Supplementary Materials

In the following, supplementary materials are provided for the author's publications relevant to the dissertation thesis.

Table 1: Appendices Overview Assigned to Publications

Bohn and Kundisch (2019)	Appendix A – "Semi-structured Interview Guide"
	Appendix B – "Data Structure"
Bohn and Kundisch (2020)	Appendix C – "E-Mails to Delphi Participants"
	Appendix D – "Examples of Technology Pivot Descriptions by Expert Panel Participants"
	Appendix E – "Example of Factor Extraction"
	Appendix F – "Comprehensive List of Factors Describing Technology Pivots"
	Appendix G – "Nominations per Sub-panel as Part of Phase 2."
Bohn and Kundisch (2018a)	Appendix H – "Semi-structured Interview Guide"
	Appendix I – "Data Structure"
	Appendix J – "Comprehensive Preliminary Theoretical Model"
Bohn and Kundisch (2018b)	Appendix K – "Pen & Paper Version of Questionnaire"
	Appendix L – "Technology Pivot Descriptions by Participants"
	Appendix M – "Comprehensive Results Framework"
Bohn (2019)	Appendix N – "Anonymized Job Ad Examples not Containing any References to the Technical and Non-technical Antecedents of Technology Pivots"

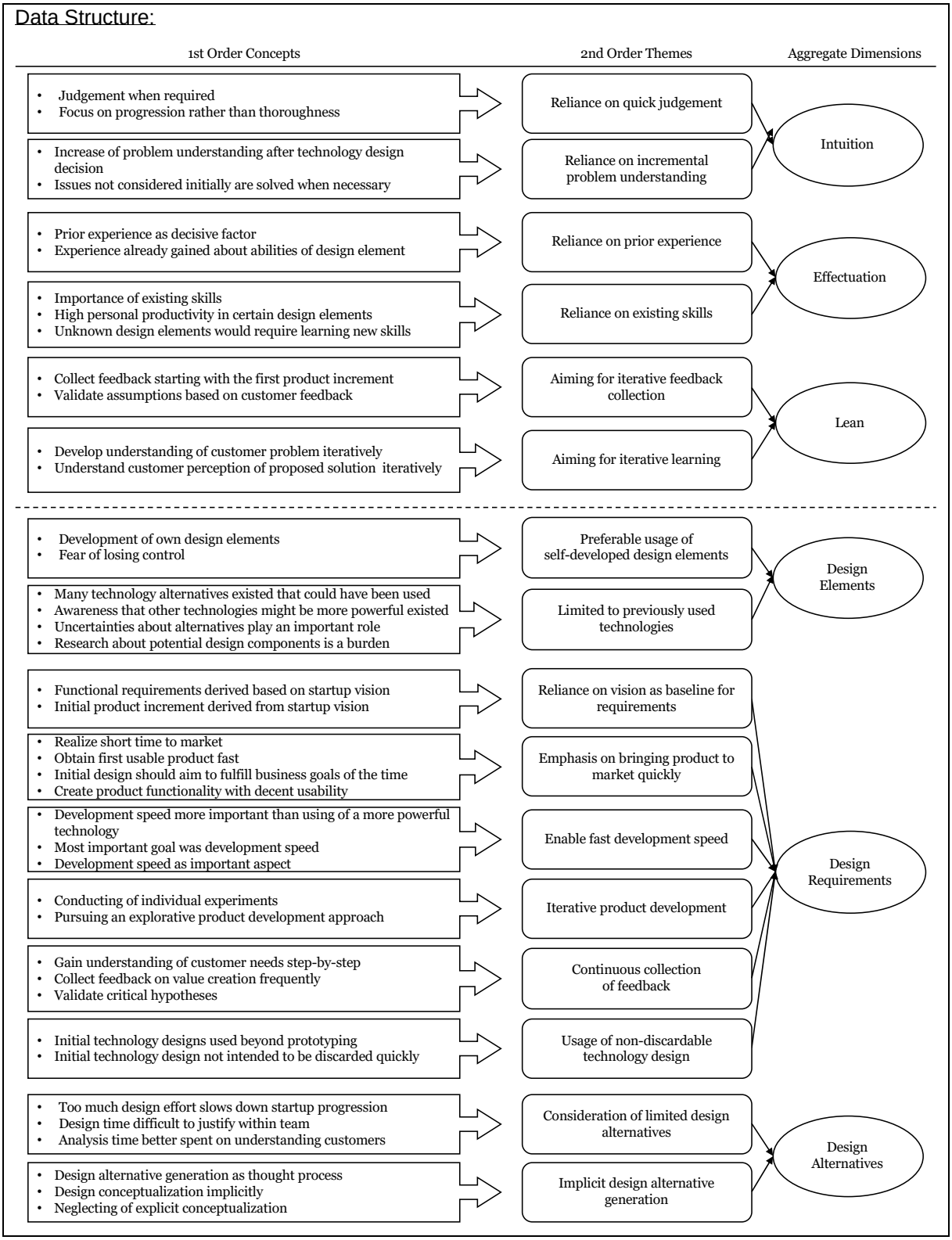
Appendix A

Table 2: Bohn and Kundisch (2019) – “Semi-structured Interview Guide”

