• preparation for the professional examination	Electrical housing technics (9)
• CAD drawing basics	Electrical housing technics (10)
• preparation for state examination in mathematics	Natural sciences (12)
• preparation for the state examination in Estonian	Languages (16)
• application of measuring, working, and cutting tools	Implement of installations (11)
• welding and soldering	Implement of installations (12)

Source: Tartu Kutsehariduskeskus 2019.

Table A.2-2: Skills profile of the electronics technician, Germany

Overview: Skills profile	**in%**	**number of skills in the curriculum**
Informal skills	**34%**	**34**
Interpersonal	3%	6
Communication	10%	18
ICT	6%	10
Formal skills	**81%**	**145**
Implementation of electronic installations	30%	54
Planning of installations	12%	21
Electrical/ energetic housing technics	12%	22
Security/ quality measures	21%	38
Automation processes	/	/
Working techniques	6%	10
in total	**100%**	**179**

Detailed: Skills in the curriculum	**Skills categorization**
Occupational modules	
Carrying out operational and technical communication and information processing	
• apply specialist literature, manuals, operating instructions, or usage instructions in German and English	Electrical housing technics (1)
• apply single-part drawings, assembly drawings, drawings on explosions, and part lists	Electrical housing technics (2)
• read, draw, and apply overview circuit diagrams, circuit plans, wiring, and connection plans	Electrical housing technics (3)
• apply and prepare arrangement and installation plans	Electrical housing technics (4)
• comply with occupation-related national and international regulations, apply technical regulations and standards as well as other technical information	Electrical housing technics (5)
• obtain, assess, select, and reproduce the information in regard to tasks and when reproduced it uses use German and English terminology	Communication (1)
• lead conversations according to the situation, taking different cultural identities into account when communicating	Communication (2)
• present facts in writing and verbally, record the results of discussions in writing and prepare minutes	Communication (3)
• use standard software, in particular communication, word processing, spreadsheet software, as well as drawing programs and planning software	ICT (1)
• back up, maintain, and archive data	ICT (2)
• respect data protection regulations, and copyright	ICT (3)
• use communication devices to transmit data and voice	ICT (4)
Planning and organizing work	
• record, repeat, and evaluate facts and information needed to process orders	Planning of installations (1)
• determine and select assembly and construction components, materials, and operational sources, request them on time, transport, store, and make them available for assembly	Planning of installations (2)
• select, dispose, procure, and provide personal safety equipment, tools, measuring devices, processing machines, and technical facilities	Security/quality measures (1)

•	specify work steps and estimate the required processing time, plan workflows and subtasks under consideration of economic and timely restraints, set priorities in the event of deviations from the plan	Planning of installations (3)
•	plan work tasks in the team	Interpersonal (1)
•	track appointments of meetings, inform customers in case of disruptions in service provision and show possible solutions	Communication (4)
•	document processed material and spare parts as well as working time and project schedule, carry out post-calculations	Planning of installations (4)
•	coordinate planning and order processing with customers and other trades	Interpersonal (2)
•	participate in project planning, in particular for sub-tasks, comply with personal planning, resource planning, time planning, and cost calculations	Interpersonal (3)
•	bring together, check, and evaluate work results and calculate costs of services rendered	Planning of installations (5)
Implementation of quality assurance measures		
•	apply operational quality assurance systems in the own workspace, implement and document quality assurance measures throughout the project	Security/quality measures (2)
•	systematically determine, eliminate and document causes of quality defects	Security/quality measures (3)
•	control achievements as part of an improvement process, in particular, perform a comparison of the target condition and actual condition	Security/quality measures (4)
•	make suggestions to improve workflows	Security/quality measures (5)
Advising and supporting customers		
•	advise customers about services, products, and material	Communication (5)
•	indicate to customers the need for maintenance work and maintenance agreements	Communication (6)
•	inform customers about the dangers of electrical systems and advise them on necessary changes to eliminating hazards	Communication (7)
•	point customers toward safety rules and regulations	Communication (8)
•	offer customers services that go beyond the order	Planning of installations (6)
•	identify customer expectations and needs	Communication (9)
•	advise customers about organizational measures for data security and data storage	ICT (5)
•	advise customers about technological innovations, rational energy spending, economy, and energy efficiency	Communication (10)
•	explain to customers the products and services of the company, demonstrate products, and advise them on product selection	Communication (11)
•	coordinate customer requests with the operational, economic, and legal options, accept order	Planning of installations (7)
•	contribute to the preparation of offers and cost calculations	Planning of installations (8)
•	present and justify possible solutions	Planning of installations (9)
•	advise customers in terms of the technical and economic feasibility of repairs	Communication (12)
•	hand over the system to customers, explain the performance features to them and instruct them on how to use such features, write acceptance reports	Communication (13)
•	indicate warranty claims to customers	Communication (14)
•	review and process complaints	Implement. of installations (1)
•	coordinate training activities with customers and prepare them organizationally	Implement of installations (2)
•	participate in conducting training courses and contribute to monitoring their success	Implement of installations (3)
Check and compliance with data protection and information security concepts		
•	advise customers about privacy and data security concepts, point to safety risks, legal regulations, and requirements, and document the result of consultation	Communication (15)
•	consider and comply with copyrights	ICT (6)
•	integrate technical measures of data security and data safety into technical systems	Security/quality measures (6)
•	check the effectiveness and efficiency of the security measures implemented	Security/quality measures (7)
•	control and evaluate log files, especially in terms of access, actions, and errors	Security/quality measures (8)
Check and evaluate protective measures on electrical systems and devices		
•	observe regulations and safety rules when working on and close to electrical systems and electrical equipment, in particular, consider regulations on accident prevention and the rules of the association for electrical, electronic, and information technologies	Security/quality measures (9)
•	assess spaces regarding their environmental conditions and the additional regulations for rooms of particular use according to building regulations	Security/quality measures (10)

• determine the type of network and the type of earthing system, and define protective measures	Security/quality measures (11)
• assess the protection against direct contact (essential safety) by visual inspection	Security/quality measures (12)
• determine the low resistance of conductors and evaluate the results	Security/quality measures (13)
• control and evaluate the main equipotential bonding, protection, and functional equipotential bonding	Security/quality measures (14)
• determine insulation resistances and assess the results	Security/ quality measures (15)
• determine loop and mains internal resistors and assess the results	Security/quality measures (16)
• control the effectiveness of protective measures in the event of indirect contact (fault protection), in particular by switching off overcurrent protective devices, and control and evaluate the residual current device	Security/quality measures (17)
• document tests and results	Security/quality measures (18)
• check visually and test the function of mechanical and electronic protective devices of movable parts	Security/quality measures (19)
• comply with provisions on preventive fire safety	Security/quality measures (20)
Analyze technical systems	
• capture systems with their system boundaries and system components, as well as interactions between system components	Electrical technics (6)
• record the main and partial functions of systems and their system components	Electrical housing technics (7)
• analyze power and energy flows as well as information flows in technical systems	Electrical housing technics (8)
• identify processes, their input and output variables, in particular, identify the corresponding process steps and technical systems	Electrical housing technics (9)
• analyze processes	Electrical housing technics (10)
• assess architecture, protocols, and interfaces of networks and operating systems	Electrical housing technics (11)
Measuring and analyzing physical characteristics of electrical systems and devices	
• select measuring methods and measuring devices	Electrical housing technics (12)
• calculate, measure, and evaluate electrical quantities	Electrical housing technics (13)
• analyze diagnostic devices and software, check, archive, and document	Electrical housing technics (14)
• control characteristics and the function of components, assemblies, and devices and consider thermal influences	Electrical housing technics (15)
• analyze and evaluate circuits with logic essential functions	Electrical housing technics (16)
• check signals and interfaces	Implement of installations (4)
• control and adjust sensors and actuators, especially for temperature, light, and motion sequences	Implement of installations (5)
• control and evaluate controls and regulations about their function	Electrical housing technics (17)
Analyze and correction of errors as well as maintenance of devices and systems	
• apply systematic correction of errors	Security/quality measures (21)
• repair devices and thereby consider electrical regulations and electromagnetic compatibility	Planning of installations (10)
• carry out and record technical tests	Security/quality measures (22)
Assembling and installing components, assemblies, and devices	
• check the order documents and compare them with local conditions and define demarcations to on-site services	Planning of installations (11)
• assess existing electrical systems, and plan changes	Planning of installations (12)
• determine circuits and protective measures	Planning of installations (13)
• specify cable routes and places for device installations, considering the local circumstances and the electromagnetic compatibility	Planning of installations (14)
• identify hazards from noise, dust, and fibers, especially asbestos, and apply low-emission processes	Implement of installations (6)
• check suitability of the substrate for implementations, prepare anchorages, and adjust and fasten supporting structures and brackets	Implement of installations (7)
• process materials, by sawing, drilling, countersinking, and thread cutting, as well as using connection techniques	Implement of installations (8)
• set up, align, fasten, and secure devices and electrical equipment in the basement and supporting structures	Implement of installations (9)
• assemble slots, housing, and switchgear combinations	Implement of installations (10)
• disassemble assemblies, and assemble and replace defective parts	Implement of installations (11)
• select and install distributors, switches, connectors, and cable-laying systems	Implement of installations (12)
• select and prepare energy, communication, broadband, and high-frequency lines and cables, and process them with different connection technologies	Implement of installations (13)
• wire and commission assemblies and devices	Implement of installations (14)

• install protective devices, fairings, and isolations	Implement of installations (15)
• correct errors and document changes	Security/quality measures (23)
• bring in grounding, lay groundings and potential equalization lines and evaluate lightning protection and assess grounding conditions	Security/quality measures (24)
• install, wire, and label internal lightning and overvoltage protection components, switchgear, and overcurrent protection devices	Security/quality measures (25)
• coordinate work done with other trades and planning, customize building information modeling (BIM)	Interpersonal (4)
Assembling and installing networks	
• assemble cables and connect components	Implement of installations (16)
• select, configure, and adapt standard software and application software dependent on areas of application as well as assess and install compatibility to hardware and system requirements	Implement of installations (17)
• install, commission, and check information transmission systems	Implement of installations (18)
• setting up, adapting, and commissioning assemblies in terms of hardware and software	Implement of installations (19)
• assess architectures, protocols, and interfaces of networks	Implement of installations (20)
• assess the compatibility of hardware components and peripheral devices	Implement of installations (21)
• customize hardware configurations	Implement of installations (22)
Setting up and testing controls and regulations	
• check, parameterize, and adjust sensors and actuators	Implement of installations (23)
• install, wire, and label equipment for controlling, regulating, measuring, and monitoring	Implement of installations (24)
• program, install, and put into operation controls and regulators	Implement of installations (25)

Profession-specific skills, knowledge, and abilities in the field of energy and building technology

Conceptualize energy and building technology systems	
• identify the inventory of the energy and building technology systems as well as their technical interfaces and identify standards	Planning of installations (15)
• assess energy and building technology systems of customers in regard to their functionality and future security, legal regulations, rational use of energy, and profitability	Planning of installations (16)
• determine customer requirements for energy and building technology systems, plan extensions of existing systems, develop and assess alternative solutions	Communication (16)
• plan energy and building technology systems and their automation equipment and select system components	Planning of installations (17)
• plan lightning and surge protection systems	Planning of installations (18)
• plan energy supply, energy conversion, and energy storage systems, also for the use of regenerative energy sources, and choose system components	Planning of installations (19)
• plan backup power supply systems and their cable routing	Planning of installations (20)
• document planned performance	Planning of installations (21)
Installation and commissioning of energy conversion systems and their control devices	
• install lighting systems	Implement of installations (26)
• install charging infrastructure for electromobility	Implement of installations (27)
• install reactive power control systems and filter technology	Implement of installations (28)
• install drive systems, in particular, install electrical machines, connect them mechanically and electrically and put them into operation, and check protection against restart and motor protection	Implement of installations (29)
• install heat generators, water heaters, and related components	Implement of installations (30)
• install and put into operation energy supply, energy conversion, and energy storage systems, also for renewable energy sources	Implement of installations (31)
• apply and install anti-static and over-voltage protection devices	Implement of installations (32)
• install backup power supplies	Implement of installations (33)
• document the work done	Implement of installations (34)
Installation and commissioning of electrical and electronic devices	
• connect communication terminals and communication systems to broadband networks	Implement of installations (35)
• set and document functional and performance characteristics	Implement of installations (36)
• set up electrical consumption devices for households, and businesses, and put them into operation	Implement of installations (37)
Installation and configuration of building system technology	
• install, configure, and parameterize building automation systems	Implement of installations (38)
• install and program small controllers	Implement of installations (39)

• install smoke alarms and alarm systems without external connection	Implement of installations (40)
• test building automation systems, monitor their operation, and detect and eliminate errors	Implement of installations 41)
Installation and test of the antenna and broadband communication equipment	
• evaluate concepts for broadcast and reception systems	Electrical housing technics (18)
• select antenna mounts, antennas, and other resources	Electrical housing technics (19)
• install antennas according to reception conditions and structural conditions and ground and install reception systems	Implement of installations (42)
• install broadband communications equipment	Implement of installations (43)
• control, identify errors, and eliminate errors in antenna and broadband communication systems	Implement of installations (44)
• write test reports	Implement of installations (45)
Carrying out repeated tests by the applicable standards and maintenance of technical building systems	
• limit errors through customer discussions	Communication (17)
• check and assess the performance of systems	Electrical housing technics (20)
• select and use diagnostic systems	Electrical housing technics (21)
• observe electromagnetic compatibility	Electrical/ housing technics (22)
• check networks, and network specific performance measurements	Implement of installations (46)
• repair electrical systems	Implement of installations (47)
• check, configure, and repair measuring, control, and control devices of heating, conditioning, refrigeration, and ventilation systems	Implement of installations (48)
• check and maintain assemblies and devices	Implement of installations (49)
• perform repeated tests, in particular, of electrical safety measures and safety lighting	Implement of installations (50)
• carry out systematic troubleshooting on automated systems	Implement of installations (51)
• carry out visual inspections of firewalls and check line penetrations	Implement of installations (52)
• do maintenance works	Implement of installations (53)
• identify pollutant-containing components and identify devices and dispose them	Implement of installations (54)
Interdisciplinary skills to be taught in an integrative manner	
Structure and organization of the training company, vocational education and training and collective bargaining law	
• explain the legal form and the organizational structure of the training company	Working techniques (1)
• represent essential content and components of the training plan, assess length and ending of the training relationship and know the tasks and describe the tasks of those involved in the dual system	Working techniques (2)
• explain the meaning, function, and content of the training plan, explain the company training plan, and contribute to the implementation	Working techniques (3)
• explain the accounting labor, social and co-determination regulations as well as tariff and working time regulations applicable to the work area	Working techniques (4)
• describe principles, tasks, and working methods of the work constitutional organs of the training company	Working techniques (5)
• name the relationships of the training company and its employees with business organizations, professional associations, and trade unions	Working techniques (6)
• explain positions of one's own pay slip	Working techniques (7)
• explain the contents of labor contracts	Working techniques (8)
• present possibilities for occupational career development and further development	Working techniques (9)
Health and safety protection at work	
• know and apply occupational health and safety regulations and accident prevention regulations	Security/quality measures (26)
• determine risks to safety and health at work, and take measures to avoid danger	Security/quality measures (27)
• explain safe and healthy working techniques	Security/quality measures (28)
• take technical and organizational measures to avoid risks as well as mental and physical stress for oneself and others, also preventively	Security/quality measures (29)
• take into consideration and apply ergonomic working methods	Security/quality measures (30)
• describe behavior in the event of accidents and initiate first measures	Security/quality measures (31)
• apply preventive fire protection regulations, describe behavior in the event of fire, and take fire-fighting measures	Security/quality measures (32)
Environment protection and sustainability	

• recognize opportunities to avoid operational burdens to the environment and society within one’s own responsibilities and contribute to further development	Security/quality measures (33)
• in work processes and about products, goods, or services use materials and energy under consideration of economic, environmental, and social points of view of sustainability	Security/quality measures (34)
• apply applicable regulations on environmental protection for the training company	Security/quality measures (35)
• avoid waste and dispose substances and materials in an environmentally friendly manner	Security/quality measures (36)
• take opportunities for economical and environmentally friendly energy and material usages	Security/quality measures (37)
• work together in compliance with company regulations in terms of economic, ecological, and socially sustainable development and communicate in a way that is appropriate to the addressee	Security/quality measures (38)
Digitalized world of work	
• deal with own and company-related data as well as data from third parties in compliance with regulations on data protection and data security	ICT (7)
• assess risks when using digital media and information technology systems and comply with operational regulations	ICT (8)
• communicate in a resource-saving, addressee-oriented, and efficient manner as well as document the communication results	Communication (18)
• recognize disruptions in communication processes and contribute to their solutions	ICT (9)
• look for information in digital networks, procure it from digital networks, and check, evaluate, and select data from external sources	ICT (10)
• apply learning and working techniques as well as methods of self-directed learning by using digital learning and realize and recognize the requirements of lifelong learning	Working techniques (10)
• plan, perform, and create tasks together with participants, also participants from other operational or business departments by using digital media	Interpersonal (5)
• practice concerning others under the premise of societal diversity	Interpersonal (6)

Source: Bundesgesetzblatt 2021.