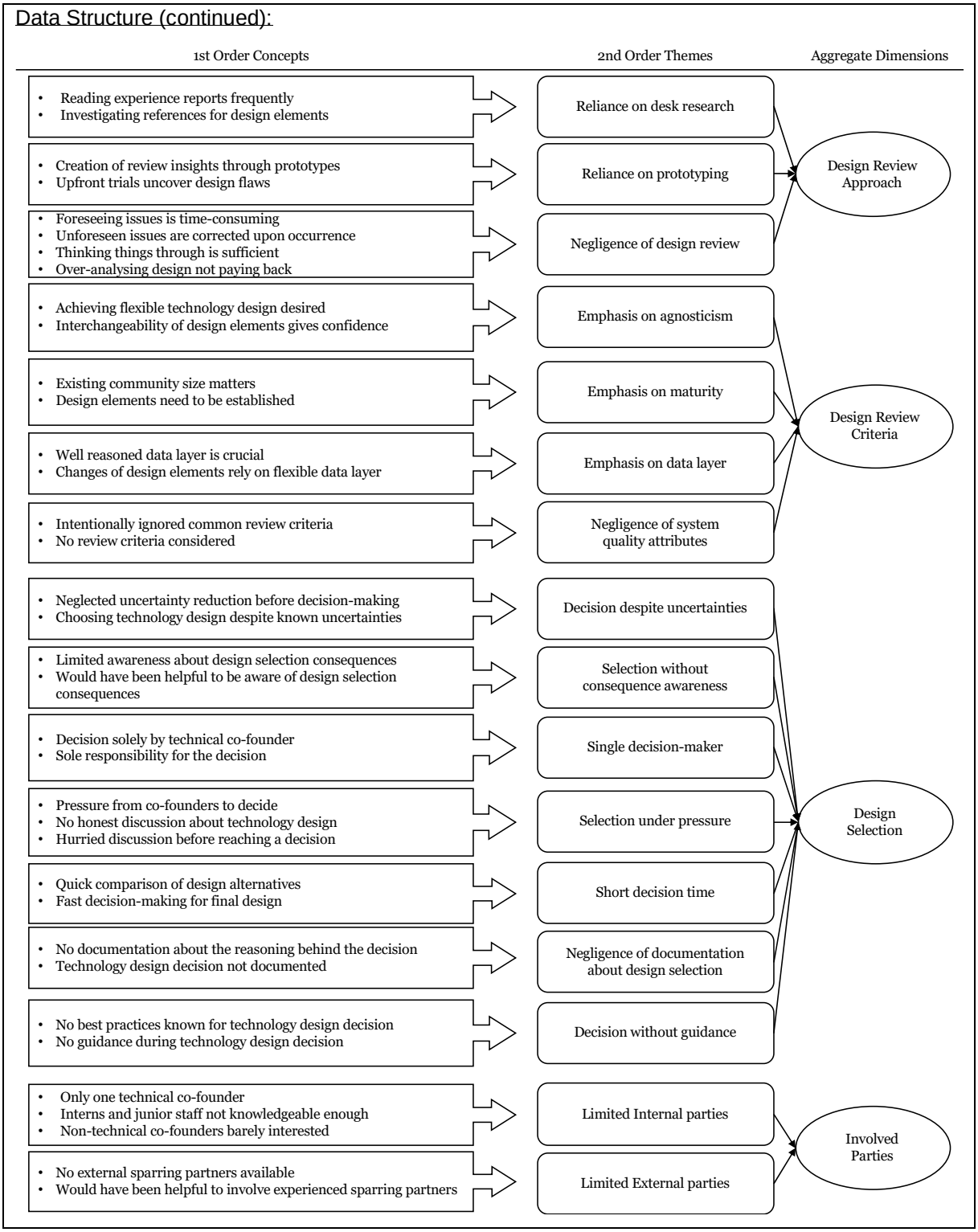
1. Introduction to Digital Startup
    a. Describe your startup including the team, product, business model and founding year.
    b. Describe your role in the startup.
2. Initial Technology Design
    a. Describe your initial technological design.
    b. How was the decision for this initial technological design made?
        i. How were individual design elements identified and selected?
        ii. What information and insights were included in the decision?
        iii. Who was involved in the decision?
        iv. What was the objective for your initial technological design?
        v. What were the (dis)advantages of your decision approach?
        vi. What would you do differently in retrospect with regard to the technological design decision?
    c. Which (technological) uncertainties were considered in the decision-making?
3. Open Questions
    a. Is there anything else relevant to this topic that we have not yet covered and that you would like to add?
    b. Is there anything else you would like to elaborate on?
4. Closing Remarks
    a. Would you be available for further enquiries on your case if necessary?
    b. Who else do you know who would be an interesting interview partner in the context of this study?

Appendix B

Table 3: Bohn and Kundisch (2019) – "Data Structure"



Data Structure (continued):



Appendix C

Table 4: Bohn and Kundisch (2020) – “First E-Mail to Delphi Participants (Q1)”

Dear NAME,

We are writing to ask for your participation in an expert-panel on “Technology Pivots for Digital startups”. The panel (a so-called Delphi survey) is part of a joint research project conducted by (blinded for review) in collaboration with (blinded for review).

Aims and background

The purpose of our research is to enable digital startups to perform technology pivots more effectively, for the right reasons and at the right time. Whilst some of the most successful tech companies have become experts at pivoting (YouTube, Instagram, Twitter to name a few), research has shown that pivoting is so daunting that many companies and especially digital startup fail to pivot at all – and go out of business as a result.

Our aim is to increase understanding of when and how to perform a particular type of pivot: technology pivots. However, the term ‘technology pivot’ currently lacks a clear definition, which hampers our efforts to provide effective decision support for digital startups. First, we need to increase our own understanding of technology pivots, what they are and what they look like in real life. This is where we need your help: based on your expertise in entrepreneurship (and the Lean Startup Methodology), your insights and examples will make our own research much more meaningful, especially to end users.

How to participate

In order to make participation in our study as easy as possible, all you need to do is reply to this email with your answers to the three questions below. All personal details will be treated with strict confidentiality and be known only to the research team. Your answers will be fully anonymized in all of our publications.

This Delphi study consists of three questionnaires. Each takes no more than 10-15 minutes to complete. Once you have returned to us the first (and only free-text) questionnaire (below), we will send you two more multiple choice questionnaires over the next few weeks. As the questionnaires complement each other, we would very much value your contribution to all four questionnaires.

Benefits

Apart from helping us to make research on technology pivots more meaningful and impactful, you will also benefit from increasing your own knowledge about technology pivots. As a participant, you will be able to see the (anonymized) responses of other participants, as well as receive a summary of our research findings either in form of a management summary or our research paper, whichever you prefer. We are also happy to engage in individual knowledge exchanges on the subject on request.

——————— QUESTIONNAIRE START ———————

Question 1: What is your understanding of the term “technology pivot”? Using examples from your own experience, what would you describe as the main characteristics of technology pivots? Please give as much detail as necessary, for readers who are not familiar with technology pivots.

Please add your answer here

Question 2: What is your expertise with regards to the Lean Startup methodology? Please briefly outline (in 1-2 sentences) how and where you were able to apply, teach or observe the Lean Startup methodology. This helps us interpret and compare all responses with regards to individual experiences made in different working environments.

Please add your answer here

——————— QUESTIONNAIRE END ———————

Thank you! This first step of the Delphi survey is now complete. Within the next few weeks you will receive a second questionnaire. Please do not hesitate to contact me if you have any more questions about the survey or the research.