Table A.2-3: Skills profile of the logistics assistant, Estonia

Overview: Skills profile	**in%**	**number of skills in the curriculum**
Informal skills	**28%**	**27**
Interpersonal	10%	10
Communication	10%	10
Problem-solving	1%	1
ICT	6%	6
Formal skills	**72%**	**71**
Logistics management	11%	11
Warehousing	5%	5
Inventory	4%	4
Security and quality measures	3%	3
Selling logistics services	4%	4
Working techniques/organization	9%	9
Natural sciences	10%	10
Languages	16%	16
Arts and social subjects	9%	9
in total	**100%**	**98**

Detailed: Skills in the curriculum	**Skills categorization**
Occupational modules	
Basic knowledge of logistics	
• has an overview of the specialization being studied, the structure of the curriculum	Logistics management (1)
• knows the history of logistics and development trends both in Estonia and at the international level	Logistics management (2)
• is aware of the companies operating in the field of logistics and their operating principles	Logistics management (3)
• defines logistical functions and associates different logistics processes to the supply chain	Logistics management (4)
• knows the classification principles of packaging and applies the relationships between them based on efficient use of space	Logistics management (5)
• knows the risks associated with logistics processes and knows how to prevent them	Security and quality measures (1)
• applies the acquired knowledge, skills, and information technology tools	ICT (1)
• solving situational tasks using professional terminology, including in English	Communication (1)
• participates in teamwork and expresses himself orally and in writing understandable and in linguistically correct manner	Interpersonal (1)
Customer Service	
• understands the basics of customer-centric service and information flow management	Communication (2)
• knows the principles of the customer service standard	Communication (3)
• knows the criteria for measuring the level of customer service and their implementation principles	Logistics management (6)
• knows and implements customer advice, complaints, grievances, and principles for resolving conflicts	Problem-solving (1)
• understands the concept of quality and is familiar with the different principles of quality management	Security and quality measures (2)
• applies the acquired knowledge, skills, and information technology tools	ICT (2)
• solving situational tasks using professional terminology, including in English	Communication (4)

• participates in teamwork and expresses himself orally and in writing in an understandable and linguistically correct manner	Interpersonal (2)
Management of warehousing operations	
• knows the classification of warehouses, their functions, and information flow management principles	Warehousing (1)
• knows the legislation regulating warehousing and prepares the necessary documents for warehousing operations as required	Warehousing (2)
• is familiar with the technologies and equipment used in warehousing operations, ensures that the warehouse is clean and tidy	Warehousing (3)
• knows the risks associated with warehousing and determines risk factors	Warehousing (4)
• applies the acquired knowledge, skills and information technology tools	ICT (3)
• solving situational tasks using professional terminology, including in English	Communication (5)
• participates in teamwork and expresses himself orally and in writing in an understandable and linguistically correct manner	Interpersonal (3)
Purchase of logistics services and selling	
• knows the stages of the process of buying and selling logistics services and the options for implementing outsourcing services according to customer needs	Selling logistics services (1)
• uses principles of quality measurement in the provision of logistics services	Selling logistics services (2)
• knows the risks of logistics services and knows how to prevent them	Selling logistics services (3)
• is familiar with the principles of logistics service contracting	Selling logistics services (4)
• applies the acquired knowledge, skills and information technology tools	ICT (4)
• solving situational tasks using professional terminology, including in English	Communication (6)
• participates in teamwork and expresses himself orally and in writing in an understandable and linguistically correct manner	Interpersonal (4)
Transport logistics management	
• knows the principles, development, and field of operation of transport logistics legislation	Logistics management (7)
• explains and draws up the starting points for the choice of modes of transport documentation accompanying transport services	Logistics management (8)
• describes the principles and links in the supply chain for the implementation of transport services	Logistics management (9)
• sets out essential criteria affecting tariffs for transport services	Logistics management (10)
• knows the basics of preparing transport contracts and invoices	Logistics management (11)
• applies the acquired knowledge, skills and information technology tools	ICT (5)
• solving situational tasks using professional terminology, including in English	Communication (7)
• participates in teamwork and expresses himself orally and in writing in an understandable and linguistically correct manner	Interpersonal (5)
Inventory management	
• knows the principles of collecting sales statistics and factors influencing demand and uses data analysis methods	Inventory (1)
• lists and explains the criteria for selecting suppliers	Inventory (2)
• knows the principles of price inquiries	Inventory (3)
• carries out various stock management operations and determines reserve stock levels and optimum purchase quantities	Inventory (4)
• applies the acquired knowledge, skills and information technology tools	ICT (6)
• solving situational tasks using professional terminology, including in English	Communication (8)
• participates in teamwork and expresses himself orally and in writing in an understandable and linguistically correct manner	Interpersonal (6)
Internship	
• is familiar with the organization of the company, the instructions relating to the job in question, and the working environment	Working techniques (1)
• understands the importance of occupational health and safety and the environmental safety	Working techniques (2)
• performs the tasks assigned by the internship supervisor	Interpersonal (7)
• values cooperation and is ready to take responsibility in emergencies	Interpersonal (8)
• carries out various logistical operations, taking account of the liability for damage to property and the environment's general principles	Working techniques (3)
• applies the basic principles of customer-oriented service in the performance of tasks, using different communication methods	Communication (9)
• analyzes himself professionally and documents formalizes, and presents what has been done work properly	Working techniques (4)

Career planning and business fundamentals	
• Understands its responsibility to make informed decisions for life in the career planning process	Working techniques (5)
• Understands the nature of the economy and the functioning of the economic environment	Working techniques (6)
• Make sense to your role in the business environment	Interpersonal (9)
• Understands your rights and responsibilities when working in a work environment	Interpersonal (10)
• Behaves in a way that supports mutual communication	Communication (10)

General study subjects

Natural sciences	
• understands the interrelationships and peculiarities of natural objects and understands the importance of models in describing real objects	Natural sciences (1)
• understands and uses the knowledge acquired in natural sciences to explain and value phenomena in the environment and in solving problems of everyday life	Natural sciences (2)
• understands the impact of scientific and technological achievements on the natural environment and humankind	Natural sciences (3)
• understand the impact of the surrounding environment on human health	Natural sciences (4)
• independently finds reliable scientific information and uses it to solve various tasks	Natural sciences (5)
• uses the learned mathematical knowledge and skills in new situations and in solving vital tasks, analyzing and evaluating the truthfulness of the results	Natural sciences (6)
• uses different sources of information when needed and understands different ways of presenting mathematical information	Natural sciences (7)
• connects mathematics with other subjects and uses their mathematical knowledge and skills in learning them	Natural sciences (8)
• presents their mathematical thoughts logically, expresses their thoughts clearly and precisely both orally and in writing	Natural sciences (9)
• uses the possibilities of mathematics to assess the profitability and sustainability of one's own and others' activities	Natural sciences (10)
Languages	
• expresses himself/ herself clearly, purposefully, and by the norms of general written language in both oral and written communication	Languages (1)
• discusses thematically and reasonably based on the text read, viewed, or listened to	Languages (2)
• compiles different types of texts, using informational and fiction texts as well as other sources as critical sources, critically evaluating them	Languages (3)
• reads and understands unbound texts (table, graph, diagram), evaluates the information presented in them, draws conclusions, and creates new connections	Languages (4)
• values reading, relates what he has read to himself and modern life phenomena, to his homeland	Languages (5)
• communicates independently in everyday language, both spoken and written, in the foreign language they are learning as a language user, presents and protects various views in discussions / communication situations	Languages (6)
• describes in a foreign language oneself, one's abilities and interests, thoughts, intentions and experiences	Languages (7)
• uses foreign language learning appropriate for the development of foreign language skills strategies and sources of information	Languages (8)
• understands the living environment and culture of Estonia and other nations and takes them into account when communicating in a foreign language;	Languages (9)
• is aware of the international opportunities for further study and applying for the labor market	Languages (10)
• prepares the application documents in foreign languages necessary for employment	Languages (11)
• linking foreign language learning with lifelong learning	Languages (12)
Arts and social subjects	
• distinguishes between art forms and music genres on the basis of examples	Arts and social subjects (1)
• Knows essential works of world and Estonian art and music and connects them with history	Arts and social subjects (2)
• analyzes its relationship with culture and creativity through direct experience	Arts and social subjects (3)
• uses art and music to improve the quality of life and develop personality	Arts and social subjects (4)
• expresses himself through creative activity	Arts and social subjects (5)

• has adequate self-esteem and knowledge, skills, and attitudes that support the development of a holistic and health-conscious person	Arts and social subjects (6)
• has an understanding of the phenomena, processes, and conflicts in society and their connections and interactions	Arts and social subjects (7)
• understands the importance of cultural diversity and democracy and its protection, and the need for sustainable development, accepting differences	Arts and social subjects (8)
• values universal values such as freedom, human dignity, equality, honesty, caring, tolerance, responsibility, justice, patriotism, and respect for oneself, others and the environment	Arts and social subjects (9)

Selective study modules

• organizational behavior and management	Working techniques (7)
• commodity education	Security and quality measures (3)
• lifts, maintenance, and operation	Warehousing (5)
• professional English	Languages (13)
• learning skills	Working techniques (8)
• Finnish	Languages (14)
• Finnish language course	Languages (15)
• foundations of entrepreneurship/ creating a student company	Working techniques (9)
• continuing course in Finnish	Languages (16)

Source: Rakvere Ametikool 2017.

Table A.2-4: Skills profile of the logistics assistant, Germany

Overview: Skills profile	**in%**	**number of skills in the curriculum**
Informal skills	**12%**	**8**
Interpersonal	3%	2
Communication	5%	3
ICT	5%	3
Formal skills	**88%**	**58**
Logistics management	36%	24
Warehousing	8%	5
Inventory	/	/
Security and quality measures	23%	15
Selling logistics services	/	/
Working techniques/organization	21%	14
in total	**100%**	**66**

Detailed: Skills in the curriculum	**Skills categorization**
Interdisciplinary skills to be taught in an integrative manner	
Vocational education and training and collective bargaining law	
• explain the importance of the training content, in particular, the conclusion, duration, and termination	Working techniques/organization (1)
• name mutual rights and obligations arising from the training contract	Working techniques/organization (2)
• name essential parts of the employment contract	Working techniques/organization (3)
• regulations of the collective agreements applicable to the training company	Working techniques/organization (4)
• name possibilities of occupational development	Working techniques/organization (5)
Structure and organization of the training company	
• explain the structure and tasks of the training company	Working techniques/organization (6)
• explain the basic functions of the training company, e.g., procurement, production, sales and administration	Working techniques/organization (7)
• name the relationships between the training company and its employees to economic organizations, occupational organizations, occupational bodies, and unions	Working techniques/organization (8)
• describe basics, tasks, and working methods of the co-determination regulations applicable to the work area	Working techniques/organization (9)
Health and safety protection at work	
• determine risks to safety and health at work, and take measures to avoid danger	Security and quality measures (1)
• apply occupational health and safety regulations and accident prevention regulations	Security and quality measures (2)
• describe behavior in case of accidents and initiate first aid measures	Security and quality measures (3)
• apply preventive fire protection regulations, describe behavior in the event of fire, and take fire-fighting measures	Security and quality measures (4)
Environment protection	
To avoid operational environmental pollution, contribute to occupational developments in terms of:	
• explain possible environmental pollution caused by the training company and explain its contribution to environmental protection, along examples	Security and quality measures (5)
• apply applicable regulations on environmental protection for the training company	Security and quality measures (6)
• take opportunities for economical and environmentally friendly energy and material usage	Security and quality measures (7)
• avoid waste, and dispose substances and materials in an environmentally friendly manner	Security and quality measures (8)
Occupational skills	

Work organization, information, and communication	
• put the storage and transport as well as the own work area into the framework of operational processes, derive consequences for one's own actions	Working techniques/organization (10)
• put working orders into working tasks by operational regulations, perform active orders in a customer-oriented manner	Communication (1)
• use operational information and communication systems under consideration of application-related networking as well as data security and data protection	ICT (1)
• apply standard software and workplace-related software	ICT (2)
• use foreign language technical terms, work with formular in foreign languages, communicate in occupation-specific terms	Communication (2)
• consider communication with precedent and succedent working units	Communication (3)
• consider effects of information, communication, and cooperation on the working atmosphere and pay attention to the work performance	Interpersonal (1)
• plan and perform tasks within the team, coordinate and evaluate results	Interpersonal (2)
Goods control and quality assurance measures	
• distinguish and manage goods according to their nature and usage	Security and quality measures (9)
• consider standards, dimensions, quantities, and weight units	Security and quality measures (10)
• apply legal and operational regulations for good-specific storage	Security and quality measures (11)
• manage goods, in particular, dangerous goods, dangerous materials, durable goods, and perishable goods according to their properties and under consideration of markings and symbols	Security and quality measures (12)
• apply legal and operational regulations for the packaging and transport of goods	Logistics management (1)
• make sure that the flow of information and material takes place within logistic processes	Logistics management (2)
• contribute to logistic planning and organizational processes	Logistics management (3)
• consider the interfaces of logistic functions and contribute to an improvement of cooperation at interfaces	ICT (3)
• coordinate and comply with handling tasks in the framework of the logistic concept in their timely and technical structure	Logistics management (4)
• determine deviations in logistic processes and contribute to countering these	Logistics management (5)
• contribute to the improvement of logistical and data-supported processes	Logistics management (6)
• carry out quality assurance measures in the own work department and contribute to the continuous development of work processes	Security and quality measures (13)
• contribute to the processing of complaints	Logistics management (7)
Use of work equipment	
• select and use work equipment for weighing, measuring, and counting	Working techniques/organization (11)
• use work and means resources	Working techniques/organization (12)
• plan the use of work and means resources under consideration of economic and ecologic aspects	Working techniques/organization (13)
• maintain work and means and check their functionality and readiness for use, arrange the elimination of disturbances	Working techniques/organization (14)
Acceptance of goods	
• check accompanying documents under consideration of customs and dangerous goods regulation and according to operational specifications on correctness and completeness	Logistics management (8)
• unload goods	Logistics management (9)
• carry out quantitative and qualitative goods inspections, capture input data, and create error logs	Security and quality measures (14)
• arrange for the elimination of disturbances	Logistics management (10)
• perform and document the return of empties, packaging, and loading aids by legal and operational requirements	Logistics management (11)
• forward goods to the place of destination	Logistics management (12)
Storage of goods	
• mark up and sort goods, create storage, and sales units, as well as prepare goods for storage	Warehousing (1)
• store goods in compliance with warehousing regulations	Warehousing (2)
• perform measures for quality and conservation	Security and quality measures (15)
• control inventories and report discrepancies	Warehousing (3)
• calculate, evaluate, and document critical figures of storage	Warehousing (4)
Commissioning and packaging of goods	

• check order documents and prepare to pick	Logistics management (13)
• remove goods under consideration of principles, document changes in inventory	Warehousing (5)
• disposition of loading and transport aids	Logistics management (14)
• select transport packaging and filling materials regarding the type of goods, type of transport, environmental criteria, and economic profitability	Logistics management (15)
• assemble and pack goods into loading units	Logistics management (16)
• check the compiled shipments and documents in terms of completeness, mark, label and secure transport goods	Logistics management (17)
Shipping of goods	
• prepare shipments for predetermined means of transport ready for loading	Logistics management (18)
• determine weight and space requirements of goods	Logistics management (19)
• prepare loading lists and plans under consideration of loading regulations	Logistics management (20)
• load and stow shipments according to the good's properties and means of transport	Logistics management (21)
• apply securing loads and closure rules	Logistics management (22)
• work with sending documents and accompanying documents, consider foreign trade regulations	Logistics management (23)
• contribute to creating tour plans	Logistics management (24)

Source: Bundesgesetzblatt 2004.

Table A.2-5: Skills profile of the IT specialist, Estonia

Overview: Skills profile	in%	number of skills in the curriculum
Informal skills	**16%**	**22**
Interpersonal	7%	9
Communication	10%	13
Formal skills	**84%**	**113**
Implementation of IT systems	16%	22
Administration of IT systems	10%	14
Technology knowledge	13%	18
Programming	7%	10
Security systems	4%	5
Working techniques	10%	13
Natural sciences	7%	11
Languages	9%	12
Arts and social subjects	7%	9
in total	**100%**	**135**

Detailed: Skills in the curriculum	Skills categorization
Occupational modules	
IT system hardware	
• organizes a workplace for the proper handling of computer hardware	Implement. of IT-systems (1)
• selects components and accessories suitable for computer systems	Implement. of IT-systems (2)
• assembles workstations and servers	Implement. of IT-systems (3)
• installs hardware components and accessories for IT systems	Implement. of IT-systems (4)
• associates the operating principles of IT systems hardware with mathematics and physics	Technology knowledge (1)
• detects non-functioning hardware in the event of hardware failures in IT systems components	Security systems (1)
Windows operating systems administration	
• installs Windows operating systems on mobile devices, workstations, and servers following best practices	Implement. of IT-systems (5)
• configures services for Windows operating systems	Implement. of IT-systems (6)
• uses correct learning skills and English with Windows operating systems	Working techniques (1)
• manages users and Windows installations using the directory service and groups policies specific to Windows operating systems	Implement. of IT-systems (7)
• plans according to the size of the company and the complexity of the IT infrastructure and software solutions	Working techniques (2)
Scripting tools	
• knows the basic level of programming concepts required for scripting	Programming (1)
• describes the primary scripting environments, the languages used for scripting, and the tools	Programming (2)
• produces scripts based on the reusability principle	Programming (3)
• automates repetitive administrative tasks with scripting tools for Linux/BSD and Linux/BSD Windows operating systems	Programming (4)
• automates administrative tasks required for application server management using a scripting API	Programming (5)
• uses basic mathematical and logical concepts in scripting	Programming (6)
Application software	

• recognizes the differences between system and application software using essential office software	Technology knowledge (2)
• participates in teamwork and uses group work software	Interpersonal (1)
• uses appropriate application software to create drawings and sketches	Admin of IT systems (1)
• prepares files with suitable parameters for various output devices	Admin of IT systems (2)
• uses terminology related to application software and expresses themselves as a learner intelligible in English	Admin of IT systems (3)
• communicates in English with user support, uses English language software, and gives instructions for using the software	Communication (1)
Application server management	
• performs database server administration tasks using both the command line and the GUI	Admin of IT systems (4)
• performs database backup and restore operations	Admin of IT systems (5)
• manages web servers and web applications	Admin of IT systems (6)
• performs monitoring and asset management	Admin of IT systems (7)
• uses English application server terminology	Communication (2)
Operating systems	
• explains the need for operating systems and describes their structures, functions, basic concepts, and nature	Technology knowledge (3)
• explains the differences and similarities between types and generations of operating systems using specialist terminology	Technology knowledge (4)
• uses specialist terminology	Technology knowledge (5)
• installs less frequently used operating systems on workstations and servers running systems	Implement. of IT systems (8)
• manages users and workstations of minor operating systems using directory services and central management tools	Admin of IT systems (8)
• uses cloud services to configure and manage mobile devices	Admin of IT systems (9)
• manage mobile device operating systems and their user accounts	Admin of IT systems (10)
• uses correct learning and English operating systems terminology	Communication (3)
BSD operating systems administration	
• installs Linux/BSD on mobile devices, workstations, and server operating systems following best practices	Implement of IT systems (9)
• configures Linux/BSD operating system services	Implement of IT systems (10)
• manages users and Linux/BSD installations using directory services specific to the operating systems and central management tools	Admin of IT systems (11)
• uses central management tools	Admin of IT systems (12)
• plans infrastructure and software solutions to suit the size and complexity of the business	Working techniques (3)
• uses correct educational and English Linux/BSD language of operating systems terminology	Working techniques (4)
Maintenance of information technology infrastructure	
• understands the role of information technology in the achievement of organizational objectives based on the IT strategy and/or process description of the organization	Technology knowledge (6)
• understands the principles of IT infrastructure maintenance management, the nature of a service level agreement, and its impact on their work	Admin of IT systems (13)
• advises end-users on the maintenance of IT infrastructure	Communication (4)
• understands the principles of the procurement process and can participate in the preparation of sales proposals	Working techniques (5)
• prepares a project plan with a simplified structure, using project management IT tools	Working techniques (6)
• complies with the principles of information security and current legislation	Security systems (2)
• uses IT terminology and expresses themself in a comprehensible manner in the language of instruction and in English	Communication (5)
Computer networks and network equipment	
• explains the mathematical and physical foundations and relates them to the used operation of computer networks	Technology knowledge (7)
• installs the components of a local area network (including cables) based on the network principles and network components, based on network installation rules and best practices	Implement of IT systems (11)
• uses learning and communication skills in the field of computer networking in the preparation of documents and communication also by using English terminology appropriately when communicating and using networking terminology	Communication (6)