Best wishes,

Table 5: Bohn and Kundisch (2020) – “Second E-Mail to Delphi Participants (Q2)”

Dear NAME,

Thank you for participating in the first step our study on ‘Technology Pivots’, which will help software startups to perform technology pivots more effectively, for the right reasons and at the right time.

We have now collected and analyzed all answers from the first questionnaire. In total 38 participants contributed to this first step, in which we aimed to sharpen our understanding about technology pivots. During our analysis, we extracted the essential parts of each answer as individual factors that describe what technology pivots are and grouped them in four categories, i.e., antecedents, nature of technology pivots, consequences, and examples.

As a next step, we give you the opportunity to review the results of our analysis. If you think we need to adapt or missed to extract any factors from your response, please let us know. Also, if you do not agree with our grouping efforts, we look forward to hearing your feedback. You can find your initial response below and our analysis results attached. Please get back to us within the next 7 days, in case you find anything we should change.

If you are satisfied with our analysis, you do not need to reply.

Following this, we will send you the third questionnaire that will ask you to select the most relevant factors necessary to answer the question what technology pivots are. Also, you will see all anonymized replies from the other participants for the first questionnaire.

Best wishes,

Table 6: Bohn and Kundisch (2020) – “Third E-Mail to Delphi Participants (Q3)”

Dear NAME,

Thank you for participating in the second round of our study on ‘Technology Pivots’, which will help software startups to perform technology pivots more effectively, for the right reasons and at the right time. We have now collected and incorporated all feedback on the extracted factors from the last round

As a next step, we kindly ask you to select at least ten factors that you consider the most important to answer the question: “What is a technology pivot?”, following this link: LINK

Please participate – if possible – within the next 7 days. You can find the anonymized full text answers of all participants attached for your own reference.

Following this, we will send you the final questionnaire that will ask you to rank the most relevant factors necessary to answer the question “What is a technology pivot?” At this point we will terminate the study and be able to identify a clear definition of what technology pivots are. We will, of course, share the final results with you.

Best wishes,

Table 7: Bohn and Kundisch (2020) – “Fourth E-Mail to Delphi Participants (Q4)”

Dear NAME,

This is the final and most important round of our study. We thank you very much for participating in this final and the previous rounds of our study on ‘Technology Pivots’, which will help software startups to perform technology pivots more effectively, for the right reasons and at the right time.

For this, we kindly ask you to carefully rank the final set of factors according to their importance for answering the question: “What is a technology pivot?”, following this link: LINK

Please participate – if possible – within the next 7 days.

Following this, we will terminate the study and, of course, share the final results with you.

Appendix D

Table 8: Bohn and Kundisch (2020) – "Examples of Technology Pivot Descriptions by Expert Panel Participants"

1.	*"Technology is the basis for the product development. If a technology pivot is being done, it means that the fundamental technology concept is abandoned and a new technology concept is put into the focus of the future product development.* *A technology pivot is always in the technological layer of a product not in the functional layer. Thus it mainly affects technical aspects of a product like scalability, faster development, higher speed."*
2.	*"In my opinion, the term "technology pivot" describes a fundamental technology change and can be seen as a precursor of a (technological) disruption. A (technological) disruption is a process in which existing business models or an entire market are replaced or "destroyed" by a (technological) innovation. Thus, a "technology pivot" would be the technological basis for building such a business model."*
3.	*"I would define 'technology pivot' as a change in a piece of technology, that is:* *a) technologically significant (capabilities, requirements, dependencies are impacted), and* *b) requires substantial resources to implement, which may or may not be accompanied by a change in business logic/model or higher-level technology.* *For example, I would not consider changing the database technology from MySQL to PostgreSQL a tech pivot, since it is usually a drop-in replacement that does not impact too many surrounding systems, as the interfaces with both storage systems are largely identical. On the other hand, rewriting a piece of software (e.g. a mobile app) with a different programming language or technology stack (e.g. native mobile app instead of a web-app), I would consider a tech pivot since it requires new capabilities in the team, and since it represents a large portion of the code to be rewritten, even though from a user's perspective this change may barely be noticeable.* *To sum up, I would consider a technical change a 'pivot' when it is sufficiently substantial in terms of the company's required capabilities, the effort required to perform the change, and interdependencies with other systems."*
4.	*"In my understanding, a technology pivot is a change in the core technology of a startup. It could be something directly related to users/customers perception (a change that is perceived by the users/customers), but it can also be a change due to legal constraints or an adaptation of the software. For instance, a given API is no longer available, or the development language needs to be changed for some reason. In sum, I believe that a technology pivot does not affect users; the business model and the interaction with the customer remains the same (or very similar). The change happens 'behind the scene'."*
5.	*"Technology pivot describes the process of adapting a young, not yet mature/proven technology with the goal of better suiting a specific purpose. A technology pivot is often based on feedback received/experiences made with the initial technology in the context of a first market/customer validation. Based on these „early learnings" (i.e. what works well, what does not work well) the technology is then refined to maximize its potential. In my opinion, a critical success factor for a successful technology pivot is the openness of the founders/ tech owners for feedback from outside. Different technology pivots can have different dimensions, meaning that the changes made in the underlying tech can either be incremental or radical. In the end, however, I would say that the core technology remains stable (as it would otherwise not be a pivot of an existing technology but the development of a new technology).* *A technology pivot needs to be differentiated from a business model pivot, as the latter – in my understanding – mainly refers to changes in components such as pricing, target group, or go-to-market."*

Appendix E

Table 9: Bohn and Kundisch (2020) – "Example of Factor Extraction"

Reply by Participant	*"I do understand "pivot" as a fundamental change in a startup, based on new results / insights from e.g. important market players / other external factors etc. but also missed critical milestones. So, "technology pivot" is that kind of significant change by changing the technology setup. That means, a startup is doing a fundamental change in their tech-stack because of internal and/or external factors, e.g. integrating a new evolving technology; also the insight that the current tech-stack cannot scale with operations when a Startup is growing. So, main characteristics are:* *- Change of tech-stack/ technology that is "mission critical" for further development of the Startup/ company* *- Causes can be internal flaws (e.g. infrastructure, wrong/ not adequate source code languages…) or external changes e.g. evolving new technologies* *- Change mostly happened in crisis/ tense situation e.g. having missed critical milestones* *- Strategic impact on the whole Startup, especially product vision and USP"*
Extracted Factors	Antecedents of technology pivots • Scalability - Technology pivots are triggered by the need for better scalability • Timeline Changes - Technology pivots are triggered by timeline changes • Crisis Situation - Technology pivots are triggered by crisis situations Nature of technology pivots • Fundamental Technology Change - Technology pivots are fundamental changes to the technology in use • Technology Innovation - Technology pivots are implementations of new technology innovations • Business Critical - Technology pivots are business critical • IT-Architecture Design - Technology pivots are changes to the IT-architecture design • Strategic Importance - Technology pivots are of strategic importance Consequences of technology pivots • Unique Selling Point - Technology pivots result in changes to the unique selling points • Product Vision - Technology pivots result in changes to the product vision

Appendix F

Table 10: Bohn and Kundisch (2020) – "Comprehensive List of Factors Describing Technology Pivots"

#	Group	Factor	# of mentions
1	Antecedents of Technology Pivots	Validated Learnings - Technology pivots are triggered by validated learnings generated through hypotheses being proven wrong	11
2		Customer Feedback - Technology pivots are triggered by customer feedback	5
3		Market Position - Technology pivots are triggered to improve the own market position	5
4		Competitive Landscape - Technology pivots are triggered by changes in the competitive landscape	3
5		Scalability - Technology pivots are triggered by the need for better scalability	2
6		Crisis Situation - Technology pivots are triggered by crisis situations	2
7		Ecosystem - Technology pivots are triggered by changes in technological ecosystems	2
8		Solution not Feasible - Technology pivots are triggered when a product cannot be realized for technical reasons	2
9		Timeline Changes - Technology pivots are triggered by changes to a startup's timeline	2
10		Product Scope - Technology pivots are triggered by a required change in the product scope	2
11		Architectural Complexity - Technology pivots are triggered by high architectural complexity	1
12		Cost Reduction - Technology pivots are triggered by the need to reduce costs	1
13		External Force - Technology pivots are triggered by external forces	1
14		Initial validations - Technology pivots are triggered by insufficient initial technology validations	1
15		Legal - Technology pivots are triggered for legal reasons (e.g. changes to laws or regulations)	1
16		Market Environment - Technology pivots are triggered by negative responses from the market environment	1
17		Business Goal - Technology pivots are triggered by business goal changes	1
18		Business Model Change - Technology pivots are triggered by a change in the business model	1
19		Customer Need Change - Technology pivots are triggered by changes in customer requirements	1
20		Technical Viability - Technology pivots are triggered by the intended use of a technical implementation being unachievable	1
21	Nature of Technology Pivots	Fundamental Technology Change - Technology pivots are fundamental changes to the technology in use	28
22		Changing Capability Requirements - Technology pivots require new technical skills and capabilities of employees	7
23		Technology Substitution - Technology pivots are substitutions of the technology being in use with a new technology	6
24		Technology Innovation - Technology pivots are implementations of new technology innovations	5
25		Business Critical - Technology pivots are critical for your business	4
26		Individuality - Technology pivots can only be analyzed on an individual case based on the case's individual dimensions	4
27		IT-Architecture Design - Technology pivots are changes to the IT-architecture design	4

28		Perceptible for Customers - Technology pivots can be perceived by customers	3
29		Imperceptible for Customers - Technology pivots cannot be perceived by customers	3
30		Considerable Resources Required - Technology pivots require considerable resources to be realized	3
31		Deliberate Course Correction - Technology pivots are deliberate changes of the technology stack in use	3
32		Business Model Disruption - Technology pivots are enablers for the disruption of existing business models	2
33		Strategic Importance - Technology pivots are of strategic importance	2
34		Irrevocability - Technology pivots are not easily revocable	2
35		Technical Dependencies - Technology pivots affect technical dependencies	2
36		Technical Layer - Technology pivots are located at the technical layer	2
37		Customer Behavior - Technology pivots are designed to change customer behavior	1
38		Technology Issues - Technology pivots are business corrections due to technology issues	1
39		Technology Redesign - Technology pivots merge existing technologies to create new offerings	1
40		Business Activities - Technology pivots are adjustments of business activities based on major technology developments	1
41		Technology Strategy - Technology pivots are adjustments of technology strategies	1
42		Lean Startup - Technology pivots are associated with the Lean Startup Approach	1
43		Sub-Pivot-Type - Technology pivots are a sub-type of pivot	1
44		Evaluation Effort - Technology pivots require effort to evaluate future technology	1
45		Implementation Effort - Technology pivots cause considerable implementation effort	1
46		Rewrites - Technology pivots include large portions of the source code being rewritten	1
47		Core Technology Remains Stable - Technology pivots do not change the core technologies of a startup	
48		Incremental Technology Change - Technology pivots are incremental changes of technology	1
49		IT Platform Orchestration - Technology pivots are platform orchestrations between provider and customer	1
50		New Technology Concept - Through technology pivots, the existing technology concept is abandoned and replaced with a new technology concept	1
51		Software Deployment - Technology pivots are fundamental changes in how software is deployed	1
52		Software Development - Technology pivots are fundamental changes in how software is developed	1
53	Consequences of Technology Pivots	Business Model Changed - Technology pivots lead to business models being changed	12
54		Value Proposition Changed - Technology pivots lead to changes to the value proposition	4
55		Business Model Unchanged - Technology pivots lead to business models remaining unchanged	4
56		Value Creation Changed - Technology pivots lead to changes to the value creating technologies and activities	4
57		Same Solution Remains - Technology pivots lead to the same solution (product or service) being achieved	3
58		Value Capture - Technology pivots lead to changes to capturing the value of technologies and activities	3