• configure network connections and equipment as appropriate to the situation and requirements	Implement of IT systems (12)
• takes into account information security requirements in the configuration and planning process based on the given information requirements of the given task and situation	Security systems (3)
• plans the construction and management of computer networks according to the situation and the direction of the network based onthe network mission statement and the price list	Implement of IT systems (13)
Organization and the business environment	
• understands the processes that take place in a multicultural organization, the individual and the general patterns of group behavior and communication	Interpersonal (2)
• relates general developments in the business environment to organizational management	Interpersonal (3)
• follows the principles of self-management based on self-control and role-mapping	Interpersonal (4)
• cooperates and works in teams	Interpersonal (5)
• distinguishes between ethical and unethical behavior and knows the principles of professional ethics	Interpersonal (6)
• respects good customer service practices in dealing with customers	Communication (7)
• prepares the documents necessary for customer communication	Communication (8)
• respects language rules and applicable legal and regulatory requirements in documented standards	Communication (9)
Computer network management and network services	
• understands how network services work and how they relate to the technologies used	Technology knowledge (8)
• plans local area network and Internet load capacity based on network services needs	Implement of IT systems (14)
• plans, installs, and configures network support services (directory services, e-mail, file, print, WWW, video conferencing, SNMP, NTP, VoIP, remote management, service server management) and the minimum basic network services required to configure them, according to the framework conditions and by following the requirements for the services to be provided	Implement of IT systems (15)
• virtualizes at least two alternative technologies based on different technologies	Implement of IT systems (16)
• runs network services based on different alternative physical servers and uses network traffic monitoring by the legislation	Implement of IT systems (17)
• uses correct academic and English language computer network management and control software and network services terminology	Communication (10)
Career planning and business fundamentals	
• understands its responsibility for making informed decisions for life in the career planning process	Working techniques (7)
• understands the nature of the economy and the functioning of the economic environment	Working techniques (8)
• understands their role in the business environment	Working techniques (9)
• understands their rights and responsibilities when working in the work environment	Interpersonal (7)
• behaves in a way that supports mutual communication	Communication (11)
Internship	
• actively participates in finding an internship	Interpersonal (8)
• works as a member of the IT team and the organization	Interpersonal (9)
• installs IT system components and accessories	Implement of IT systems (18)
• detects failing IT system components	Security systems (4)
• uses network traffic monitoring and documentation	Working techniques (10)
• manages and installs workstations and / or servers	Implement of IT systems (19)
• maintains and configures applications and / or application servers	Implement of IT systems (20)
• uses the correct practice terminology to describe what has been done in the work	Communication (12)
• uses the best practices in the field in its work (incl. ITIL framework)	Working techniques (11)

General study subjects

Natural sciences	
• understands the interrelationships and peculiarities of natural objects and understands the importance of models in describing real objects	Natural sciences (1)

• understands and uses the knowledge acquired in natural sciences to explain and value phenomena in the environment and in solving problems of everyday life	Natural sciences (2)
• understands the impact of scientific and technological achievements on the natural environment and humankind	Natural sciences (3)
• understand the impact of the surrounding environment on human health	Natural sciences (4)
• independently finds reliable scientific information and uses it to solve various tasks	Natural sciences (5)
• uses the learned mathematical knowledge and skills in new situations and in solving vital tasks, analyzing and evaluating the truthfulness of the results	Natural sciences (6)
• uses different sources of information when needed and understands different ways of presenting mathematical information	Natural sciences (7)
• connects mathematics with other subjects and uses their mathematical knowledge and skills in learning them	Natural sciences (8)
• presents his / her mathematical thoughts logically, expresses their thoughts clearly and precisely both orally and in writing	Natural sciences (9)
• uses the possibilities of mathematics to assess the profitability and sustainability of one's own and others' activities	Natural sciences (10)
Languages	
• expresses himself/ herself clearly, purposefully, and by the norms of general written language in both oral and written communication	Languages (1)
• discusses thematically and reasonably based on the text read, viewed or listened to	Languages (2)
• compiles different types of texts, using informational and fiction texts as well as other sources as critical sources, critically evaluating them	Languages (3)
• reads and understands unbound texts (table, graph, diagram), evaluates the information presented in them, draws conclusions, and creates new connections	Languages (4)
• values reading, relates what he has read to himself and modern life phenomena, to his homeland	Languages (5)
• communicates independently in everyday language, both spoken and written, in the foreign language their learning as a language user, presents and protects various their views in discussions / communication situations	Languages (6)
• describes in a foreign language oneself, one's abilities and interests, thoughts, intentions and experiences	Languages (7)
• uses foreign language learning appropriate for the development of foreign language skills strategies and sources of information	Languages (8)
• understands the living environment and culture of Estonia and other nations and takes them into account when communicating in a foreign language;	Languages (9)
• is aware of the international opportunities for further study and applying for the labor market	Languages (10)
• prepares the application documents in foreign languages necessary for employment	Languages (11)
• linking foreign language learning with lifelong learning	Languages (12)
Arts and social subjects	
• distinguishes between art forms and music genres on the basis of examples	Arts and social subjects (1)
• knows essential works of world and Estonian art and music and connects them with history	Arts and social subjects (2)
• analyzes its relationship with culture and creativity through direct experience	Arts and social subjects (3)
• uses art and music to improve the quality of life and develop personality	Arts and social subjects (4)
• expresses himself through creative activity	Arts and social subjects (5)
• has adequate self-esteem and knowledge, skills, and attitudes that support the development of a holistic and health-conscious person	Arts and social subjects (6)
• has an understanding of the phenomena, processes and conflicts in society and their connections and interactions	Arts and social subjects (7)
• understands the importance of cultural diversity and democracy and its protection, and the need for sustainable development, accepting differences	Arts and social subjects (8)
• values universal values such as freedom, human dignity, equality, honesty, caring, tolerance, responsibility, justice, patriotism, and respect for oneself, others and the environment	Arts and social subjects (9)

Selective study modules

Monitoring of information systems	
• names information system monitoring tools	Technology knowledge (9)

• can carry out monitoring under the supervision	Admin of IT systems (14)
• describes the standard solutions that can be used during monitoring and in case of failures, advises users on the use of the information system	Technology knowledge (10)
Remote Management of IT systems	
• is aware of different remote management solutions and their use	Technology knowledge (11)
• advises clients on IT issues with remote management tools	Technology knowledge (12)
• resolves standard errors in IT systems using remote management	Security systems (5)
• Customer service	Communication (13)
Virtualization	
• names and describes the most common virtualization platforms	Technology knowledge (13)
• installs and manages various virtualization platforms	Implement of IT systems (21)
automates virtualization-intensive activities	Implement of IT systems (22)
Scripting languages	
• compiles scripts on a reusable basis using best practices	Programming (7)
• automates the installation of Linux/BSD and Windows operating systems	Programming (8)
• uses different scripting languages	Programming (9)
• automates administrative tasks required to manage application servers using different scripting languages	Programming (10)
National defense	
• understands the requirements of military service as a specific field	Working techniques (12)
• has the knowledge, skills, and attitudes necessary for the effective functioning of the defense forces and in the field of national defense	Working techniques (13)
Digital technology	
• understands the nature and differences between analog and digital electronics	Technology knowledge (14)
• can use numerical systems used in digital technology and make conversions	Technology knowledge (15)
• make conversions between different numbering systems and understands the working principle of logic elements and their connection with algebra	Technology knowledge (16)
• can use different microcontroller development boards	Technology knowledge (17)
• understands the working principles and applications of sequential logic circuits in information technology	Technology knowledge (18)

Source: Pärnu Kutsehariduskeskus 2020.

Table A.2-6: Skills profile of the IT specialist, Germany

Overview: Skills profile	in%	number of skills in the curriculum
Informal skills	**19%**	**17**
Interpersonal	3%	3
Communication	1%	9
Problem-solving	4%	1
ICT	10%	4
Formal skills	**81%**	**75**
Implementation of IT systems	15%	14
Administration of IT systems	15%	14
Technology knowledge	8%	7
Programming	5%	5
Security systems	14%	13
Working techniques	24%	22
in total	**100%**	**92**

Detailed: Skills in the curriculum	Skills categorization
Interdisciplinary professional skills	
Planning, preparation, and implementation of working tasks in coordination with custom-specific business and performance processes	
• apply principles and methods of project management	Working techniques (1)
• check order documents and feasibility of the order, in particular with regard to legal, economic and timely requirements, and coordinate the order with operational processes and options	Working techniques (2)
• set schedules and sequence of work steps for your own workspace	Working techniques (3)
• plan and coordinate appointments and monitor these appointments	Working techniques (4)
• analyze problems and define problems as tasks and develop and evaluate alternative solutions	Problem-solving (1)
• use work and organizational resources in a economical and ecological responsible manner taking into account the existing resource and budgetary specifications	Working techniques (5)
• plan and coordinate tasks with the team as well as with internal and external customers	Interpersonal (1)
• collect and evaluate commercially relevant data taking into account the existing resource and budgetary specifications	Working techniques (6)
• reflect on one's own approach and the execution of tasks within the team and contribute to improvement of working processes	Interpersonal (2)
Information and advice of customers	
• compare prices, services, and conditions of competitors as part of the market observation	Working techniques (7)
• determine the needs of customers and differentiate among target groups	Communication (1)
• inform customers in compliance with communication rules and present facts using German and English terminology	Communication (2)
• support marketing and sales activities	Working techniques (8)
• evaluate task-related information sources, also in English, and use them for customer information	Communication (3)
• conduct conversations appropriate to the situation and consult customers taking customer interests into account	Communication (4)
• manage customer relations in compliance with legal regulations and operational principles	Communication (5)
• interpret data and facts, prepare by using multimedia tools and present these using digital tools and under consideration of operational requirements	ICT (1)

Assess marketable IT systems and customer-specific solutions	
• assess marketable IT systems for different areas of application in terms of performance, cost-effectiveness and accessibility	Technology knowledge (1)
• obtain and evaluate offers for IT components, IT products and IT services and compare their specifications and conditions	Implement. of IT systems (1)
• ascertain technological development trends of IT systems and determine their economic, social and professional implications	Technology knowledge (2)
• ascertain changes in fields of applications for IT systems due to technical, economic and social developments	Technology knowledge (3)
Develop, create and maintain IT solutions	
• analyze IT systems for processing operational specialist tasks and conceptualize, configure, test and document them by taking into account license models, copyrights and accessibility	Implement. of IT systems (2)
• differentiate programming languages, in particular procedural and object-oriented programming languages	Programming (1)
• detect, analyze and fix systematical errors	Admin of IT systems (1)
• formulate algorithms and create applications in programming language	Programming (2)
• distinguish database models, organize and save data, and create queries	Admin of IT systems (2)
Perform and document quality assurance measures	
• apply operational quality assurance systems in the own workspace, implement and document quality assurance measures throughout the project	Security systems (1)
• systematically determine, eliminate and document causes of quality defects	Security systems (2)
• control achievements as part of an improvement process, in particular perform a comparison of the target condition and actual condition	Security systems (3)
Implement, integrate and check measures for IT security and for privacy	
• comply with operational requirements and legal regulations for IT security and data protection	Security systems (4)
• analyze security requirements of IT systems and derive, coordinate, implement and evaluate measures for IT security	Security systems (5)
• recognize threat scenarios and assess potential damage, taking into account economic and technical criteria	Technology knowledge (4)
• advise customers with regard to IT security and data protection requirements	Communication (6)
• check the effectiveness and efficiency of the implemented IT security and data protection measures	Security systems (6)
Provision of services and orders	
• document services according to operational and contractual documents	Implement. of IT systems (3)
• coordinate and control the provision of services with customers, taking into account the organizational and timely specifications	Implement. of IT systems (4)
• accompany and support change processes	Implement. of IT systems (5)
• advise customers in the use of products and services	Communication (7)
• hand over orders and documentations to customers and prepare acceptance reports	Communication (8)
• record costs for implemented services and evaluate them in terms of time and of a comparison of the target condition and actual condition	Implement. of IT systems (6)
Operating IT systems	
• differentiate network concepts for different applications	Technology knowledge (5)
• realize data exchange of networked systems	Admin. of IT systems (3)
• analyze availability and probability of failure and propose solutions	Admin. of IT systems (4)
• initiate measures for preventive maintenance and fault avoidance and implement these	Admin. of IT systems (5)
• record and analyze fault reports and take measures to eliminate faults	Admin. of IT systems (6)
• prepare, provide and maintain documentation that is target group specific and barrier-free, in particular technical documentation, and system and user documentation	Admin. of IT systems (7)
Commission storage solutions	
• define and implement security mechanisms, in particular ,access options and rights	Security systems (7)
• integrate storage solutions, in particular, database systems	Implement. of IT systems (7)
Programming of software solutions	
• define program specifications, derive data models and structures from technical requirements, and define interfaces	Programming (3)
• select programming languages and use different programming languages	Programming (4)

• automate subtasks of IT systems	Programming (5)

Profession-specific skills, knowledge and abilities in the field of system integration

Conceptualization and implementation of IT systems	
• conceptualize system solutions according to customer-specific requirements, taking into account security aspects	Implement. of IT systems (8)
• select, install, and configure IT systems	Implement. of IT systems (9)
• evaluate, select IT resources, and integrate them into IT systems	Technology knowledge (6)
• Assess, and solve compatibility problems of IT systems and system components	Technology knowledge (7)
• create test concepts and carry out and document tests	Implement. of IT systems (10)
• plan the handover of systems and coordinate and implement this with the involved organizational units and customers	Implement. of IT systems (11)
• plan and carry out data transfers	Implement. of IT systems (12)
Installation and configuration of networks	
• evaluate and select network protocols and interfaces for different application areas	Impleme t. of IT systems (13)
• select, install, and configure network components	Implement. of IT systems (14)
• implement and document systems for IT security in networks	Security systems (8)
Administration of IT systems	
• create and introduce guidelines for the use of IT systems	Admin of IT systems (8)
• manage license rights and monitor compliance with license regulations	Admin of IT systems (9)
• draft, coordinate, and implement concepts for usage	Admin of IT systems (10)
• evaluate and carry out system updates	Admin of IT systems (11)
• create and implement concepts for data backup and archiving	Security systems (9)
• create and implement concepts for data and system recovery	Admin of IT systems (12)
• monitor system utilization and administer resources	Admin of IT systems (13)
• monitor, evaluate, and take measures on system behavior	Admin of IT-systems (14)
• record, analyze, and resolve user requests	Communication (9)

Interdisciplinary skills to be taught in an integrative manner

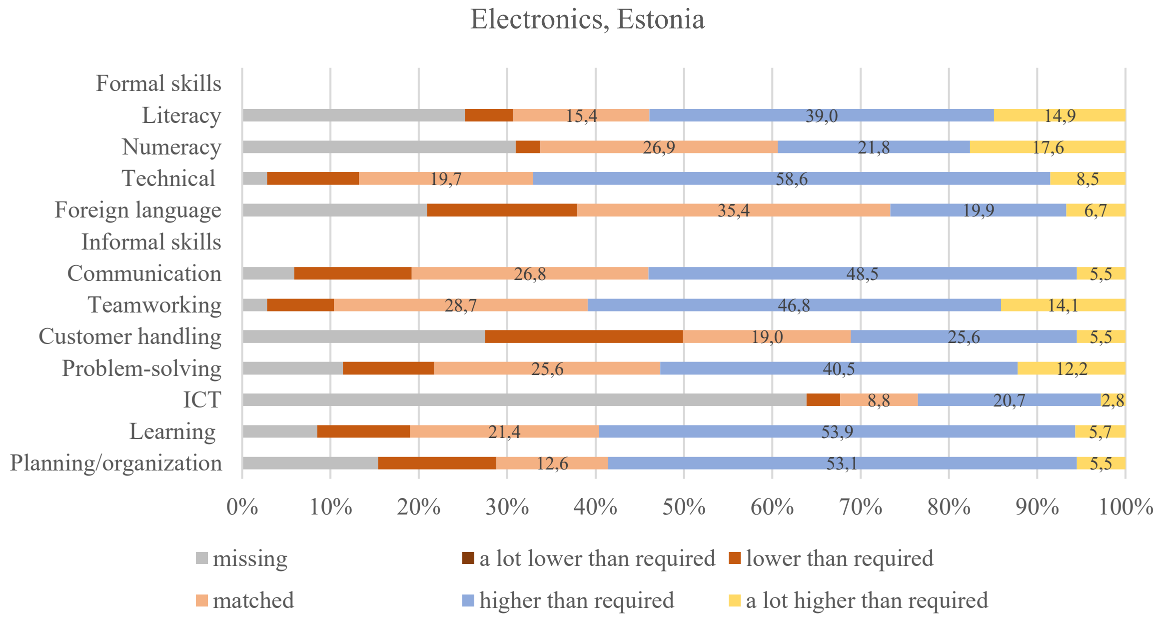
Vocational education and training and collective bargaining law	
• represent essential content and components of the training contract, assess rights and obligations from the training contract and describe the tasks of those involved in the dual system	Working techniques (9)
• compare the company training plan with the training structure	Working techniques (10)
• take into account labor, social and co-determination regulations as well as tariff and working time regulations applicable to the work area	Working techniques (11)
• explain positions of one’s own pay slip	Working techniques (12)
• reason the chances and requirements of lifelong learning for professional and personal development and develop own skills	Working techniques (13)
• apply learning and working techniques as well as methods of self-directed learning and use professionally relevant information	Working techniques (14)
• present possibilities for occupational career development and further development	Working techniques (15)
Structure and organization of the training company	
• explain the legal form and the organizational structure of the training company with its tasks and responsibilities and the relationship between business processes	Working techniques (16)
• name the relationships of the training company and its employees with business organizations, occupational associations and trade unions	Working techniques (17)
• describe principles, tasks, and working methods of the work constitution organs of the training company	Working techniques (18)
Health and safety protection at work	
• determine risks to safety and health at work, and take measures to avoid danger	Security systems (10)
• apply occupational health and safety regulations and accident prevention regulations	Security systems (11)
• describe behavior in case of accidents and initiate first aid measures	Security systems (12)
• apply preventive fire protection regulations, describe behavior in the event of fire, and take fire-fighting measures	Security systems (13)

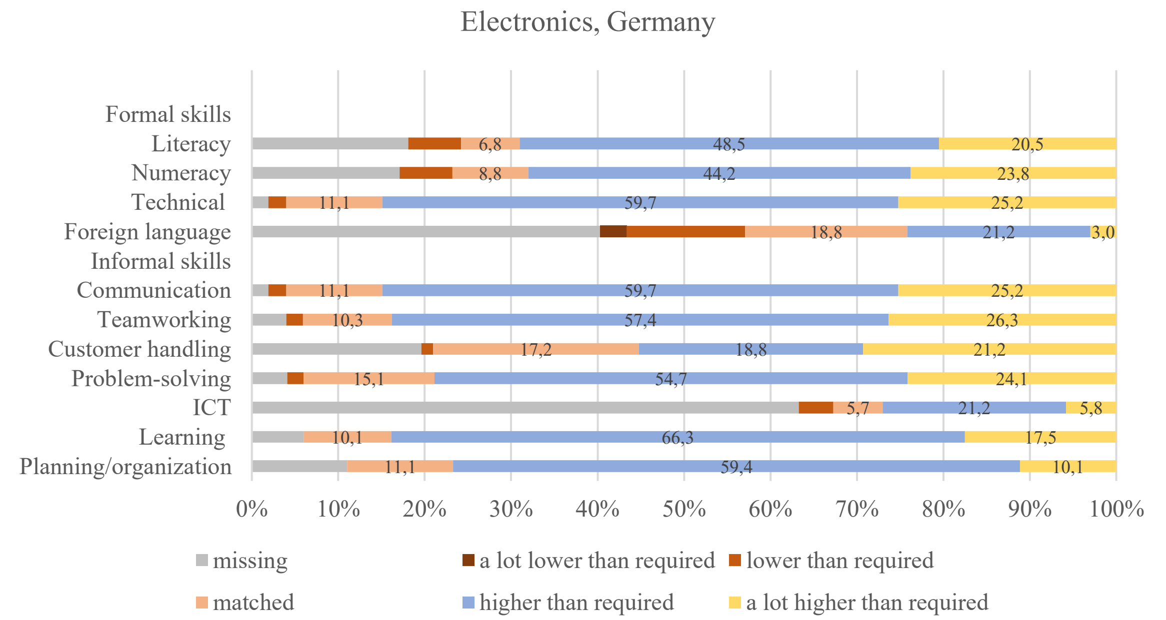
Environment protection	
To avoid operational environmental pollution, contribute to occupational developments in terms of:	
• explain possible environmental pollution caused by the training company and explain its contribution to environmental protection, along examples	Working techniques (19)
• apply applicable regulations on environmental protection for the training company	Working techniques (20)
• take opportunities for economical and environmentally friendly energy and material usages	Working techniques (21)
• avoid waste, and dispose substances and materials in an environmentally friendly manner	Working techniques (22)
Networked collaboration using digital media	
• practice mutual respect in operational processes under consideration of societal diversity	Interpersonal (3)
• apply strategies for dealing responsibly with digital media and operate in virtual environments while respecting the personal rights of third parties	ICT (2)
• consider the consequences of one own's communication and information behavior in particular when storing, displaying and sharing digital content	ICT (3)
• reflect on ethical aspects in the assessment, development, implementation and support of IT solutions	ICT (4)

Source: Bundesgesetzblatt 2020.