59		Strategy Adjustment - Technology pivots lead to changes to business strategies	2
60		Software Features - Technology pivots lead to new software features being possible that were previously not possible	2
61		Technology Disruption - Technology pivots are precursors to technological disruption	2
62		Scalability Increased - Technology pivots lead to better scalability	1
63		Customer Cost - Technology pivots lead to changes to the costs for customers	1
64		Customer Effort - Technology pivots lead to changes to the required efforts by customers	1
65		Customer Segment - Technology pivots lead to changes to the targeted customer segments	1
66		Product Quality - Technology pivots lead to changes to the product quality	1
67		Product Vision - Technology pivots lead to changes to the product vision	1
68		Competence Devaluation - Technology pivots lead to devaluations of existing skills and competences	1
69		Value-in-use - Technology pivots lead to changes to the value-in-use of a product or service	1
70		Unique Selling Point - Technology pivots lead to changes to the unique selling point(s)	1
71		Development Speed - Technology pivots lead to changes to the development speed	1
72		Technology Stack underlying Business Model - Technology pivots lead to changes to the technology stack underlying a business model	1
73		Cost Structure – Technology pivots lead to lower business costs	1
74	Examples of Technology Pivots	Programming Language - Technology pivots involve, for example, switches in programming languages	9
75		Third Party Solution - Technology pivots involve, for example, implementations of third party solutions	4
76		Database - Technology pivots involve, for example, changes to database systems	3
77		Cross Platform Engine - Technology pivots involve, for example, changes from native to cross-platform development and vice versa	2
78		API - Technology pivots involve, for example, changes of used APIs	1
79		Data Mining - Technology pivots involve, for example, changes to data mining approaches	1
80		Open vs. Closed Source - Technology pivots involve, for example, changes from proprietary source code to open source and vice versa	1
81		Operating System - Technology pivots involve, for example, changes to operating systems	1
82		On-premise to Cloud - Technology pivots involve, for example, switching from on-premise hosting to cloud	1
83		Monolith to Micro-services - Technology pivots involve, for example, architecture redesigns from monolith to micro-services	1

Appendix G

Table 11: Bohn and Kundisch (2020) – “Nominations per Sub-panel as Part of Phase 2.”

Academics (n=16)		**Practitioner (n=18)**	
Factors (n=22)	**Nominations**	**Factors (n=19)**	**Nominations**
Validated Learnings	10	Fundamental Technology Change	18
Customer Feedback	9	Validated Learnings	15
Fundamental Technology Change	8	Scalability	13
Market Position	8	Technology Substitution	11
Technology Substitution	7	Programming Language	11
Programming Language	7	Market Position	11
Cross Platform Engine	7	Business Critical	10
Business Model Changed	7	Changing Capability Requirements	9
Technology Innovation	6	Business Model Changed	9
API	6	IT-Architecture Design	8
Open vs. Closed Source	6	Value Proposition Changed	8
On-premise to Cloud	6	Technology Innovation	7
Monolith to Micro-services	6	Customer Feedback	7
Competitive Landscape	6	New Technology Concept	6
Scalability	6	Third Party Solution	6
Business Model Changed	6	Monolith to Micro-services	6
Value Proposition Changed	6	Ecosystem	6
Value Creation Changed	6	Software Features	6
Business Critical	5	Product Quality	6
IT-Architecture Design	5		
Strategic Importance	5		
Business Goal	5		

Appendix H

Table 12: Bohn and Kundisch (2018a) – “Semi-structured Interview Guide”

1. Introduction to company
    a. Describe the company including background information about the product, the founding year, and the current size.
    b. Describe your role inside the company.
2. Company growth path
    a. Describe the initial business model of the company and the implemented technological solution
    b. Describe the development of the company along its growth path.
3. Key pivotal points
    a. Describe key pivotal points in which technology changes were made and how the business model changed
    b. In which development phase was the startup at this point?
4. Decision-making arguments towards technology pivotal points
    a. Which arguments lead to the decision towards a technology pivot?
    b. What did you hope to achieve through the technology pivot?
5. Effects observed throughout and after the technology pivot
    a. What were the observed expected and unexpected effects of the technology pivot throughout its performance?
    b. What were the observed expected and unexpected effects of the technology pivot after its performance?
6. Closing remarks
    a. Do you have any additional internal material (presentations, reports) that can be used for the study?
    b. Would you be available for further enquiries in case they are necessary?

Appendix I

Table 13: Bohn and Kundisch (2018a) – “Data Structure”

Open Codes	Axial Codes	Selective Codes	Dimension
System cannot be scaled any further	Increasing systems performance scalability	Increasing System Performance	Antecedent
Performance limit reached			
Low performance due to low response times			
Amount of data to be processed reached performance limit			
Resolving issues of frequently crashing system	Increasing system stability		
Improved system stability as core part of value proposition			
Constraints in system functionality	Reducing technological constraints		
Constraints in data-binding options			
Constraints due to implementation of third-party components			
Limited customization options			
Product quality perceived to be low	Resolving customer product feedback issues		
Unsatisfactory usability of existing solution for customers			
System accessibility limited for customers			
Avoid user and customer churn resulting from technical complications	Resolving bugs visible to the customers		
Customer demo sessions contained bugs			
Inconsistencies in system behavior perceived by customers			
Achieve high quality for software design	Aiming for high internal software quality	Increasing Architectural Future Viability	
Implement fewer error-prone system components			
Diminish uncommon technology design with low documentation			
Self-made components show low quality			
Pursue technology trends	Adapting to new technological standards		
Increase level of standardization			
Observed development into certain direction			
Internal solution could not compete with externally available technology innovation			
Initial technology design too short sighted	Avoiding technological obsolescence		
Fear of investment into dying technology			
Achieve technological solution that is sustainable			
No proper trial period performed initially	Correcting insufficient initial technical validation		
Correction of initial mistakes			
Monolithic approach caused overhead	Reducing complexity of architectural design	Increasing System Maintainability	
Reduction of architectural complexity			
Resolve system dependencies			
Realized that own architecture is over-engineered			
All employees should be able to handle infrastructure			