Appendix A.3: Workforce Skill Utilization and Changes at Work

Figure A.3-1: Skill utilization in the field of electronics in Estonia and Germany, in%

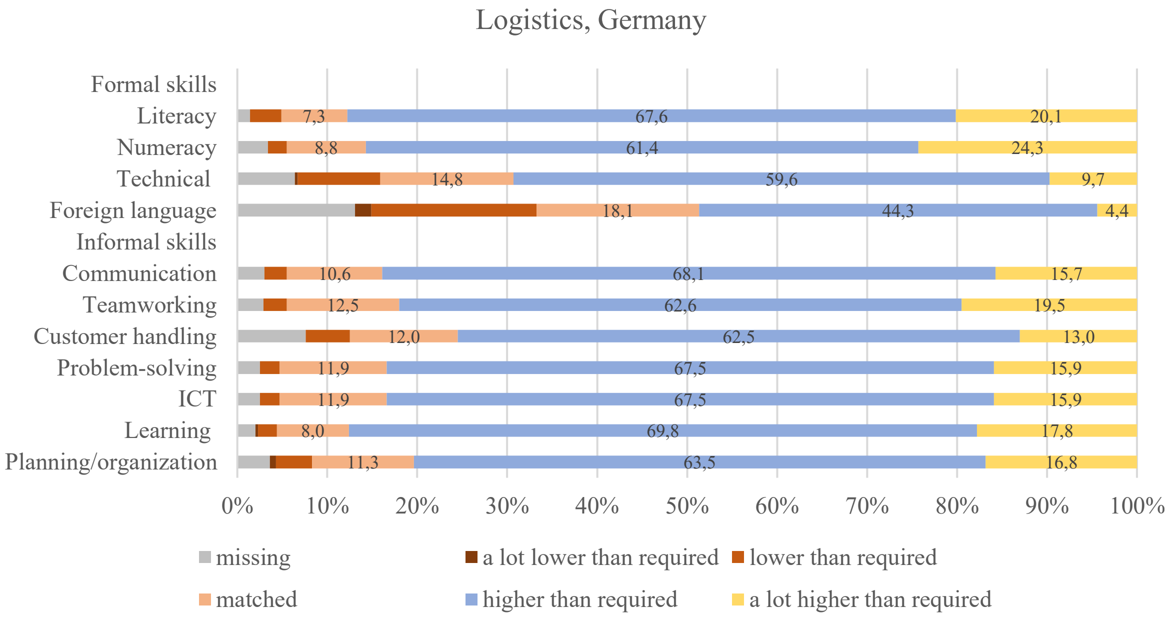




Note: The frequencies in% show what respondents answer to the question “Which of the following best describes your level of skills required for doing your job?” Answers are grouped in: no answer, skills are a lot lower than required, lower than required, matched, higher than required, a lot higher than required.

Cedefop ESJS 2014; EU: N = 752, Estonia: N = 33, Germany: N = 56, author’s calculations.

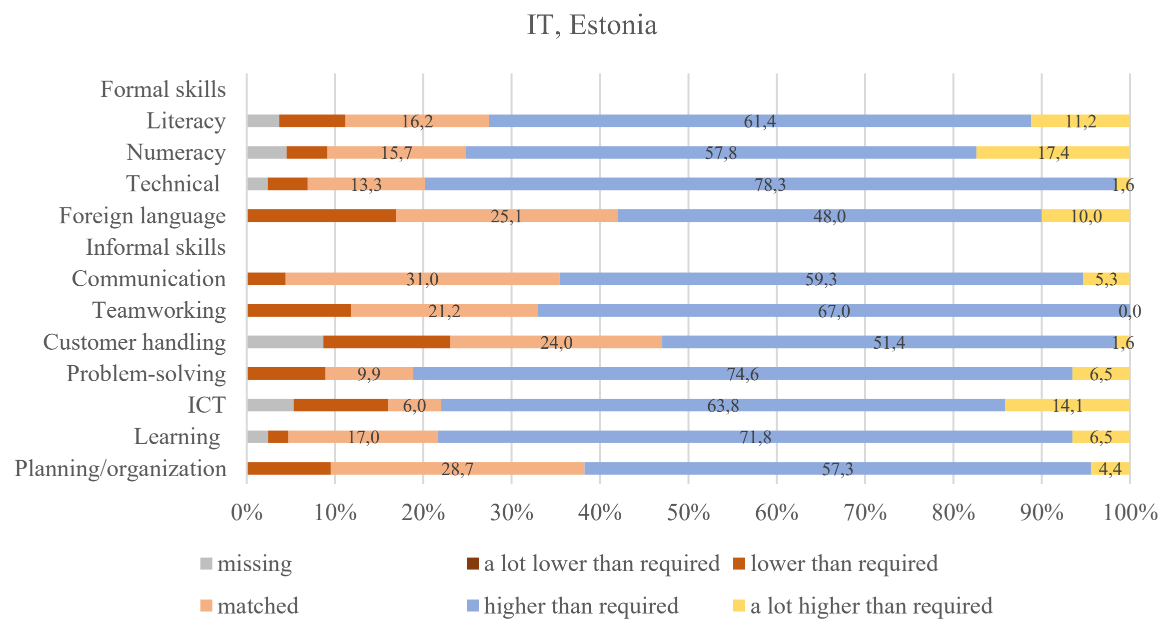
Figure A:3-2: Skill utilization in the field of logistics in Germany, in%

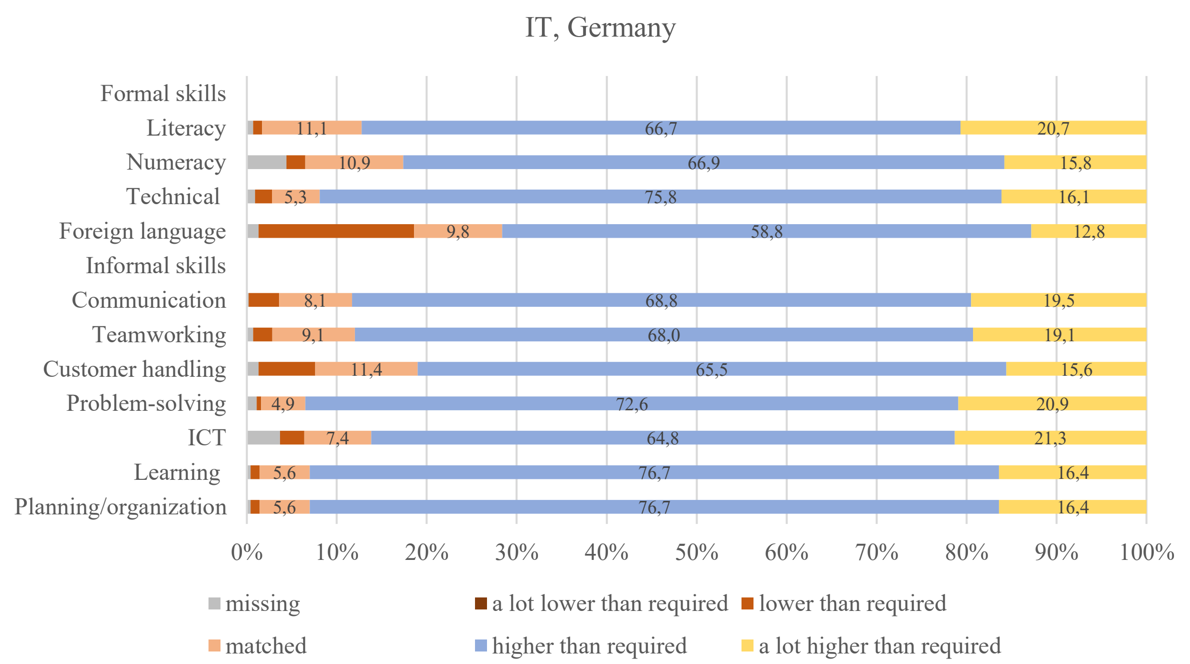


Note: The frequencies in% show what respondents answer to the question “Which of the following best describes your level of skills required for doing your job?” Answers are grouped in: no answer, skills are a lot lower than required, lower than required, matched, higher than required, a lot higher than required.

Source: Cedefop ESJS 2014; Germany: N =287, author’s calculations.

Figure A.3-3: Skill utilization in the field of IT in Estonia and Germany, in%





Note: The frequencies in% show what respondents answer to the question “Which of the following best describes your level of skills required for doing your job?” Answers are grouped in: no answer, skills are a lot lower than required, lower than required, matched, higher than required, a lot higher than required.

Source: Cedefop ESJS 2014; Estonia: N = 40, Germany: N =287, author’s calculations.

Table A.3-1: Workplace changes reported by employees in Estonia and Germany

Workplace changes: Varieties of tasks in %					
	decreased	stayed the same	increased	missing	N
All occupations					
Estonia	1.1	23.2	75.5	0.2	100 (N=988)
Germany	4.1	15.4	80.3	0.2	100 (N=3971)
Electronics					
Estonia	0.0	29.4	70.6	0.0	100 (N=33)
Germany	0.0	18.9	81.1	0.0	100 (N=56)
Logistics					
Estonia	0.0	25.0	75.0	0.0	100 (N=16)
Germany	5.9	13.2	80.8	0.0	100 (N=287)
IT					
Estonia	2.1	16.1	81.8	0.0	100 (N=40)
Germany	3.7	11.2	85.1	0.0	100 (N=286)

Workplace changes: Difficulty of tasks in %					
	decreased	stayed the same	increased	missing	N
All occupations					
Estonia	1.6	26.8	71.3	0.3	100 (N=988)
Germany	3.9	20.3	75.5	0.3	100 (N=3971)
Electronics					
Estonia	0.0	36.1	63.9	0.0	100 (N=33)
Germany	0.0	23.6	76.4	0.0	100 (N=56)
Logistics					
Estonia	0.0	12.8	87.2	0.0	100 (N=16)
Germany	3.9	16.4	79.7	0.0	100 (N=287)
IT					
Estonia	0.0	18.4	81.6	0.0	100 (N=40)
Germany	0.9	13.6	85.5	0.0	100 (N=286)

Workplace changes: The need to learn new things in %					
	decreased	stayed the same	increased	missing	N
All occupations					
Estonia	2.8	23.8	72.9	0.5	100 (N=988)
Germany	4.0	16.2	79.6	0.3	100 (N=3971)
Electronics					
Estonia	0.0	42.2	57.8	0.0	100 (N=33)
Germany	4.3	29.4	66.3	0.0	100 (N=56)
Logistics					
Estonia	0.0	5.5	94.5	0.0	100 (N=16)
Germany	3.9	12.5	83.6	0.0	100 (N=287)
IT					
Estonia	2.3	7.7	90.0	0.0	100 (N=40)
Germany	2.0	12.3	85.7	0.0	100 (N=286)

Note: The frequencies in% show what respondents answer to the question “Have the following increased, decreased or remained the same: The variety of tasks/ Difficulty of tasks/ The need to learn new things”. Answer categories are decreased (values from 0 to 4), stayed the same (value 5), increased (values from 6 to 10).

Source: Cedefop ESJS 2014; author’s calculations.

Table A.3-2: Overskilling in Estonia by gender, age, education, and work experience, in%

My skills are…	Estonia	
higher than required	21.5	
matched	62.9	
lower than required	15	
missing	0.7	
sum	100	N=988

	Gender				Age in years			
	male	female			24-39	40-54	55-65	
My skills are…								
higher than required	51.0	49.0			52.2	32	15.8	
matched	48.8	51.2			33.3	43.7	23	
lower than required	47.6	52.4			51.8	36.1	12.1	
sum	51.9	48.1	100.0		40.4	39.9	19.8	100.0

	Education						
	ISCED 1	ISCED 2	ISCED 3	ISCED 4	ISCED 5	ISCED 6	
My skills are…							
higher than required	5.3	2.8	30.1	13.6	47.8	0.3	
matched	2.6	3.9	34.8	18.7	39.0	0.9	
lower than required	3.7	2.6	31.1	19.8	41.9	1.0	
sum	3.4	3.6	33.3	17.8	41.3	0.8	100.0

	Work experience				
	1 year	2-4 years	5-14 years	> 15 years	
My skills are…					
higher than required	19.5	33.6	35.6	11.3	
matched	17.2	21.7	39.5	21.7	
lower than required	17.5	22.1	41.9	18.6	
sum	17.6	24.5	38.8	19.1	100.0

Note: The frequencies in% show what respondents answer to the question “Overall, how would you best describe your skills in relation to what is required to do your job? Please select one option only”. Answer categories are higher than required, matched, lower than required.

Source: Cedefop ESJS 2014; author’s calculations

Table A.3-2: Overskilling in Estonia by gender, age, education, and work experience, in%

My skills are…		
higher than required	45.1	
matched	50.3	
lower than required	4.0	
missing	0.6	
sum	100	N=3971

	Gender				Age in years			
	male	female			24-39	40-54	55-65	
My skills are…								
higher than required	55.0	45.0			35.1	45.4	19.5	
matched	51.6	48.4			35.3	46.7	18	
lower than required	40.1	60.9			41.7	41.9	16.5	
sum	52.6	47.4	100.0		35.5	45.9	18.6	100.0

	Education						
	ISCED 1	ISCED 2	ISCED 3	ISCED 4	ISCED 5	ISCED 6	
My skills are…							
higher than required	0.5	7.1	42.8	19.8	28.7	1.0	
matched	0.2	6.5	47.3	17.6	27.4	1.0	
lower than required	2.5	12.5	35.7	19.1	29.2	1.1	
sum	0.4	7.0	44.8	18.7	28.1	1.0	100.0

	Work experience				
	1 year	2-4 years	5-14 years	> 15 years	
My skills are…					
higher than required	10.8	23.8	36.5	29.0	
matched	9.0	19.9	39.4	31.7	
lower than required	23.1	13.1	36.4	27.4	
sum	10.4	21.4	37.9	30.3	100.0

Note: The frequencies in% show what respondents answer to the question “Overall, how would you best describe your skills in relation to what is required to do your job? Please select one option only”. Answer categories are higher than required, matched, lower than required.