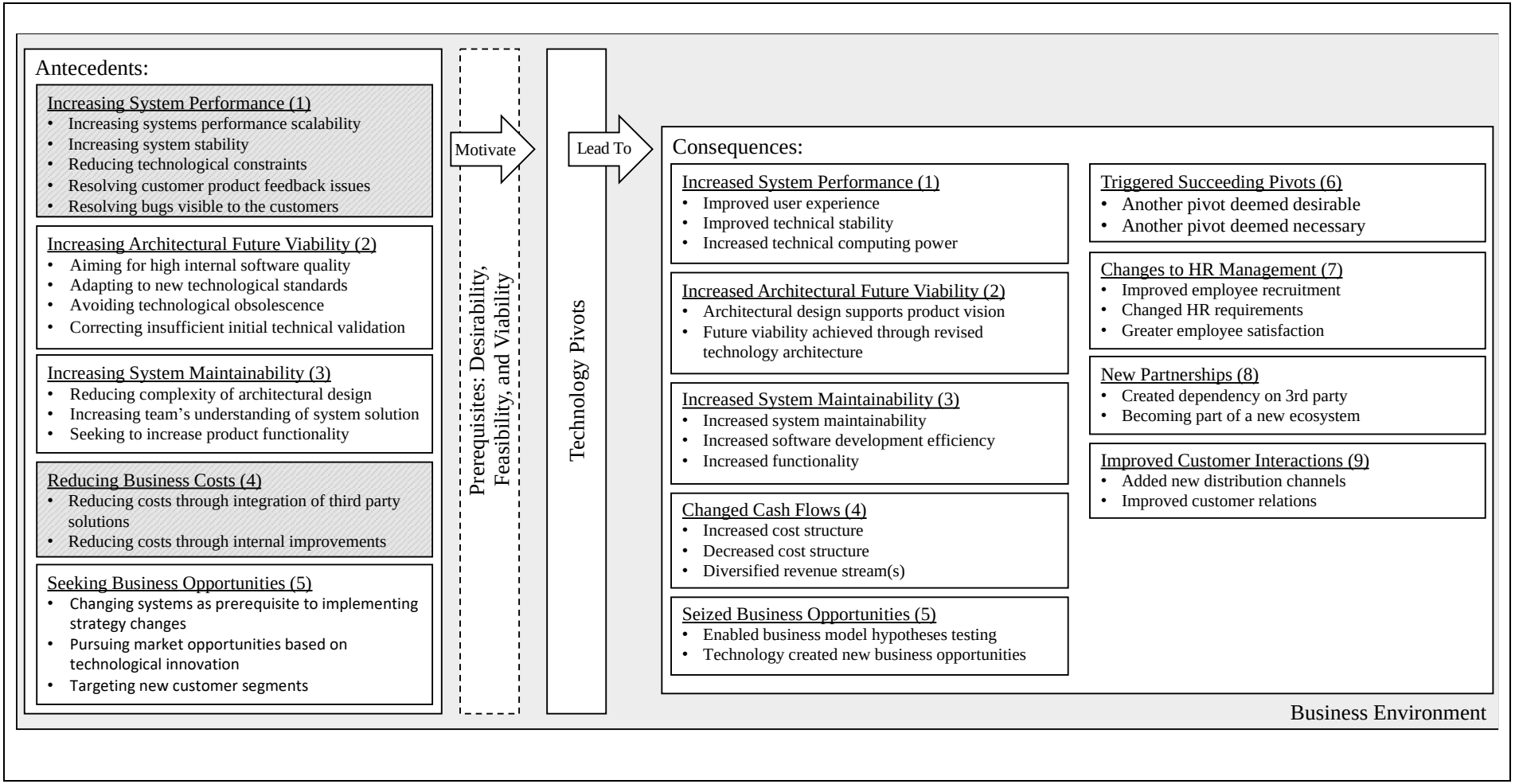
Requirement for in-depth knowledge about system acts as a barrier to new joiners taking on responsibility	Increasing team's understanding of system solution		
Employee with most knowledge left the organization			
High onboarding effort for new employees			
Software structure was too complex for most team members			
Allow for new features to be implementable	Seeking to increase product functionality		
New features are part of new technologies			
Multi-platform support desired			
Alternative technologies are more cost efficient	Reducing costs through integration of third-party solutions	Reducing Business Costs	
High effort in maintaining in-house solution compared to externally sourced solution			
Reduction of necessary implementation effort through simplification of system	Reducing costs through internal improvements		
Implemented architectural design led to high operational costs			
Increase business profitability through new technologies			
Changes in perspective of product requires technology to be changed	Changing systems as prerequisite to implementing strategy changes	Seeking Business Opportunities	
Long-term vision developed over time and changed			
Change technology according to product strategy			
Market opportunity pursued is based on technological innovation	Pursuing market opportunities based on technological innovation		
Technological innovation expected to lead to growth of user base			
Belief that new technology will enhance opportunities for growth			
Existing product unsuitable to development of new customer segment	Targeting new customer segments		
Initial targeted customer segment does not have need for product			
Change in value proposition for customer segment requires technical changes			
The need to pivot underpinned by several reasons	Desirability	Prerequisites	-
Sufficient agreement on reasons for pivoting			
Validation of technology prior to implementation possible	Feasibility		
Validation of new system possible through proof-of-concepts			
Necessary knowledge and skill available			
Roadmap allows change of technology	Viability		
Resources available for completion of technology change			
Considerable improvement of user experience	Improved user experience	Increased System Performance	Effects
System accessibility improved			
Product stability increased	Improved technical stability		
Improved product quality perceived by customers			

Improved response time	Increased technical computing power	
Increased processing speed		
Increased system performance		
Future viability of architecture increased as technology design supports vision	Architectural design supports product vision	Increased Architectural Future Viability
Pivot paved way to achieving long-term vision		
Solution after pivot leads to next steps towards vision		
Enabled possibility to test further business model hypotheses	Future viability achieved through revised technology architecture	
Increased software development efficiency		
Increased system and source code maintainability	Increased system maintainability	Increased System Maintainability
Architectural quality improved		
Improved system monitoring options		
Reduced complexity achieved with new solution		
Increase in development speed noticeable	Increased software development efficiency	
Effort estimations possible and accurate		
Reduced training period for new staff		
Easier prototyping possibilities		
Customer feature requests can be fulfilled	Increased functionality	
Viable set of functionality increased		
New functionality implementable		
Increase in cost structure through third-party fees	Increased cost structure	Changed Cash Flows
Development cost increased as additional test environment needed to be created		
Development cost increased as more specialists were required		
Cost reduction through new technology	Decreased cost structure	
System operation cost reduced		
Implementation speed increase reduced development costs		
Change and extension of revenue streams	Diversified revenue stream(s)	
Higher revenue stream through self-service		
Change to subscription model		
New business model related hypothesis testable	Enabled business model hypotheses testing	Seized Business Opportunities
Further business model validation with new technical solution easier		
Increased number of viable business opportunities through higher efficiency	Technology created new business opportunities	
Further changes of business model enabled		
Pivot of other type added to roadmap	Another pivot deemed desirable	Triggered Succeeding Pivots
Customer problem pivot planned		
Customer channel pivot planned		
Another pivot required as a result of technology change performed	Another pivot deemed necessary	
Technology changes made business-related pivot necessary		

New employees easier to recruit	Improved employee recruitment	Changes to HR Management	
New technology more attractive for hiring candidates			
Hiring employees with same mindset easier			
More human resources needed	Changed HR requirements		
New technological skills required			
Skill transition for existing staff necessary			
Employees enjoy work more because of reduced technical complexity	Greater employee satisfaction		
New technology creates more interesting challenges for employees			
Roadmap adjustment according to key partners	Created dependency on third-party	New Partnerships	
Less bargain power with third-parties due to dependencies			
Dependency on third-party established			
Implemented third-party technology changed its roadmap unexpectedly			
Engagement in open source community	Becoming part of a new ecosystem		
Interacting more with new partners from other ecosystems			
Distribution channels changed	Added new distribution channels	Improved Customer Interactions	
New distribution channels added			
New distribution channels desirable			
Easier interaction with customer	Improved customer relations		
Customer relationship management through new channels			
Customer interaction automatable			
Disagreements about the necessity of technology pivots	Friction between stakeholders	Business Environment (Complications)	-
Extensive discussions about necessity of technology pivot			
Frustration during pivot implementation			
Increased overheads on a people management level	Considerable overheads		
Increased overheads on a technical level			
Pivot implementation effort underestimated	Completion period longer than expected		
Technology pivot needed more often than expected			

Appendix J

Table 14: Bohn and Kundisch (2018a) – "Comprehensive Preliminary Theoretical Model"



Appendix K

Table 15: Bohn and Kundisch (2018b) – "Pen & Paper Version of Questionnaire (exemplified by the case of one technology pivot)"

A **technology pivot** is a structured technological course correction that allows the introduction of significant technical improvements for an existing offering as well as the introduction of IT-innovations to distinctly adapt and enhance the value created through products and services (i.e. larger technological changes in your startup that may influence your business model).

Examples are - among many others:

- *Replacing a core-frontend framework that allow a better performance and may influence your value proposition.*
- *Adjusting your architecture by switching from a monolith to micro-services.*
- *Switching from a desktop-based product/service to a mobile-based product/service.*
- *Enhancing the core business logic with a machine learning solution to provide a better value-add to the end user.*

Prerequisite: Did you perform at least one technology pivot according to the description above?

○ Yes ○ No

Q0: How many technology pivots have you performed in total?

Q1: Please shortly describe the first technology pivot you performed in 1-3 sentences:

Q2: In which life-cycle stage was your startup when you started to perform your first technology pivot? Please choose **only one** of the following:

○ **Concept & Development** - Initial phase of a new startup, incl. development of the business idea, construction of a prototype product, and selling the business idea to financial backers.
○ **Commerce** - Focus is on developing the product/technology for commercialization. Learning how to make the product work well and produce it beyond the prototype approach.
○ **Growth** - Produce, sell, and distribute the product in volume. With pressures to attain profitability, the venture must carefully balance profits against future growth.
○ **Stability** - The founders had been either replaced or supported by a professional, experienced team of managers. The major problems at this stage are launching a second-generation product while simultaneously managing the efficiency of the existing product line.

Q3: Was your first technology pivot motivated by necessity or desirability? Please choose **only one** of the following:

○ The technology pivot was necessary to resolve issues.
○ The technology pivot was desired because of strategic changes or observed/identified opportunities.

Q4: What were the main reasons for you to perform this technology pivot?

☐ **Increasing System Performance** - The degree to which a system or component accomplishes its designated functions within given constraints, such as speed, accuracy, or memory usage.
- ☐ Extending product functionality
- ☐ Reducing technological constraints
- ☐ Increasing systems performance scalability
- ☐ Increasing system stability

- ☐ Resolving customer product feedback
- ☐ Resolving customer facing bugs
- ☐ Other:

☐ **Increasing Architectural Future Viability** - Increasing the long-term future viability of hardware and software components and their interfaces.

- ☐ Seeking high internal software quality
- ☐ Following arising technological standards
- ☐ Avoiding technological obsolescence
- ☐ Correcting insufficient initial technical validation
- ☐ Other:

☐ **Increasing System Maintainablity** - The ease with which a software system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment.

- ☐ Reducing complexity of architectural design
- ☐ Increasing team's understanding of system solution
- ☐ Seeking validatable functionality of product
- ☐ Other:

☐ **Reducing Business Costs** - Includes all the costs (fixed, variable, direct, indirect) incurred in carrying out the operations of the business.

- ☐ Reducing costs through integration of 3rd party solution
- ☐ Reducing costs through internal improvement
- ☐ Other:

☐ **Seeking Business Opportunities** - Business opportunity recognition describes the alertness to and exploitation of changed conditions or overlooked possibilities.

- ☐ Changing systems as prerequisite to implement strategy change
- ☐ Pursuing market opportunity based on technological innovation
- ☐ Targeting new customer segments
- ☐ Other:

☐ Other:

Q5: How long did it take you to complete this technology pivot after you decided to perform it (in months)?

Q6: What were the observed consequences after you performed this technology pivot?

☐ **Increased System Performance** - The system performance increased considerably with regards to e.g. speed, accuracy, or memory usage.

- ☐ Improved user experience
- ☐ Increased technical stability
- ☐ Increased technical computing power
- ☐ Other:

☐ **Increased Architectural Future Viability** - The long-term future viability of hardware and software components and their interfaces increased.

- ☐ Architectural design supports product vision
- ☐ An increased future viability of your technology architecture revision
- ☐ Other:

☐ **Increased System Maintainability** - Your software system or individual components can be modified or extended easier.

- ☐ Increased system maintainability
- ☐ Increased software development efficiency

- ☐ Increased implementable functionality
- ☐ Other:

☐ **Changed Cash Flows** - Your cash flows (costs or revenues changed considerably).

☐ Increased cost structure

☐ Decreased cost structure

☐ Changed revenue stream

☐ Other:

☐ **Seized Business Opportunities** - You utilized or exploited an identified business opportunity successfully.

- ☐ Enabled business model hypotheses testing
- ☐ Technology created new business opportunities
- ☐ Other:

☐ **Changes to HR Management** - Your HR requirements (number of employees, skills needed) changed or employee satisfaction increased.

- ☐ Easier recruiting of new employees
- ☐ Changed requirements for HR
- ☐ Increased employee satisfaction
- ☐ Other:

☐ **New Partnerships** - You established new partnerships or became part of new ecosystems.

- ☐ Created dependency on 3rd party
- ☐ Becoming part of a new ecosystem
- ☐ Other:

☐ **Improved Customer Interactions** - Your approach to interact with customers improved through e.g. new channels, software systems or similar.

- ☐ Added new distribution channel
- ☐ Changed customer relationship
- ☐ Other:

☐ Other:

Q7: Which of the following components of your business model were impacted through this technology pivot?