Source: Cedefop ESJS 2014; author’s calculations

Appendix B: Factorial Survey Experiment

Appendix B.1 Set-up of the Experimental Design

1. Dofile of the factorial survey design

```
*****************************************************************
****Set-up of the factorial survey***
*****************************************************************
clear all
discard
set more off
set rmsg on
cd "C:\Users\pollo\Desktop\PAD\Promotion\Data\Kap 8 Factorial Survey\Fragebogen Gestaltung\Vignettes
Setup"

ssc install dcreate
ssc install fre
net install listtab, from(http://fmwww.bc.edu/RePEc/bocode/l)
*result: installation complete*
*****************************************************************
 /// 1. GENERATION OF THE VIGNETTES
 *****************************************************************
*******************************************
// 1.1 GENERATION OF VIGNETTE UNIVERSE
*******************************************
** Generate variables for the single dimensions of the vignette for the full faktorials for the universe
matrix levmat = 4,4,2,2,2,2
genfact, levels(levmat)
save universe.dta

** Check if the number of cases is correct;
fre x1
*result: vignette universe consists of 256 observations/vignettes

corr x1 - x6
save universe_1, replace
************************************************
// 1.2 ALLOCATION OF VIGNETTES TO DECKS
************************************************
** If you want the respondents to evaluate 8 vignettes you have to create the vignette universe 256/8 = 32 decks
**(questionnaire versions) furthermore, no random sample drawn out of the vignette universe, because a full
**factorial survey is implemented;
** Allocation of vignettes to decks: decision: random allocation to decks. This splits the universe into 32 decks
**into 32 equal sized fractions

gen random=runiform()
sort random
gen nr = _n

xtile deck=nr, nquantiles(32) // splits the universe into 32 decks
lab var deck "vignette deck"
drop nr
save universe_2, replace

**Generate a variable indicating the serial position within the deck
bysort deck: gen vignr = _n
lab var vignr "position of vignette within deck"

** Move all identifiers to the first columns of the data set:
order deck vignr, first
```

```
drop random

** Check again the statistical efficiency of the vignette sample
* and the single decks:
corr x1 - x6
fre x1 - x6
bysort deck: corr x1 - x6
bysort deck: fre x1 - x6

save random32, replace
**************************************************************************
///2 LABELING OF VARIABLES
**************************************************************************
****************************************
// 2.1: LOAD AND PREPARE THE SAMPLE
****************************************
use random32, clear

** Assign each vignette an identifier
gen id_vignette = _n
lab var id_vignette "ID of vignette"
order id_vignette
****************************************
// 2.2 LABELING AND RECODING
****************************************
rename x1 genedu
rename x2 vocedu
rename x3 studyfield
rename x4 interpersonal
rename x5 problemsolving
rename x6 ict

* Labeling of all vignette dimensions
lab var deck "vignette deck"
lab var vignr "position of vignette within deck"
lab var genedu "general educational certificate"
lab var vocedu "vocational educational certificate"
lab var studyfield "field of vocational study program"
lab var interpersonal "interpersonal skills"
lab var problemsolving "problem-solving skills"
lab var ict "ict skills"

lab define genedu 1"above average" 2"average" 3"below average" 4"no certificate"
lab val genedu genedu

lab define vocedu 1"above average" 2"average" 3"below average" 4"no certificate"
lab val vocedu vocedu

lab define studyfield 1"exact" 2"other"
lab val studyfield studyfield

lab define interpersonal 1"einwandfei" 2"bemüht"
lab val interpersonal interpersonal

lab define problemsolving 1"comprehensive" 2"rudimentary"
lab val problemsolving problemsolving

lab define ict 1"comprehensive" 2"rudimentary"
lab val ict ict

save setup32, replace
*********************************************************************
```

```
///3 GENERATION OF VIGNETTE TEXTS
**********************************************************************
*********************************************************************
// 3.1: GENERATE TEXT PHRASES & SENTENCES: GERMAN VERSION
*********************************************************************
use setup32, clear

**** Vignette text****
* First, generate the single text phrases
gen phrase_A1 = "error"
replace phrase_A1 = "Allgemeinbildender Abschluss: über dem Durchschnitt innerhalb dieser Bewerbergruppe"
if genedu ==1
replace phrase_A1 = "Allgemeinbildender Abschluss: im Durchschnitt innerhalb dieser Bewerbergruppe " if
genedu ==2
replace phrase_A1 = "Allgemeinbildender Abschluss: unter dem Durchschnitt innerhalb dieser Bewerbergruppe"
if genedu ==3
replace phrase_A1 = "Allgemeinbildender Abschluss: kein Abschluss" if genedu ==4

gen phrase_B1 = "error"
replace phrase_B1 = "Berufsbildungsabschluss: über dem Durchschnitt innerhalb dieser Bewerbergruppe und" if
vocedu ==1
replace phrase_B1 = "Berufsbildungsabschluss: im Durchschnitt innerhalb dieser Bewerbergruppe und" if
vocedu ==2
replace phrase_B1 = "Berufsbildungsabschluss: unter dem Durchschnitt innerhalb dieser Bewerbergruppe und"
if vocedu ==3
replace phrase_B1 = "Berufsbildungsabschluss: kein Abschluss und" if vocedu ==4

gen phrase_B2 = "error"
replace phrase_B2 = "in zutreffender Fachrichtung" if studyfield ==1
replace phrase_B2 = "in abweichender Fachrichtung" if studyfield ==2

gen phrase_C1 = "error"
replace phrase_C1 = "Im Umgang mit Vorgesetzten und in der Zusammenarbeit mit Mitarbeitern war sein
Verhalten einwandfrei." if interpersonal ==1
replace phrase_C1 = "Im Umgang mit Vorgesetzten und in der Zusammenarbeit mit Mitarbeitern war er um ein
gutes Verhältnis bemüht." if interpersonal ==2

gen phrase_D1 = "error"
replace phrase_D1 = "Problemlösungskompetenz: umfassend" if problemsolving ==1
replace phrase_D1 = "Problemlösungskompetenz: grundlegend" if problemsolving ==2

gen phrase_E1 = "error"
replace phrase_E1 = "Computerkenntnisse, IKT sowie berufsrelevante Programme: umfassend" if ict ==1
replace phrase_E1 = "Computerkenntnisse, IKT sowie berufsrelevante Programme: grundlegend" if ict ==2

*Check if all levels are considered
assert phrase_A1 ~= "error"
assert phrase_B1 ~= "error"
assert phrase_B2 ~= "error"
assert phrase_C1 ~= "error"
assert phrase_D1 ~= "error"
assert phrase_E1 ~= "error"

*Create the sentences: Unipark only allows 5 wildcards; therefore integrate the 6 vignette dimensions into 5

*First tabular listing
gen vigA = phrase_A1

*Second tabular listing
gen vigB = phrase_B1 +" "+ phrase_B2

*Third tabular listing
```

```
gen vigC = phrase_C1

*Fourth tabular listing
gen vigD = phrase_D1

*Fifth tabular listing
gen vigE = phrase_E1

drop phrase_A1 - phrase_E1

save vignettetexts_de.dta, replace
**********************************************************************
// 3.2: GENERATE TEXT PHRASES & SENTENCES: ESTONIAN VERSION
**********************************************************************
use setup32, clear

**** Vignette text****
* First, generate the single text phrases
gen phrase_A1 = "error"
// this is only to have later on an easy possiblity to
// check if all levels were considered!
replace phrase_A1 = "Põhikooli lõputunnistus: alagrupi taseme keskmisest kõrgem" if genedu ==1
replace phrase_A1 = "Põhikooli lõputunnistus: alagrupi taseme keskmine" if genedu ==2
replace phrase_A1 = "Põhikooli lõputunnistus: alagrupi taseme keskmisest madalam" if genedu ==3
replace phrase_A1 = "Põhikooli lõputunnistus: tunnistus puudub" if genedu ==4

gen phrase_B1 = "error"
replace phrase_B1 = "Kutsehariduskooli lõputunnistus: alagrupi taseme keskmisest kõrgem," if vocedu ==1
replace phrase_B1 = "Kutsehariduskooli lõputunnistus: alagrupi taseme keskmine," if vocedu ==2
replace phrase_B1 = "Kutsehariduskooli lõputunnistus: alagrupi taseme keskmisest madalam," if vocedu ==3
replace phrase_B1 = "Kutsehariduskooli lõputunnistus: tunnistus puudub," if vocedu ==4

gen phrase_B2 = "error"
replace phrase_B2 = "nõuetele vastav õppekava" if studyfield ==1
replace phrase_B2 = "muu õppekava" if studyfield ==2

gen phrase_C1 = "error"
replace phrase_C1 = "Kandidaadi viimase praktika hinne (koostöö kolleegi(de)ga ja suhtlus juhendaja(te)ga):
hinne 4" if interpersonal ==1
replace phrase_C1 = "Kandidaadi viimase praktika hinne (koostöö kolleegi(de)ga ja suhtlus juhendaja(te)ga):
hinne 2" if interpersonal ==2

gen phrase_D1 = "error"
replace phrase_D1 = "Probleemide lahendamise oskus: ammendav" if problemsolving ==1
replace phrase_D1 = "Probleemide lahendamise oskus: rahuldav" if problemsolving ==2

gen phrase_E1 = "error"
replace phrase_E1 = "IKT ning professionaalsed pädevused, sh erialaste programmide kasutamine: ammendav"
if ict ==1
replace phrase_E1 = "IKT ning professionaalsed pädevused, sh erialaste programmide kasutamine: rahuldav" if
ict ==2

*Check if all levels are considered
assert phrase_A1 ~= "error"
assert phrase_B1 ~= "error"
assert phrase_B2 ~= "error"
assert phrase_C1 ~= "error"
assert phrase_D1 ~= "error"
assert phrase_E1 ~= "error"

*Create the sentences_ Unipark only allows 5 wildcards; therefore integrate
*the 6 vignette dimensions into 5 "sentences"/wildcards
```

```
*First tabular listing
gen vigA = phrase_A1

*Second tabbular listing
gen vigB = phrase_B1 +" "+ phrase_B2

*Third tabulat listing
gen vigC = phrase_C1

*Fourth tabulat listing
gen vigD = phrase_D1

*Fifth tabulat listing
gen vigE = phrase_E1

drop phrase_A1 - phrase_E1

save vignettetexts_ee.dta, replace
************************************************************
// 4. RANDOM VIGNETTE ORDER & WIDE FORMAT & EXPORT
************************************************************
******************************************
// 4.1: RANDOM ORDER
******************************************
*random vignettes orders within deck

*DE:
use vignettetexts_de.dta, replace
order deck vignr

bys deck: gen random = runiform()
sort deck random
bys deck: replace vignr = _n
list in 1 / 100
corr vignr id_ vignr
drop random

gen id_quest = _n
lab var id_quest "ID of vignette"
drop id_vignette
order id_quest deck vignr, first

gen country = 1
lab define country 1 "Germany"

save vignettes_de_long, replace

// check again your design
fre genedu - ict
corr genedu - ict

*EE:
use vignettetexts_ee.dta, clear
order deck vignr
bys deck: gen random = runiform()
sort deck random

bys deck: replace vignr = _n
list in 1 / 100
corr vignr id_ vignr
drop random
```

```
gen id_quest = _n
lab var id_quest "ID of vignette"
drop id_vignette
order id_quest deck vignr, first

gen country = 2
lab define country 2 "Estonia"

save vignettes_ee_long, replace

// check again your design

fre genedu - ict
corr genedu - ict
****************************************
// 4.2: RESHAPE INTO WIDE FORMAT
****************************************
// Reshape your data to a wide format for their further use
*DE:
use vignettes_de_long.dta, clear
drop id_quest
drop genedu-ict

reshape wide vigA vigB vigC vigD vigE, i(deck) j(vignr)
save vignettes_de_wide.dta
export excel using vignette_de_wide, replace
*EE:
use vignettes_ee_long.dta, clear
drop id_quest
drop genedu-ict
reshape wide vigA vigB vigC vigD vigE, i(deck) j(vignr)
save vignettes_ee_wide.dta
export excel using vignette_ee_wide, replace
****************************************
// 4.3: KEEP SETUP DATA
****************************************
*DE:
use vignettes_de_long.dta
drop vig*
save setup32_de_neu, replace

*EE:
use vignettes_ee_long.dta, clear
drop vig*
save setup32_ee_neu, replace

exit
```

2. Vignette dimensions: Correlations and frequencies

Table B.1.1: Pair-wise correlation of vignette variables (Cramer's V; N = 1056)

		1	2	3	4	5	6
1	General Education	1.000					
2	Vocational Education	-0.030	1.000				
3	Studyfield	-0.004	0.020	1.000			
4	Interpersonal Skills	-0.001	0.004	-0.001	1.000		
5	Problem-solving Skills	-0.012	-0.006	-0.036	0.003	1.000	
6	ICT Skills	0.063	0.032	0.009	-0.022	-0.019	1.000

Table B.1.2: Level balance of vignette variables

			Set-Up		Realized	
			Frequency	%	Frequency	%
1	General Education	1 - above average	64	25.0	259	24.5
		2 - average	64	25.0	266	25.1
		3 - below average	64	25.0	272	25.8
		4 - no certificate	64	25.0	259	24.5
2	Vocational Education	1 - above average	64	25.0	265	25.1
		2 - average	64	25.0	261	24.7
		3 - below average	64	25.0	257	24.3
		4 - no certificate	64	25.0	273	25.9
3	Studyfield	1 - exact	128	50.0	530	50.2
		2 - other	128	50.0	526	49.1
4	Interpersonal Skills	1 - comprehensve	128	50.0	523	49.5
		2 - rudimentary	128	50.0	533	50.5
5	Problem-solving Skills	1 - comprehensve	128	50.0	523	49.5
		2 - rudimentary	128	50.0	533	50.5
6	ICT Skills	1 - comprehensve	128	50.0	523	49.5
		2 - rudimentary	128	50.0	533	50.5
		Vignette Universe	**256**	**100.0**	**1056**	**100.0**

Note: The number of realized vignettes (N=1056) deviates from the total possible vignette universe (N=1376) because of survey drop-outs of the 156 respondents.

3. Full factorial design: Number of answered decks by respondents

The vignette universe consists of 256 vignettes which are attributed by random blocking technique to 32 different decks containing 8 vignettes (see Stata do-file above). Each of the 32 decks is answered by several respondents (Table B-1.3): The random allocation of decks towards respondent within the online survey (via trigger) was successful with the result that each deck is approved between four to six times by different respondents.

Table B.1.3: Number of answered decks

Decks	Frequency	%
1	5	3.21
2	6	3.84
3	6	3.84
4	5	3.21
5	4	2.56
6	5	3.21
7	4	2.56
8	6	3.84
9	6	3.84
10	5	3.21
11	5	3.21
12	4	2.56
13	4	2.56
14	5	3.21
15	5	3.21
16	5	3.21
17	6	3.84
18	4	2.56
19	4	2.56
20	4	2.56
21	4	2.56
22	5	3.21
23	6	3.84
24	6	3.84
25	6	3.84
26	4	2.56
27	4	2.56
28	4	2.56
29	6	3.84
30	5	3.21
31	4	2.56
32	4	2.56
Total	156	100.00

Appendix B.2 Online Questionnaire: Implementation of the Factorial Survey Elements into the Online Questionnaire and Standardized Questionnaire

1. E-mail invitation: Example in the German language version

Beschäftigungsfähigkeit von Absolventen: Einladung zu einer Umfrage Posteingang ×

Sender:
Receiver:

Date

UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Sehr geehrte Name

was weckt Ihr Interesse, wenn Sie Bewerbungen für offene Stellenangebote erhalten? Welche Voraussetzungen sollten Kandidaten erfüllen, um eine Stelle in Ihrem Unternehmen zu erhalten?

Uns interessiert **Ihre Meinung zur Beschäftigungsfähigkeit von Absolventen** von dualen Ausbildungsgängen im technischen Bereich, in den Berufen Elektroniker für Energie und Gebäudetechnik, Fachkraft Lagerlogistik oder Fachinformatiker Systemintegration. Wir, das ist der Fachbereich Soziologie an der Universität Paderborn. Uns treibt schon seit längerem das Thema der Beschäftigungsfähigkeit von Jugendlichen auf dem Arbeitsmarkt um. Mit diesem Projekt wollen wir gezielt Jugendliche als Absolventen der beruflichen Bildung erforschen.

Uns ist bewusst, dass viele Unternehmen gerade vor sehr großen Herausforderungen stehen. Unser Interesse an Ihrer Meinung ist jedoch durch die Krise nicht verloren gegangen. **Wir würden uns sehr freuen, wenn Sie sich kurz Zeit für unsere Umfrage nehmen würden. (Dauer: ca. 10 Minuten).** Als Entgegenkommen verlosen wir unter den Teilnehmenden drei Amazon-Gutscheine im Wert von je 100 Euro.

ZUR UMFRAGE HIER KLICKEN

Hinweis:
Sie müssen aktuell keine offenen Stellenangebote haben, um an der Umfrage teilzunehmen. Wenn Sie denken, ein Kollege oder Kollegin weiß mehr zu diesem Thema, freuen wir uns sehr, wenn Sie diese Mail weiterleiten.
Ihre Kontaktdaten erhielten wir durch eine zufällige Auswahl auf der Grundlage von öffentlich und frei zugänglichen Online-Branchenbucheinträgen. In jedem Fall behandeln wir Ihre Antworten anonym. Ihre Kontaktdaten werden nicht in Zusammenhang mit der Umfrage gebracht.

Für Ihre Teilnahme möchten wir uns im Voraus ganz herzlich bei Ihnen bedanken!
Mit freundlichen Grüßen
Magdalena Polloczek

Universität Paderborn
Fakultät für Humanwissenschaft
Fach Soziologie
Web: www.kw.uni-paderborn.de/fach-soziologie
Mail: magdalena.polloczek@uni-paderborn.de

Subject:
Invitation to a research survey on graduates' employability
Kutse tööalase konkurentsivõime uuringusse

Text elements:
Dear Mr X, Dear Ms Y,
Tere!

We would like to ask you from the company X for support in our survey: Our research project at the University Paderborn, Germany, deals with employability of graduates having completed vocational education and training in the technical field in Estonia. We engage with labour market entrants and are interested in human resource processes for the positions of Sisetööde elektrik, Logistiku abi, IT-süstemiide nooremspetsialist.
Tahaksime teie ettevõttelt X meie uuringus tuge küsida: Otsime täisealisi kutsehariduskoolide tehnoloogia alase koolituse lõpetanuid Paderborni Ülikooli (Saksamaa) tööalase konkurentsivõime uuringusse. Me teadustöö projekt tegeleb tööturule sisenejatega ja on huvitatud järgmiste ametite personaliprotsessidest: sisetööde elektrik, logistik-assistent, IT-süsteemide nooremspetsialist.

You needn't have any job vacancies currently available, to fill out the survey. If you have the feeling that your colleague is more into HR, feel free to forward this mail to him or to her. Feel free to tell what you think – we consider your answers anonymously and comply with the current data protection regulations.
Küsimustiku täitmiseks ei pea teie ettevõttes olema hetkel vabu töökohti. Küsimustiku edastamine sobivatele asjaosalistele on vägagi teretulnud. Uuringu andmeid säilitatakse ja kasutatakse vaid anonüümsel kujul teaduslikel eesmärkidel pidades silmas Euroopa isikuandmete kaitse seaduse sätteid.

We are aware that many companies are currently facing major challenges due to the Corona crisis. However, our interest in your opinion has not decreased. We very warmly welcome you to participate(about 10 minutes)! Your support does not remain without reward! We say thank you by giving you the chance to take part in our raffle – be there and win one of three amazon vouchers worth 100 €.
Oleme teadlikud, et paljud ettevõtted seisavad Corona kriisi tõttu silmitsi suurte probleemidega. Kuid meie huvi teie arvamuse vastu pole vähenenud. Ootame teid südamest osalema - see võtab umbes 10 minutit! Kõigi katses osalejate vahel loosime tänutäheks välja kolm 100 eurost Amazoni kinkekaarti!

Thanks for your help, we appreciate it a lot!
Täname teid panuse eest.

In case of further interest in our research, visit our website https://kw.uni-paderborn.de/fach-soziologie/
Kui soovite uurimuse kohta rohkem teada, külastage veebilehekülge https://kw.uni-paderborn.de/fach-soziologie/.

Yours sincerely
Lugupidamisega,
Magdalena Polloczek
Paderborn University / Paderborni Ülikool
Faculty of Arts and Humanities / Humanitaarteaduste ja kunstide valdkond
Institute of Humanities (Sociology) / Humanitaarteaduste instituut, sotsioloogia suund
Germany / Saksamaa

2. Introduction to the survey: Welcome text in German, English and Estonian

Title:
Befragung zur Beschäftigungsfähigkeit von Absolventen
HR Survey on Graduates' Employability
Inimressursside uuring kutsehariduskoolide lõpetanute tööalase konkurentsivõime kohta

Welcome message:
Herzlich Willkommen! Wir freuen uns über Ihre Teilnahme und weisen Sie darauf hin, dass alle Antworten anonym erfasst werden und ausschließlich für Forschungszwecke erhoben werden (siehe DGSVO weiter unten). Der Aufbau der Befragung erlaubt es Ihnen, zwischen den Fragen hin- und herzugehen und Antworten zu korrigieren. Wenn Sie unterbrochen werden, können Sie zu einem späteren Zeitpunkt zur Befragung zurückkehren – klicken Sie in diesem Fall auf „später fortfahren".
Welcome to our survey! We look forward to your participation and your assessments as experts in the field of personnel recruitment. All questions relate to the employability of applicants who have competed vocational training.
Tere tulemast meie uuringusse! Ootame teie osalust uuringus ja teie hinnanguid personali värbamise valdkonna ekspertidena. Kõik küsimused on seotud kutseõppes osalenud kandidaatide tööalase konkurentsivõimega.

We take data protection seriously and will use the results of the survey for research purposes only (see the remark on the General Data Protection Regulation (GDPR) below).
The set-up allows you to move back and forth when answering our questions while your answers will be kept. Should you get interrupted by any more important event – don't worry! In this case just click on "continue later" and come back whenever it suits you.
Peame andmekaitset oluliseks, mis tõttu kasutame uuringu tulemusi ainult teadustöö eesmärkidel (vt allpool märkust ELi andmekaitse üldmääruse kohta). Uuringu seadistus võimaldab teil küsimustele vastates edasi-tagasi liikuda, salvestades sisestatud vastused. Küsimustiku täitmist on võimalik ka peatada ning selle juurde hiljem tagasi tulla vajutades nuppu "Jätka hiljem".

Description:
Die Beschäftigungsfähigkeit von Absolvent*innen der beruflichen Bildung ist relevant für wirtschaftlichen Erfolg und gesellschaftliche Stabilität. Wir interessieren uns dafür, was Sie als Expert*innen im Gebiet der Personalauswahl hierzu an Erfahrungen und Eindrücken haben.
The topic of graduate employability is relevant to guarantee economic performance and societal stability. That's why we from the University of Paderborn are curious about your opinion on graduates leaving vocational education and training. You are experts in this fields dealing with issues of recruitment and personnel every day. Let's give us the opportunity to learn from your insights!
Lõpetajate tööalase konkurentsivõime teema on oluline majandusliku jõudluse ja ühiskondliku stabiilsuse tagamiseks. Just seetõttu on Paderborni Ülikool huvitatud teie arvamusest kutsehariduskoolide lõpetanute tööturu nõuetele vastavusest. Tegeledes personali värbamise ja probleemidega igapäevaselt, olete antud valdkonna eksperdid, mis tõttu soovime õppida just teie kogemustest ja teadmistest

3. Privacy & data protection policy[11] in German, English and Estonian

German Version: Hinweise zum Datenschutz

Wir, die Universität Paderborn Fachbereich Soziologie arbeiten nach den Vorschriften der Datenschutz-Grundverordnung, des Bundesdatenschutzgesetzes, des nordrheinwestfälischen Datenschutzgesetzes und allen anderen datenschutzrechtlichen Bestimmungen.

Im Rahmen dieser Studie werden Daten zu persönlichen Einstellungen von BewerberInnen erhoben. Darin wird auch nach persönlichen Angaben und organisations-bezogenen Charakteristika des Unternehmens gefragt. Die Interviews werden geschützt aufbewahrt und nur berechtigte Forscherinnen und Forscher erhalten Zugriff auf diese. Die Mitarbeiter, die Zugriff auf diese Daten haben, werden schriftlich zur Einhaltung der datenschutzrechtlichen Bestimmungen verpflichtet. Die Ergebnisse der Interviews werden ausschließlich in anonymisierter Form dargestellt. Das bedeutet: Niemand kann aus den Ergebnissen erkennen, von welcher Person die Angaben gemacht worden sind. Die Veröffentlichung von Forschungsergebnissen in Publikationen oder auf Tagungen erfolgt ebenso anonymisierter Form.

Sie haben jederzeit die Möglichkeit, folgende Rechte geltend zu machen:
Art. 7 Abs. 3 DSGVO: Recht auf Widerruf der Einwilligung: Sie haben das Recht, Ihre Einwilligung jederzeit mit Wirkung für die Zukunft zu widerrufen.

Art. 15 DSGVO: Auskunftsrecht: Sie haben uns gegenüber das Recht, Auskunft darüber zu erhalten, welche Daten wir zu Ihrer Person verarbeiten.

Art. 16 DSGVO: Recht auf Berichtigung: Sollten die Sie betreffenden Daten nicht richtig oder unvollständig sein, so können Sie die Berichtigung unrichtiger oder die Vervollständigung unvollständiger Angaben verlangen.

Art. 17 DSGVO: Recht auf Löschung: Sie können jederzeit die Löschung ihrer Daten verlangen.

Art. 18 DSGVO: Recht auf Einschränkung der Verarbeitung: Sie können die Einschränkung der Verarbeitung der Sie betreffenden personenbezogenen Daten verlangen.

Art. 21 DSGVO: Widerspruchsrecht: Sie können jederzeit gegen die Verarbeitung der Sie betreffenden Daten Widerspruch einlegen.

Art. 77 DSGVO: Recht auf Beschwerde bei einer Aufsichtsbehörde: Wenn Sie der Auffassung sind, dass wir bei der Verarbeitung Ihrer Daten datenschutzrechtliche Vorschriften nicht beachtet haben, können Sie sich mit einer Beschwerde an die zuständige Aufsichtsbehörde wenden, die Ihre Beschwerde prüfen wird.

In jedem Fall gilt: **Ihre Teilnahme an unserer Studie ist freiwillig**. Für die Einhaltung der Datenschutzbestimmungen ist verantwortlich: Universität Paderborn. Ihr Ansprechpartner in datenschutzrechtlichen Fragen: Andreas Fröger. Ihre Ansprechpartnerin bei Rückfragen: Magdalena Polloczek.

Ich erkläre meine Einwilligung damit, dass meine Daten wie in der Informationsschrift beschrieben verwendet werden.

[11] The compilation is based on the European Union General Data Protection Regulation of 2016 (European Parliament, Council of the European Union (2016)) and the recommendations of Paderborn University (Universität Paderborn).

English Version: Privacy and Data Protection Policy

We at the University of Paderborn, Germany, Department of Sociology, work according to the regulations of the European Union Data Protection Basic Regulation, the German Federal Data Protection Act, the Data Protection Act of North Rhine-Westphalia and all other data protection regulations.

Within the framework of this study, data on personal attitudes of applicants will be collected. It also asks for selected personal details and organizational characteristics of the company. The filled interviews are stored in a protected environment and only authorised researchers have access to them. These employees who have access to this data need to sign a document confirming to comply with data protection regulations. The results of the interviews are presented exclusively in anonymised form. This means that no one can tell from the results which person has provided the information. The publication of research results in scientific publications or at scientific conferences is also done in anonymous form.

At any time, you have the possibility to assert the following rights:

Art. 7 Section 3 GDPR: Right to withdraw your consent at any time with effect for the future.

Art 15 GDPR: Right to information: You have the right to obtain from the controller confirmation as to whether or not personal data concerning him or her are being processed, and, where that is the case, has access to the personal data.

Art. 16 GDPR: Right to rectification: If the data concerning you is incorrect or incomplete, you have the right to have incomplete personal data completed, including by means of providing a supplementary statement.

Art. 17 GDPR: Right to erasure ('right to be forgotten'): You can request the deletion of your data at any time and without undue delay.

Art. 18: GDPR: Right to restriction of processing: You have the right to request that the processing of personal data concerning you may be limited.

Art. 21 GDPR: Right to object: You have the right to object, on grounds relating to your particular situation, at any time to processing of personal data concerning you.

Art. 77 GDPR: Right to lodge a complaint with a supervisory authority: If you believe that we have failed to comply with data protection regulations when processing your data, you can lodge a complaint with the relevant supervisory authority, which will investigate your complaint.

In any case: **Your participation in our study is voluntary**. The University of Paderborn, Germany, is responsible for compliance with data protection regulations. Your contact person for data protection issues is Andreas Fröger. Your contact person for all relating questions is Magdalena Polloczek.
I declare my consent to my data being used as described in this information document.

Estonian Version: Privaatsus- ja andmekaitsepoliitika

Meie, Saksamaa Paderborni Ülikooli sotsioloogia osakonnas töötame vastavalt Euroopa Liidu isikuandmete kaitse üldmääruse, Saksamaa Föderaalse ja Nordrhein-Westfaleni andmekaitseseaduse ning kõigi muude kehtivate andmekaitse-eeskirjade sätetele.
Selle uuringu raames kogutakse andmeid taotlejate isiklike hoiakute kohta. Samuti küsitakse valitud isikuandmeid ning ettevõtte organisatsioonilisi omadusi. Täidetud küsitlusi hoitakse kaitstud keskkonnas ja neile pääsevad ligi ainult volitatud teadlased allkirjastades dokumendi andmekaitse-eeskirjade järgimise kohta. Küsitluste tulemused esitatakse eranditult anonüümselt. See tähendab, et tulemusi ei ole võimalik kokku viia teabe edastajaga. Uurimistulemused avaldatakse teaduslikes väljaannetes või teaduskonverentsidel anonüümselt.

Uuringus osalejal on igal ajahetkel võimalik Euroopa Liidu isikuandmete kaitse üldmääruse (ELIKÜM 2016) alusel kasutada järgmisi õigusi:

Andmesubjektil on õigus oma nõusolek igal ajal tagasi võtta. Nõusoleku tagasivõtmine ei mõjuta enne tagasivõtmist nõusoleku alusel toimunud töötlemise seaduslikkust. Andmesubjekti teavitatakse sellest enne nõusoleku andmist. Nõusoleku tagasivõtmine on sama lihtne kui selle andmine. (ELIKÜM art 7 lg 3)

Õigus tutvuda andmetega. Andmesubjektil on õigus saada vastutavalt töötlejalt kinnitust selle kohta, kas teda käsitlevaid isikuandmeid töödeldakse, ning sellisel juhul tutvuda isikuandmetega. (ELIKÜM, art 15 lg 1)

Õigus andmete parandamisele. Andmesubjektil on õigus nõuda, et vastutav töötleja parandaks põhjendamatu viivituseta teda puudutavad ebaõiged isikuandmed. Võttes arvesse andmete töötlemise eesmärke, on andmesubjektil õigus nõuda mittetäielike isikuandmete täiendamist, sealhulgas täiendava õiendi esitamise teel. (ELIKÜM, art 16)

Õigus andmete kustutamisele („õigus olla unustatud“). Andmesubjektil on õigus nõuda, et vastutav töötleja kustutaks põhjendamatu viivituseta teda puudutavad isikuandmed ja vastutav töötleja on kohustatud kustutama isikuandmed põhjendamatu viivituseta. (ELIKÜM, art 17 lg 1)

Õigus isikuandmete töötlemise piiramisele. Andmesubjektil on õigus nõuda vastutavalt töötlejalt isikuandmete töötlemise piiramist. (ELIKÜM, art 18 lg 1)

Õigus esitada vastuväiteid. Andmesubjektil on õigus oma konkreetsest olukorrast lähtudes esitada igal ajal vastuväiteid teda puudutavate isikuandmete töötlemise suhtes. (ELIKÜM, art 21 lg 1)

Õigus esitada järelevalveasutusele kaebus. Ilma et see piiraks muude halduslike või õiguslike kaitsevahendite kohaldamist, on igal andmesubjektil õigus esitada kaebus järelevalveasutusele, eelkõige liikmesriigis, kus on tema alaline elukoht, töökoht või väidetava rikkumise toimumiskoht, kui andmesubjekt on seisukohal, et teda puudutavate isikuandmete töötlemine rikub käesolevat määrust. (ELIKÜM, art 77 lg 1)

Osalemine meie uuringus on vabatahtlik. Andmekaitse-eeskirjade täitmise eest vastutab Saksamaa Paderborni Ülikool. Kontaktisik andmekaitse küsimustes on Andreas Fröger. Kontaktisik kõigis muudes küsimustes on Magdalena Polloczek.

Kinnitan, et nõustun oma andmete kasutamisega käesolevas teatises kirjeldatud viisil.

4. Factorial survey instruction for respondents in German, English and Estonian

Title:
Voraussetzungen geeigneter Bewerber
Requirements of suitable applicants
Nõuded sobivatele kandidaatidele

Description:
In den folgenden Fragen sind wir an Ihrer Einschätzung zu Bewerbern interessiert, die eine duale Ausbildung im technischen Bereich, zum Beispiel als Elektroniker - Energie und Gebäudetechnik, Fachkraft Lagerlogistik, oder zum Fachinformatiker Systemintegration abgeschlossen haben.
We are now interested in your opinion about graduates who finished vocational education in the technical field, for example in the programs electronics technician, logistics assistant or IT specialist.
Meid huvitab teie arvamus tehnikaalase kutsehariduskoolide elektrotehnika, logistik-assistendi või IT-spetsialisti eriala lõpetanute sobivuse kohta tööpostidele.

Stellen Sie sich bitte folgende Situation vor: Sie haben eine offene Ausschreibung für eine Vollzeitstelle (40 Stunden / Woche) und würden gerne einen **Absolventen dieses Berufsbildungsganges** einstellen. Nachdem Sie die Ausschreibung in Ihren üblichen Kanälen beworben haben, erhalten Sie mehrere Bewerbungsschreiben. Die Bewerbungsfrist ist verstrichen und Sie beginnen mit dem Auswahlprozess potenzieller Kandidat*innen anhand der schriftlichen Bewerbungsunterlagen. Die Kandidaten weisen folgende Gemeinsamkeiten auf:
Image you have an open vacancy to fill for the position and would like to hire a graduate from the vocational track. The position (40 working hours per week) is highly suitable for VET-graduates and **you will only consider VET-graduates**. After you've posted the position at your usual channels, you receive several applications. The application deadline has passed, and you got a list of potential candidates. You start your selection process, and sort the application documents.
Kujutlege, et teil on vabanenud täiskohaga tööpost ning soovite sellele palgata vaid kutsekooli lõpetanu. Vaba ametikoha välja kuulutamisel tavapärastel meetoditel laekub teile mitmeid avaldusi. Kandideerimise tähtaja möödudes saate nimekirja potentsiaalsetest kandidaatidest. Alustate avalduste sorteerimist ning valikuprotsessi.

GERMAN VERSION: Alle Bewerber sind **männlich, 19 Jahre alt** und haben die gleiche Schulart besucht: Elektroniker und Fachkraft für Lagerlogistik: Realschule; Fachinformatiker: Gymnasium.
ESTONIAN VERSION: All applicants are **male**, are **19 years old** and graduated from **basic school**.
Kõik kandidaadid on **19-aastased meessoost põhikooli lõpetanud** isikud.

Die Bewerbungsunterlagen sind vollständig und enthalten alle diese Dokumente:
All application documents respond to the requirements and contain the following documents
Kõik taotlusdokumendid vastavad nõuetele ja sisaldavad järgmisi faile:

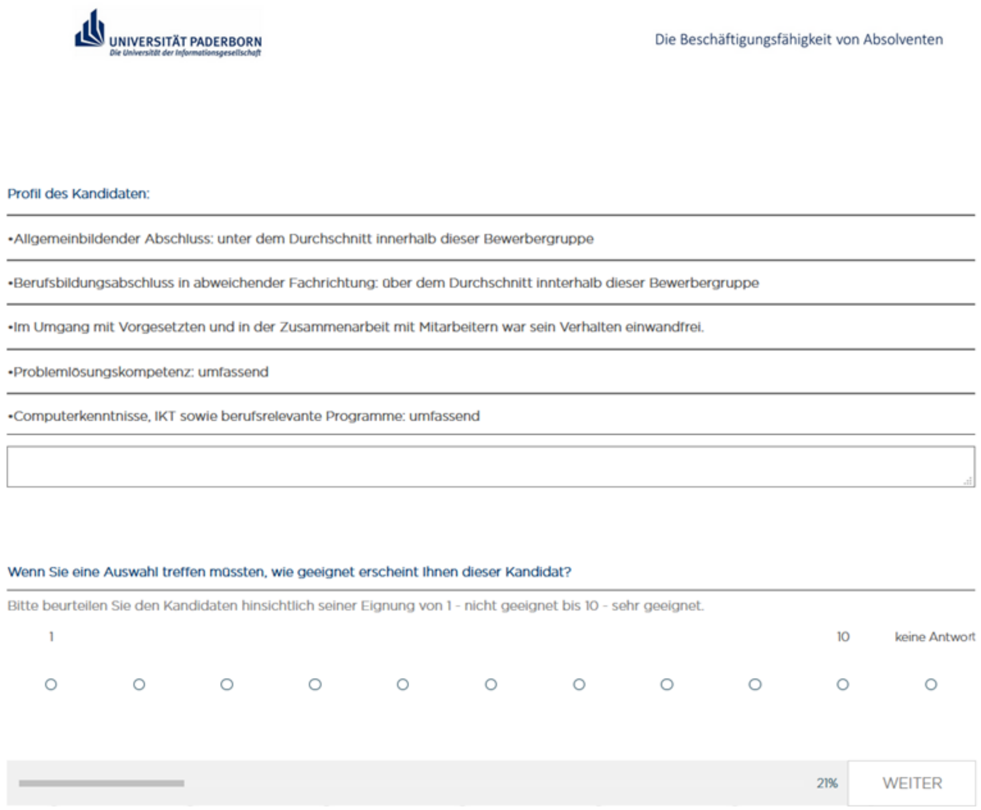
-Anschreiben mit Lebenslauf
-Abschlusszeugnis der Realschule mit Notenangaben
-Abschlusszeugnis der Berufsschule mit Notenangaben
-Qualifiziertes betriebliches Ausbildungszeugnis sowie IHK Zeugnis
-Ergebnisse eines Tests zu Problemlösungs-Kompetenzen
-Cover letter and CV
-School leaving certificate of basic school with remark on grades
-Vocational school certificate and school report with final grades
-Professional certificate and references from companies the students made internships at which hints to field of practice as well as information on interpersonal skills
-Test scores of a test on problem-solving skills
-Kaaskiri ja CV
-Põhikooli lõputunnistus hinnetega
-Kutsekooli lõputunnistus hinnetega

-Kutsetunnistus ja soovituskirjad praktika ettevõtetelt, sisaldades muuhulgas infot tehtud praktika sisu ja praktikandi koostöö oskuste kohta
-Probleemilahendamise oskuste testi tulemused

Wir listen Ihnen nun fiktive Kandidaten in anonymisierter Form auf, mit reduzierten Angaben zum Lebenslauf und zu Eigenschaften. Sie unterscheiden sich ausschließlich in den im folgenden präsentierten Merkmalen.
In the following section we list fictious candidates and present reduced versions of their CVs which are anonymous. The candidates in these presentations only differ by the listed items.
Järgmises osas toome välja kujutletavad kandidaadid ja esitame nende CV-de anonüümsed lühendatud versioonid. Järgnevad kandidaadid erinevad teineteisest vaid välja toodud osade poolest.

5. Vignette presentation in the online factorial survey

Vignette presentation: Example in the German questionnaire


UNIVERSITÄT PADERBORN
Die Universität der Informationsgesellschaft

Die Beschäftigungsfähigkeit von Absolventen

Profil des Kandidaten:

•Allgemeinbildender Abschluss: unter dem Durchschnitt innerhalb dieser Bewerbergruppe

•Berufsbildungsabschluss in abweichender Fachrichtung: über dem Durchschnitt innterhalb dieser Bewerbergruppe

•Im Umgang mit Vorgesetzten und in der Zusammenarbeit mit Mitarbeitern war sein Verhalten einwandfrei.

•Problemlösungskompetenz: umfassend

•Computerkenntnisse, IKT sowie berufsrelevante Programme: umfassend

Wenn Sie eine Auswahl treffen müssten, wie geeignet erscheint Ihnen dieser Kandidat?

Bitte beurteilen Sie den Kandidaten hinsichtlich seiner Eignung von 1 - nicht geeignet bis 10 - sehr geeignet.

1 10 keine Antwort

21% WEITER

6. Vignette Sample: Vignette dimensions and levels in German, English and Estonian

Dimension / Mõõde	**Levels / Tase**			
Allgemeinbildender Abschluss General educational certificate Põhikooli lõputunnistus	über dem Durchschnitt innerhalb dieser Bewerbergruppe; above average within this applicant group; alagrupi taseme keskmisest kõrgem	Durchschnittlich innerhalb dieser Bewerbergruppe; Average within this applicant group; alagrupi taseme keskmine	unter dem Durchschnitt innerhalb dieser Bewerbergruppe; below average within this applicant group; alagrupi taseme keskmisest madalam	kein Abschluss; no certificate; tunnistus puudub
Berufsbildungsabschluss Vocational educational certificate Kutsehariduskooli lõputunnistus	über dem Durchschnitt innerhalb dieser Bewerbergruppe above average within this applicant group; alagrupi taseme keskmisest kõrgem	Durchschnittlich innerhalb dieser Bewerbergruppe; Average within this applicant group; alagrupi taseme keskmine	unter dem Durchschnitt innerhalb dieser Bewerbergruppe; below average within this applicant group; alagrupi taseme keskmisest madalam	kein Abschluss; no certificate; tunnistus puudub
Fachrichtung und Ausbildungsgang Field of study Õppekava	Zutreffend Exact field of study Nõuetele vastav õppekava	Andere Fachrichtung und Ausbildungsgang Other field of study Muu õppekava		
GERMAN VERSION: Im Umgang mit Vorgesetzten und in der Zusammenarbeit mit Mitarbeitern In dealing with supervisors and in cooperation with other employees, ESTONIAN VERSION:	war sein Verhalten einwandfrei. his conduct was impeccable.	war er um ein gutes Verhältnis bemüht. he made every effort to maintain a good relationship.		

The applicant received during his last company-internship the following grade in dealing with supervisors and in cooperation with emplyees: (note: 5 - väga hea 4 - hea 3 – rahuldav 2—puudulik) Kandidaadi viimase praktika hinne (koostöö kolleegi(de)ga ja suhtlus juhendaja(te)ga) (5 - väga hea 4 - hea 3 – rahuldav 2—puudulik)	grade 4 hinne 4	grade 2 hinne 2		
Problemlösungskompetenz Problem-solving skills Probleemide lahendamise oskus	umfassend comprehensive ammendav	grundlegend rudimentary rahuldav		
Computerkenntnisse und berufsrelevante Programme ICT (information and communication technology) skills and professionally relevant programs Info- ja kommunikatsioonitehnoloogia (IKT) ning professionaalsed pädevused, sh erialaste programmide kasutamine	umfassend comprehensive ammendav	grundlegend rudimentary rahuldav		

Answer scale

Question:
Wenn Sie eine Auswahl treffen müssten, wie geeignet erscheint Ihnen der folgende Kandidat?
If you had to make a selection, how suitable does the here shown candidate appear to you?
Kui peaksite andma hinnangu, kui sobilikuks peaksite kandidaati?

Answer scale:
Bitte beurteilen Sie diesen Kandidaten hinsichtlich seiner Eignung auf einer Skala von 1 - nicht geeignet bis 10 - sehr geeignet.
We kindly ask you to evaluate this candidate regarding his suitability from 1 not suitable to 10 very suitable.
Palume teil hinnata neid potentsiaalseid kandidaate vastavalt nende sobivusele välja kuulutatud ametikohale skaalal 1 - mitte sobilik kuni 10 – väga sobilik.

7. Standardized Questionnaire

Page title
Ihre derzeitige berufliche Situation / Your current professional situation / Teie praegune tööhõive

Description:
Im folgenden Abschnitt geht es um Ihren aktuellen Beruf. Wenn Sie mehrere Berufe ausüben, machen Sie bitte Angaben zu dem, in welchem Sie die meisten Stunden beschäftigt sind.
The following section is about your current job. If you have more than one job, please give details of the one in which you work most hours.
Järgmine osa tuleb täita teie praeguse töökoha kohta. Kui teil on rohkem kui üks töökoht, palun kirjeldage seda töökohta, millel töötate kõige suurema koormusega.

Questions:
Q1 Welche Bezeichnung beschreibt Ihren aktuellen Beruf am besten? Bitte markieren Sie das Berufsfeld was Ihrem Beruf am nächsten kommt.[12]
Which of the following describes best your current job? Please mark one of the fields that fits to your occupation.
Milline järgmistest kirjeldab kõige paremini teie praegust töökohta? Palun märkige see väli, mis sobib teie ametiga.

1	Bediener von Anlagen/Maschinen und Montageberufe Plan and Machine Operator and Assembler Seadme- ja masinaoperaatorid ja koostaja	z.B. Bediener stationärer Anlagen, Fahrzeugführer und Bediener mobiler Anlagen e.g. transport machine drivers, plant and machine operators, routine operators (sorter, assembler), train/bus/taxi driver; Nt tootmismasina operaator, mootoripaigaldaja, sõidukikoostaja, rongi-, bussi-, taksojuht, madrus	Antwort Answer Vastus
2	Handwerks- und verwandte Berufe Building, Crafts or a related Trade Person Oskustöötajad ja käsitöölised	z.B. Metallarbeiter, Mechaniker, Elektriker- und Elektroniker, Berufe in der Holzverarbeitung, Nahrungsmittelverarbeitung, Bau- und Ausbaufachkräfte e.g. Electricians, motor mechanics, machine repairers, metal workers, blacksmiths, TV engineers, carpenters, printer, butchers, furniture maker	

[12] Following the ISCO-08 codes, the list corresponds to the ISCO-08 major groups with giving selected examples on occupations (International Labour Office (2012); Züll (2015)). To locate the exact names of the same major groups in the Estonian language, a translation by the OECD was used. (OECD - Organization for Economic Cooperation and Development (2018))

		Nt ehituselektrik, maaler, pillimeister, automehaanik, metallitööline, lihunik, pagar, puusepp, tisler, rätsep	
3	Fachkräfte in Land-/Forstwirtschaft und Fischerei A Skilled Agricultural, Forestry and Fishery Worker Põllumajandus, metsandus, kalandus ja jahindus oskustööline	z.B. Fachkräfte im Ackerbau und Tierhaltung, Fischer, Gärtner e.g. Dairy producer, landscape gardener Nt piimatootja, maastikuaednik	
4	Dienstleistungsberufe und Verkäufer A Sales, Customer or Personal Service Worker Teenindus- ja müügitöötaja	z.B. Verkaufskräfte, Berufe im Bereich personenbezogener Dienstleistungen, Betreuungsberufe, Sicherheitsberufe e.g. Sales Assistant, Retail Cashier, Telesales, Customer Care Occupations Nt giid, juuksur, ettekandja, kokk, poemüüja, kõnekeskuse müüja, lapsehoidja, õpetajaabi, turvatöötaja, päästja, politseinik	
5	Bürokräfte und verwandte Berufe Clerical Support Kontoritöötaja ja klienditeenindaja	z.B. Sekretariat, Bürokräfte im Finanz- und Rechnungswesen, Bürokräfte mit Kundenkontakt e.g. Secretaries, Receptionists, person and Insurance Office Clerks, Office Assistants, Database Assistants, Book-keepers, Wage Clerks, Communication operators, research interviewers Nt sekretär, üldadministraator, andmesisestaja, arveametnik, pangateller, küsitleja	
6	Techniker und gleichrangige nichttechnische Berufe A Technician or Associate Professional	z.B. Ingenieurtechnische Fachkräfte, Produktionsleiter im Bau oder bei der Herstellung von Waren, Techniker in der Prozesssteuerung, Informations- und Kommunikationstechniker, nicht-akademische betriebswirtschaftliche und kaufmännische Fachkräfte e.g. Science, Engineering and IT Technicians; Manufacturing/Construction Supervisors; Finance and Investment Analysts and Advisers; Graphic Designers; Health and Safety Officers	

	Tehnik ja keskastme spetsialist	Nt arvutioperaator, ehitusinspektor, müügiesindaja, tervishoiutöötaja, tööohutuse inspektor, maakler	
7	Akademische Berufe A Professional Tippspetsialist	z.B. Betriebswirte, Akademische und vergleichbare Fachkräfte im Bereich Finanzen, Vertrieb, Marketing oder Öffentlichkeitsarbeit, Fachkräfte in der Informations- und Kommunikationstechnologie, Juristen, Sozialwissenschaftler, Lehrkräfte, Kulturberufe e.g. Professional engineers, Software and IT Professionals, Accountants, Chemists, Scientific Researchers; Architects; Lawyers; Social Workers; Teachers; Journalists Nt insener, tarkvaraarendaja, pearaamatupidaja, keemik, teadlane, arhitekt, jurist, sotsiaaltöötaja, õpetaja, ajakirjanik	
8	Führungskräfte A Manager Juht	z.B. Führungskräfte im Personalwesen, Führungskräfte im kaufmännischen Bereich; Geschäftsführer, Vorstände Chief Executives; Senior Officials; Managing Directors; Senior Business Manager; Senior Production Manager Nt tippjuht, tegevjuht, tegevdirektor, müügijuht, turundusjuht	
9	Hilfsarbeitskräfte Elementary Occupations Lihttööline	z.B. Küchenhelfer, Regelauffüller e.g. Labourers, Packer, Storage Staff; Shelf Fillers; Kitchen/Catering Assistants; Postal Workers. Nt hooneehituse lihttööline, pakkija, kaubaladuja, toitlustuse abitööline, pakikandja	
10	Angehörige der regulären Streitkräfte Employed in Military Capacity by the Armed Forces Sõjaväelane		
11	keiner dieser Bereiche None of the above Muu		

99	keine Antwort No answer Vastus puudub		

Q2 **Haben Sie in Ihrer Tätigkeit Leitungsfunktion?** (Info: Anleitung und Beaufsichtigung von Mitarbeiter*Innen, das kann auch in weniger qualifizierten Berufen der Fall sein)[13]
Does your position include supervisory responsibilities? (Info: Guidance and supervision of employees may also be the case in less qualified professions)
Kas teie ametikoht sisaldab järelevalvekohustusi? (Info: töötajate juhendamine ja juhendamine võib kehtida ka madalama kvalifikatsiooniga kutsealadel)

1 Ja / yes / Jah
2 Nein/ no / Ei
99 keine Antwort / no answer / Vastus puudub

Q3 **Welche Abteilung ist Ihrer Stelle zugeordnet?**
In which department is your position located?
Millisesse osakonda teie töökoht kuulub?

1 Personalabteilung (→q5)
2 Abteilung mit Verantwortlichkeiten zu Personalentscheidungen (→ q5)
3 andere Abteilung (→ q4)
1 HR department
2 department with responsibilities for personnel decisions
3 other department
1 Personaliosakond (→ q5)
2 Muu osakond, mis vastutab personaliotsuste eest (→ q5)
3 Muu osakond (→ q4)

99 no answer / Vastus puudub

Filter: If q3 = 3 then q4 applies
Q4 **Andere Abteilung** / **Work department „other department"**/ **Muu osakond**

Antwort __________ / such as: ______ / Palun täpsusta oma vastust ______
99 eine Antwort / no answer / Vastus puudub

Q5 **Seit wann arbeiten Sie bereits in dieser Stelle im Unternehmen?**
Since when are you working in this position at your company?
Kui kaua oled sellel töökohal töötanud?

In Jahren: ______ / In years: _________ / Alates aastast _______
99 keine Antwort / no answer / Vastus puudub

[13] Following the Labour Force Survey's concept of „supervisory responsibilities" (SUPERVIZOR) which is being asked since 2006 (European Commission and Eurostat (2019).

Q6 Wie lange treffen Sie bereits Personalentscheidungen?
In general, how many years of work experience do you have?
Mitu aastat töökogemust sul on?

1 Jahr
2-5 Jahre
6 Jahre und länger
1Year
2-5 years
6 years and longer
1 aasta
2-5 aastat
6 või rohkem aastat

99 keine Antwort / no answer / Vastus puudub

Page title:
Ihre Einschätzungen zur Beschäftigungsfähigkeit von Absolvent*innen / Your assessment of graduate employability / Teie hinnang kutsekooli lõpetanu tööalasele konkurentsivõimele

Description:
In diesem Abschnitt interessieren uns Ihre Einschätzungen zur Beschäftigungsfähigkeit sowie Ihre Einstellungspraxis von Bewerber*innen und Absolvent*innen der genannten beruflichen Ausbildungsgänge im technischen Bereich.
In this section we are interested in your assessment of graduate employability as well as your hiring practice of applicants having completed the vocational training courses in the technical field mentioned.
Järgnevas osas küsime teie hinnangut ja arvamust kutsekoolide tehnikaalaste õppekavade lõpetanute tööalase konkurentsivõime ning nende töölevõtmise praktikate kohta.

Questions:
Q7 Haben Sie oder hatten Sie vor, einen Absolventen des hier gefragten Ausbildungsganges einzustellen?
Did you ever employ or intend to employ VET graduate of this field at your company?
Olete te oma ettevõttesse kunagi palganud või kaalunud palgata tööle kutsehariduskoolide õpilasi?

1 Ja / yes / Jah
2 Nein / no / Ei
99 eine Antwort / no answer / Vastus puudub

Q8 Haben Sie momentan in Ihrem Unternehmen unbesetzte Stellen für Arbeitsmarkteinsteiger*innen? Seit wann?
In your company, do you have vacant entry positions at the moment? Since when?
Kas teie ettevõttes on hetkel vabu ametikohti? Kui jah, siis mis ajast saati?

1 Ja / yes / Jah (→ q9)
2 Nein / no / Ei (→q10)
99 keine Antwort / no answer / Vastus puudub

Filter: if q8=1 then q9 applies
Q9 Unbesetzte Stelle / **Vacant entry position:** **/Vaba ametikoht**

Seit ____ Monaten /Since ________ (months) / Viimased ___ kuud

99 eine Antwort / no answer / Vastus puudub

Q10 Nach welchen neuen Mitarbeiter*innen halten Sie in der Regel Ausschau, wenn Sie offene Stellen zu besetzen haben?
Which new employees do you usually look for when you have to fill vacancies?
Millise profiiliga kandidaate te tavaliselt töökoha vabanemisel otsite?

1 Absolventen von berufsbildenden Studiengängen
2 Absolventen mit (Fach-)Hochschulabschluss
3 Bewerber mit 1-3-jähriger Berufserfahrung und berufsbildendem Abschluss
4 Bewerber mit 1-3-jähriger Berufserfahrung und Hochschulabschluss
5 Bewerber mit mehr als 3-jähriger Berufserfahrung und berufsbildendem Abschluss
6 Bewerber mit mehr als 3-jähriger Berufserfahrung und Hochschulabschluss
1 Graduates from VET-programs
2 Graduates with a university degree
3 Applicants with work experience of 1-3 years and a vocational degree
4 Applicants with work experience of 1-3 years and an university degree
5Applicants with more than 3 years work experience and vocational degree
6 Applicants with more than 3 years work experience and university degree
1 Kutseharidusega kandidaadid
2 Kõrgharidusega kandidaad
3 1 kuni 3-aastase töökogemusega ja kutseharidusega kandidaadid
4 1 kuni 3-aastase töökogemusega ja kõrgharidusega kandidaadid
5 Rohkem kui 3-aastase töökogemuse ja kutseharidusega kandidaadid
6 Rohkem kui 3-aastase töökogemuse ja kõrgharidusega kandidaadid

Q11 Würden Sie sagen, Ihr Unternehmen hat Schwierigkeiten geeignete Nachwuchskräfte zu finden?
Would you say you have problems to find new graduate employees?
On teil keeruline leida uusi haritud töötajaid?

1 Ja / yes / Jah (→ q12)
2 Nein / no / Ei (→ q13)
99 keine Antwort / no answer / Vastus puudub

Filter: If q11=1 then q12 applies
Q12 Wie häufig kommt diese Situation vor?
Yes, labour shortage:
Tööjõupuudust on esinenud

1 Immer bei Ausschreibungen
2 Regelmäßig in den letzten Jahren
3 Im letzten Jahr
4 Im letzten halben Jahr
5 Manchmal
1 Always
2 Regularly over the last 2 years
3 In the last year
4 In the last 6 months
5 Sometimes
1 Alati
2 Regulaarselt viimase kahe aasta jooksul
3 Viimase aasta jooksul

4 Viimase kuue kuu jooksul
5 Mõnikord

99 eine Antwort / no answer / Vastus puudub

Q13 Haben Sie den Eindruck, Absolvent*innen beruflicher Bildungsgänge, die in Ihrem Unternehmen eingestellt wurden, benötigen weitere Unterstützung und Weiterbildung (abgesehen von der typischen Einarbeitungsphase)?
Do you have the impression that VET-graduates need further training to perform at your company at the job (besides typical introductory phase)?
Kas leiate, et kutsehariduse omandanud vajavad teie ettevõttes töötamiseks täiendkoolitust (lisaks tavalise sissejuhatusele)?

1 Ja / yes / Jah (→ q14)
2 Nein / no / Ei (→ q16)
99 keine Antwort / no answer / Vastus puudub

Filter: If q13=1 then q14 and q15 apply

Q14 Würden Sie sagen, dies ist heute öfter der Fall als ein paar Jahre zuvor?
If yes, would you say this is nowadays more often than a few years ago?
Kui jah, kas teile tundub, et tänapäeval vajavad kutsehariduse omandanud rohkem juhendamist, kui mõned aastad tagasi?

1Ja / yes / Jah
2 Nein / no / Ei
3 Schwierig zu sagen / hard to say / Raske öelda
99 eine Antwort / no answer / Vastus puudub

Q15 Was vermuten Sie, warum ist das so?
And why would you guess is that?
Palun põhjendage oma vastust.

Antwort _________/ Answer:______ / Vastus: ______
99 eine Antwort / no answer / Vastus puudub

Q16 Haben Sie in den letzten 5 Jahren starke Veränderungen in den Aufgaben von Berufsbildungsabsolventen dieses Ausbildungsbereichs in Ihrem Unternehmen beobachtet?
Over the past 5 years, have you observed severe changes in the tasks VET-graduates of this field perform at your company?
Kas olete viimase viie aasta jooksul täheldanud märgatavaid muutusi tööülesannetes, mille kutsehariduskoolide lõpetajad teie ettevõttes täidavad?

1 Ja /yes / Jah (→q17)
2 Nein / no / Ei (→q18)
99 keine Antwort / no answer / Vastus puudub

Filter: If q16=1 then q17 applies

Q17 Welche Veränderungen sind das? (Mehrfachantworten möglich)[14]
What kinds of changes (Please select all that apply)
Palun märkige järgnevatest valikutest, milliseid muutusi olete täheldanud.

1Veränderungen in den von ihnen verwendeten Technologien (z.B. Maschinen, IKT-Systeme)
2 Veränderungen in den Arbeitsmethoden und -praktiken (z.B. wie sie verwaltet werden oder wie sie funktionieren)
3 Veränderungen in den Produkten oder Dienstleistungen, die zur Produktion beitragen
4 Veränderungen der Kontaktmenge mit Partnern oder Kunden (z.B. Umgang mit Kunden-/ Kundenanfragen oder Beschwerden)
1 Changes to the technologies they use (e.g. machinery, ICT systems)
2 Changes to the working methods and practices (e.g. how they are managed or how they work)
3 Changes to the products/services that help to produce
4 Changes to the amount of contact they have with clients or customers (e.g. dealing with customer/client queries or complaints)
1 Muutused kasutatavas tehnoloogias (nt masinad, IKT-süsteemid)
2 Töömeetodite ja tavade muudatused (nt viis, kuidas nad töötavad või kuidas neid hallatakse)
3 Muutused toodetes või tootmist toetavates teenustes
4 Muutused klientidega suhtlemises (nt klientide päringute või kaebustega tegelemine)

99 eine Antwort / no answer / Vastus puudub

Q18 Würden Sie sagen, nicht-formelle Kompetenzen der Bewerber*innen, wie beispielsweise interpersonale Kompetenzen (Teamwork), Problemlösung oder Computer- und Programmkenntnisse, sind wichtige Kriterien der Bewerberauswahl von Berufsbildungsabsolventen?
Would you say informal skills like interpersonal (e.g. teamwork), problem-solving or ICT skills are important criteria to measure performance of VET-graduates?
Kas ütleksite, et mitteformaalsed oskused nagu inimestevahelised oskused (nt meeskonnatöö), probleemide lahendamine või IKT-oskused on kutsehariduskoolide lõpetanute soorituse mõõtmise juures olulised kriteeriumid?

1 Ja / yes / Jah (→q19)
2 Nein / no / Ei (→ q20)
99 Keine Antwort / no answer / Vastus puudub

Filter: If q18=1 then q19 applies
Q19 Bitte bewerten Sie die Wichtigkeit dieser drei nicht-formellen Kriterien und vergeben Sie Rangplätze.
Please rank the three informal criteria depending on personal perception.
Palun järjestage lähtudes oma arvamusest järgnevad kolm mitteformaalset kriteeriumi nende tähtsuse järgi.

Bitte wählen Sie die Zahl 1 für die höchste Platzierung, 2 für Zweitplatzierung, und 3 für den dritten Platz aus.
Please use figure 1 to rank highest, 2 lower and 3 lowest.
Kasutage väärtust 1 kõige kõrgema, 2 madalama ja 3 kõige madalama tähtsusastme määramiseks.

[14] Following the European Skills and Jobs Survey, question 36: "In the last five years have any of these changes taken place in your workplace?". (Cedefop (2015a).

Interpersonale Kompetenzen (bsp. Teamwork)
Problemlösungs-Kompetenzen
Computer- und berufspezifische Programmkenntnisse
Interpersonal skills, e.g. teamwork
Problem-solving skills
ICT and occupation specific skills
Inimestevahelised oskused, nt meeskonnatöö
Probleemide lahendamise oskused
IKT-oskused ning professionaalsed pädevused, sh erialaste programmide kasutamine

Q20 Welche Bedeutung haben für Sie diese nicht-formellen Kompetenzen in der Beurteilung der Beschäftigungsfähigkeit von Beweber*innen?
In recruiting situations, how important are those informal skills for you to decide over a candidate's suitability?
Kui olulisteks peate neid mitteformaalsed oskusi värbamissituatsioonides kandidaadi sobivuse üle otsustamisel?

1 Ich beurteile hauptsächlich diese nicht-formalen Kompetenzen
2 Ich ziehe beide gleichermaßen in Betracht, nicht-formale Kompetenzen und formale
3 Ich beurteile hauptsächlich auf Grundlage formaler Kompetenzen
1 I mainly look at those informal skills only
2 I consider both, informal skills and formal skills like educational certificates
3 I mainly look at formal skills like educational certificates
1 Vaatan peamiselt ainult neid mitteformaalseid oskusi
2 Pean oluliseks nii mitte-formaalseid kui ka formaalseid oskusi nagu tunnistused
3 Vaatlen peamiselt formaalseid oskusi nagu tunnistused

99 keine Antwort / no answer / Vastus puudub

Page title:
Ihr Unternehmen / Your company /Teie ettevõte

Description:
Wir bitten Sie nun um ein paar grundlegende Angaben zum Unternehmen, in welchem Sie arbeiten.
We would now be interested in some details about your company you work in.
Järgnevas osas palume täpsustavaid detaile teie ettevõtte kohta.

Questions:
Q21 Wie viele Mitarbeiter sind am Standort Ihres Unternehmens angestellt?[15]
Approximately, how many people are employed in the local unit of company you work in?
Kui suur on teie ettevõte ligikaudselt?

1 bis zu 10 Mitarbeiter*innen
2 11 bis 19 Mitarbeiter*innen
3 20 bis 49 Mitarbeiter*innen
4 über 50 Mitarbeiter*innen
5 Weiß ich nicht genau, aber weniger als 11 Mitarbeiter*innen
6 Weiß ich nicht genau, aber mehr als 10 Mitarbeiter*innen
1 Up to 10 people

[15] Following the Labour Force Survey's concept of „number of persons working at the unit" (SIZEFIRM). (European Commission and Eurostat (2019))

2 11 to 19 people
3 20 to 49 people
4 50 persons or more
5 Don’t know but less than 11 oersons
6 Don’t know but more than 10 persons
1 Kuni 10 töötajat
2 11 kuni 19 töötajat
3 20 kuni 49 töötajat
4 50 või rohkem töötajat
5 Ei tea, kuid usun, et vähem kui 11 töötajat
6 Ei tea, kuid usun, et rohkem kui 10 töötajat

99 eine Antwort / no answer / Vastus puudub

Q22 In welchem Bundesland liegt das Unternehmen?[16]
In which county is the company located?
Kus teie ettevõte asub?

German Version
1 Baden-Württemberg
2 Bayern
3 Berlin
4 Brandenburg
5 Bremen
6 Hamburg
7 Hessen
8 Mecklenburg-Vorpommern
9 Niedersachsen
10 Nordrhein-Westfalen
11 Rheinland-Pfalz
12 Saarland
13 Sachsen
14 Sachsen-Anhalt
15 Schleswig-Holstein
16 Thüringen
99 keine Antwort

Estonian Version
1 Põhja-Eesti (Harju County)
2 Lääne-Eesti (Hiiu County, Lääne County, Pärnu County, Saare County)
3 Kesk-Eesti (Järva County, Lääne-Viru County, Rapla County)
4 Kirde-Eesti (Ida-Viru County)
5 Lõuna-Eesti (Jõgeva County, Põlva County, Tartu County, Valga County, Viljandi County, Võru County)
99 Vastus puudub

Q23 Welche der folgenden Beschreibungen passt am besten zur Organisationsform des Unternehmens in dem Sie arbeiten?[17]

[16] The categorization of provinces is based on NUTS, the European Union Nomenclature of Territorial Units for Statistics. It was developed by Eurostat and also used e.g. by the LFS. (Eurostat (1998-2020).
[17] Following the European Skills and Jobs Survey, question 5 “Which of the following best describes the type of organization you currently work for?”. (Cedefop (2015a).

Which of the following best describes the type of organization your work for?
Milline järgnevatest kirjeldab kõige paremini ettevõtet, kus töötate?

1 Ein privates Unternehmen
2 Eine nationale, regionale oder lokale Organisation des öffentlichen Sektors.
3 Eine gemeinnützige Stiftung, Wohltätigkeitsorganisation oder Nichtregierungsorganisation.
4 Eine andere Art von Organisation
1 A private company or partnership
2 A national, regional or local public sector organization
3 A not-for profit trust, charity or non-Governmental organization
4 Another type of organisation
1 Osaühing või aktsiaselts
2 Riiklik, regionaal või kohalik avaliku sektori organisatsioon
3 Mittetulunduslik ühing, heategevusorganisatsioon või vabaühendus
4 Muu

99 eine Antwort / no answer / Vastus puudub

Q24 Was ist die Haupttätigkeit Ihres Unternehmens (am Standort an welchem Sie arbeiten)?[18]
Info: Wenn ein Unternehmen mehrere Standorte hat, geben Sie bitte den Tätigkeitsbereich der lokalen Einheit an in welcher Sie arbeiten, und nicht vom ganzen Unternehmen.
What is the main activity carried out by your (local unit) of your company you work in?
Info: If an enterprise has several locations, please indicate the branch of activity of the local unit, not of the whole enterprise.
Milline on teie ettevõtte peamine tegevusvaldkond?
Märkus: Kui ettevõttel on mitmeid üksuseid, palun märkige oma kohaliku üksuse peamine tegevusvaldkond.

1 Öffentliche Verwaltung, Verteidigung, Sozialversicherung
2 Land- und Forstwirtschaft, Fischerei
3 Bergbau und Gewinnung von Steinen und Erden
4 Wasserversorgung; Abwasser- und Abfallentsorgung und Beseitigung von Umweltverschmutzungen; Energieversorgung
5 Verarbeitendes Gewerbe, Herstellung von Waren
6 Baugewerbe, Bau
7 Handel, Instandhaltung und Reparatur von Kraftfahrzeugen
8 Gastgewerbe/Beherbergung und Gastronomie
9 Verkehr und Lagerei
10 Information und Kommunikation
11 Erbringung von Finanz- und Versicherungsdienstleistungen
12 Erbringung von freiberuflichen, wissenschaftlichen und technischen Dienstleistungen
13 Erziehung und Unterricht, Gesundheits- und Sozialwesen
14 Kunst, Unterhaltung und Erholung
15 Erbringung sozialer und persönlicher oder sonstiger Dienstleistungen
16 etwas anderes
1 Administration and support services, including public administration and defence
2 Agriculture, horticulture, forestry or fishing

[18] The answer categories belonging to this question refer to NACE Rev.2 which is the Statistical Classification of Economic Activities in the European Community (Eurostat (o.J.) For the Estonian titles of economic sectors, the EMTAK 2008 - The Estonian Classification of Economic Activities 2008 is used. It is based on the NACE Rev.2 System, and therefore comparable to the European Union NACE Rev. 2 categorization, and thus to the German titles.

3 Supply of gas or electricity, mining or quarrying
4 Supply, management or treatment of water or steam
5 Manufacturing or engineering
6 Construction or building
7 Retail, sales, shop work or wholesale
8 Accommodation, catering or food services
9 Transportation or storage
10 Information technology or communication services
11 Financial, insurance, or real estate services
12 Professional, scientific or technical services
13 Services relating to education or health
14 Cultural industries (arts, entertainment or recreation)
15 Social and personal services
16 Something else
1 Haldus- ja abitegevused, sh avalik haldus ja riigikaitse
2 Põllumajandus, aiandus, metsandus või kalandus
3 Elektrienergia, gaasi, auru ja konditsioneeritud õhuga varustamine
4 Veevarustus; kanalisatsioon, jäätme- ja saastekäitlus
5 Tootmine või töötlev tööstus
6 Ehitus
7 Hulgi- ja jaekaubandus
8 Majutus ja toitlustus
9 Veondus ja laondus
10 Info ja side
11 Finants-, kindlustus- või kinnisvaraalanetegevus
12 Kutse-, teadus- ja tehnikaalane tegevus
13 Haridus
14 Kunst, meelelahutus ja vaba aeg
15 Tervishoid ja sotsiaalhoolekanne
16 Muu

99 keine Antwort / no answer / Vastus puudub

Page title:
Ihre Berufsbiographie / Your professional biography / Teie professionaalne profiil

Description:
Wir kommen nun zu Fragen über Ihre Berufsbiographie und Ausbildung.
We now come to questions about your professional biography and education.
Järgnevas osas küsime teie professionaalse kogemuse ja haridustee kohta.

Questions:
Q25 Welchen höchsten Bildungsabschluss haben Sie erreicht?[19]

[19] Q25 queries educational attainment classified as ISCED-A 2011 levels (Unesco (2020)). ISCED, the International Standard Classification of Education, maps information on national education systems and their degrees on an internationally comparative scale, and is in the European Union a widely used classification scheme for education. The answer scales used here correspond to the official German and Estonian mappings.

What is the highest level of education or training you have obtained?
Milline on teie kõrgeim omandatud haridustase?

German Version:

1 kein Schulabschluss
2 Abschluss der Grundschule (Primarbereich) (ISCED1)
3 Abschluss der Sekundarstufe I bspw. Hauptschulabschluss, Realschulabschluss, Integrierte Gesamtschule (ISCED2)
4 Abschluss der Sekundarstufe II, bspw. Gymnasium/Gesamtschule in der Oberstufe mit Abschluss der Hochschulreife, Abschluss der Fachoberschule oder Berufsfachschule mit Fachhochschulreife, oder Abschluss der Berufsschule (ISCED3)
5 Abschluss des Postsekundären nicht-tertiären Bereichs, bspw. Abendgymnasium, Kolleg, Berufsoberschule, Technische Oberschule, Zweitausbildung an Berufs(fach)schule, 2-jährige Berufsfachschulen im Gesundheitswesen (ISCED4)
6 Meisterausbildung (ISCED 5)
7 Hochschule: Bachelor oder gleichwertiges Bildungsprogramm (ISCED 6), bspw. Bachelor an Universitäten, Fachhochschulen, Dualen Hochschulen, Diplomstudiengang FH
8 Hochschule: Master oder gleichwertiges Bildungsprogramm (ISCED 7), bspw. Master an Universitäten und Fachhochschulen, Diplom an Universitäten
9 Promotion (ISCED 8)
1 No completed education
2 Primary education (ISCED 1)
3 Lower secondary education (ISCED 2)
4 Upper secondary education (e.g. professional secondary education based on basic education) (ISCED 3
5 Post-secondary including pre-vocational or vocational education but not tertiary (ISCED 4)
6 Short-Cycle tertiary education (e.g. professional secondary education based on secondary education) (ISCED 5)
7 Tertiary education – first level, Bachelor’s degree or equivalent (ISCED 6)
8 Tertiary education – advanced level, Master’s degree or equivalent (ISCED 7)
9 Doctoral level or equivalent (ISCED 8)

Estonian Version[20]

1 Haridus on omandamata
2 Algharidus (ISCED 1)
3 Põhiharidus või Kutseõpe põhihariduse baasil (ISCED2)
4 Üldkeskharidus või kutsekeskharidusõpe või kutseharidus põhihariduse baasil (ISCED3)
5 Kutseõpe keskhariduse baasil, Nt Viienda taseme kutseõppe esmaõpe, Viienda taseme kutseõppe jätkuõpe (ISCED4)
6 Bakalaureus, rakenduskõrgharidus või sellega võrdsustatud haridus (ISCED6)
7 Magister või sellega võrdsustatud haridus (ISCED 7)
8 Doktorantuur või sellega võrdsustatud haridus (ISCED8)

99 keine Angabe / no answer / Vastus puudub

Filter: If German Version and if q25=3 then q26 is applied:

Q26 Welchen höchsten Abschluss der Sekundarstufe I haben Sie erreicht?
What is the highest level of lower secondary education you have achieved?

(European Commission (2020e, 2020d); Unesco (2020); Bundesministerium für Bildung und Forschung (2015))

[20] In the Estonian Classification System, there doesn’t exist ISCED-level 5 which would correspond to the German “Meisterausbildung”.

1 Hauptschule: Erfolgreicher Abschluss
2 Hauptschule: qualifizierte Reife
3 Hauptschule: Mittlere Reife / Mittlerer Schulabschluss
3 Realschule: Mittlerer Schulabschluss / Realschulabschluss
4 Gymnasium: Mittlerer Schulabschluss nach der 10. Klasse
5 Anderer
99 eine Angabe

Q27 **Ist Ihr höchster Bildungsabschluss ein beruflicher Abschluss?**
Would you describe your highest educational qualification as a vocational qualification?
Kas kirjeldaksite oma kõrgemat haridustaset kutseharidusena?

1 Ja / yes / Jah
2 Nein/ no / Ei
99 eine Antwort / no answer / Vastus puudub

Q28 **In welchem Fachbereich haben Sie Ihren höchsten Abschluss erzielt?**[21]
In what (main) field have you obtained your highest level of qualification?
Millises valdkonnas omandasite oma kõrgeima kvalifikatsioonitaseme?

1 Pädagogik
2 Geisteswissenschaften und Künste (bsp. Geschichte, Philosophie, Design)
3 Sozialwissenschaften, Journalismus und Informationswesen
4 Wirtschaft, Verwaltung und Recht
5 Naturwissenschaften, Mathematik und Statistik
6 Informatik und Kommunikationstechnologie
7 Ingenieurswesen, verarbeitendes Gewerbe und Baugewerbe
8 Landwirtschaft, Forstwirtschaft, Fischerei und Tiermedizin
9 Gesundheit und Sozialwesen
10 Dienstleistungen
1 Education
2 Arts and Humanities (e.g. History, Linguistics, Philosophy, Design
3 Social Sciences, Journalism and Information
4 Business, Administration and Law
5 Natural Sciences, Mathematics and Statistics
6 Information and Communication Technologies
7 Engineering, Manufacturing and Construction
8 Agriculture, Forestry, Fisheries and Veterinary
9 Health and Welfare (e.g. Medicine, Nursing and Midwifery, Pharmacy, Care, Social Work)
10 Services (e.g. Personal Services, Transport Services)
1 Haridus
2 Kunst ja humanitaarteadused (nt ajalugu, lingvistika, filosoofia, disain)
3 Ühiskonnateadused, ajakirijandus ja informatsioon
4 Äri, haldus ja õigus
5 Loodusteadused, matemaatika ja statistika
6 Info- ja kommunikatsioonitehnoloogiad
7 Inseneriteadus, tootmine ja ehitus
8 Põllumajandus, metsandus, kalandus ja veterinaaria
9 Tervishoid ja sotsiaaltöö (nt meditsiin, põetus ja ämmaemandus, farmaatsia, hooldus, sotiaaltöö)

[21] This question and answers are based on the ISCED-F-2013 categorization which maps certificates in different educational fields. (Unesco (2015).

10 Teenindus (nt klienditeenindus, transporditeenused)

99 keine Angabe / no answer / Vastus puudub

Q29 Würden Sie sagen, dass dieses Fach dem Ausbildungsgang der Studie hier nahekommt?
Would you consider this as close to the VET program under study?
Kas peaksite seda valdkonda kutsehariduslikuks valdkonnaks?

1 Ja / yes / Jah
2 Nein / no / Ei
99 keine Antwort / no answer / Vastus puudub

Q30 Wie alt sind Sie?
What is your age?
Kui vana te olete?

In Jahren: _____ Jahre alt / in years: __ years old / ___-aastane
99 Keine Angabe / no answer / Vastus puudub

Q31 Was ist Ihr Geschlecht?
What is your gender?
Mis on teie sugu?

1 weiblich / female / naissugu
2 männlich / male / meessugu
3 divers / divers / muu
99 keine Angabe / no answer / Vastus puudub

Closing question
Q32 War es für Sie schwierig, die Fragen zu beantworten?
Please let us know if you found it difficult to understand the questions?
Palun hinda, kas teie jaoks oli keeruline küsimustest aru saada.

1 Ja, ich fand es eher schwierig, die Fragen zu verstehen und zu beantworten.
2 Die Fragen waren für mich verständlich, an manchen Stellen war ich mir jedoch unsicher.
3 Nein, ich fand die Fragen gut verständlich und war mir in den Antworten sicher.
1 yes, I found it rather difficult to understand the questions and to fill them out.
2 the questions were understandable, but in some parts I felt unsure.
3 no, I think I understood the questions and was quite sure in my answers.
1 Jah, mul oli üsna keeruline küsimustest aru saada ning neile vastata.
2 Küsimused olid mõistetavad, kuid kohati ei tundnud ma end kindlalt.
3 Ei, ma arvan, et mõistsin küsimusi ja olin oma vastustes üsna kindel.

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