☐ **Value Proposition** - The value to be delivered, communicated, and acknowledged to your customers changed. Respectively the belief from your customers about how value (benefit) will be delivered, experienced and acquired changed.

☐ **Value Architecture** - The resources and inputs used to serve the market effectively changed. This comprises tangible and intangible organizational assets, resources, and core competencies.

☐ **Value Network** - The social and technical resources used within your startup and between your startup and other businesses changed. This includes e.g., that transactions among parties, multiple companies and stakeholders improved.

☐ **Value Finance** - The costing, pricing (methods), and revenue structures of your startup changed.

☐ Other:

Q8: How important was this technology pivot for your startup on its way to grow into a viable and sustainable business? (1= not at all important, 5= extremely important)

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

Q9: Why or why not was your technology pivot important for your startup to grow into a viable business?

Q10: Have you performed any pivots that directly relate to this technology pivot?
E.g. customer segment change, other customer need targeted / satisfied, distribution channel change, value proposition change, change from application to platform and vice versa

○ Yes ○ No *(IF YOU SELECT NO, PLEASE CONTINUE WITH QUESTION 19)*

Q11: How was your technology pivot related to this / these other pivot(s)?

○ **It was related to a previous pivot** - You performed another pivot prior

○ **It was related to a subsequent pivot** - You performed another pivot afterwards

○ **Both** - It was related to a previous and a subsequent pivot

Q12: Which previous pivot was your technology pivot related to? Which type did this pivot have?

☐ Zoom-in - A single feature becomes the whole product
☐ Zoom-out - Whole product becomes a single feature of a much larger product
☐ Customer Segment - Change of targeted customer segments
☐ Customer Need - Other customer need targeted / satisfied
☐ Platform - Change from application to platform and vice versa
☐ Business Architecture - A switch from high margin, low volume to low margin, high volume
☐ Value Capture - Changes to the way how value is captured
☐ Engine of Growth - Changes in strategy to seek faster growth
☐ Channel - Switch to channels with better effectiveness

Q13: How long was the time span between finishing the previous pivot until the beginning of the technology pivot (in months)?

Q14: How was your technology pivot related to this previous pivot?

○ The previous pivot made the technology pivot necessary
○ The previous pivot made the technology pivot desirable

Q15: Which subsequent pivot was your technology pivot related to? Which type did this pivot have?

☐ Zoom-in - A single feature becomes the whole product
☐ Zoom-out - Whole product becomes a single feature of a much larger product
☐ Customer Segment - Change of targeted customer segments
☐ Customer Need - Other customer need targeted / satisfied
☐ Platform - Change from application to platform and vice versa
☐ Business Architecture - A switch from high margin, low volume to low margin, high volume
☐ Value Capture - Changes to the way how value is captured
☐ Engine of Growth - Changes in strategy to seek faster growth
☐ Channel - Switch to channels with better effectiveness

Q17: How long was the time span between finishing the technology pivot until the beginning of the subsequent pivot (in months)?

Q18: How was your technology pivot related to this subsequent pivot?

- ○ The technology pivot made the subsequent pivot necessary
- ○ The technology pivot made the subsequent pivot desirable

Q19: Have you observed any complications inside your startup's environment related to this technology pivot?

- ☐ Increased friction between stakeholders (e.g., between management and employees).
- ☐ Considerable management overheads on the project and people management level.
- ☐ Completion of the technology pivot took more time than expected.
- ☐ Other:

Q20: Which of the following prerequisites did you consider before performing your technology pivot?

- ☐ Desirability - You validated that sufficient reasons existed that confirmed the desirability of a technology pivot.
- ☐ Feasibility - You validated that you had the skill and knowledge-based ability to implement technological changes. For this, e.g. proof-of-concepts were utilized.
- ☐ Viability - You validated that you had the prevailing resources (e.g., HR, time, and money) to successfully exercise a technology pivot.
- ☐ Other:

General Information About Your Startup

In which year was your startup founded?

How many employees does your startup currently have?

What is your role in your startup?

- ○ C-Level (e.g. CEO, CTO)
- ○ Management (e.g. VP Engineering, Head of Product)
- ○ Other:

What is your main business model?

- ○ B2C
- ○ B2B

What is the current life-cycle stage of your startup? (Select only one)

- ○ **Concept & Development** - Initial phase of a new startup, incl. development of the business idea, construction of a prototype product, and selling the business idea to financial backers.
- ○ **Commerce** - Focus is on developing the product/technology for commercialization. Learning how to make the product work well and produce it beyond the prototype approach.
- ○ **Growth** - Produce, sell, and distribute the product in volume. With pressures to attain profitability, the venture must carefully balance profits against future growth.
- ○ **Stability** - The founders had been either replaced or supported by a professional, experienced team of managers. The major problems at this stage are launching a second-generation product while simultaneously managing the efficiency of the existing product line.

Thank you for your participation. In case you are interested in the results of this study, please leave your e-mail address below.

May we contact you in case of additional questions?

Appendix L

Table 16: Bohn and Kundisch (2018b) – “Technology Pivot Descriptions by Participants”

#	**Description**
1	We pivoted towards a micro-service structure of our architecture. This helped us to build applications faster across all layers.
2	We completely re-built the technology for our website and product.
3	We pivoted our technology stack as part of pivoting from an photo tagging app to a messenger bot that uses a sophisticated product recommendation system and NLP.
4	We pivoted our technology stack from a mobile app that was intended to build up a two sided marketplace to a more transactional web based product.
5	We shifted from a pure cloud-based architecture to a hybrid, where we self-hosted parts of the architecture.
6	We switch from a monolith structure to a micro-service structure.
7	We moved from professional services to a stand-alone product and subsequently needed to pivot the existing technology.
8	We pivoted from a monolith architecture to using micro-services.
9	We pivoted from a PHP based web application to Java micro-services backend architecture & PHP frontend.
10	We pivoted our development and products from a Facebook Canvas focus to Mobile Apps.
11	We performed a pivot to all internal sales tools using a modern tech stack (from ExtJS to React.js, 50% of employees work in sales and use those tools). Besides technical changes we update and adjust processes in sales team and combine them with organizational changes as well. Observation are based on current progress as the switch has multiple parts.
12	We pivoted our architecture from a dedicated self-hosted server to using AWS as a cloud solution.
13	We switched to a smarter and more sophisticated backend solution.
14	We changed the backend templating system, to make it more flexible and easier for employees to use.
15	We pivoted from using BigChain DB towards IPDB for the core of our service.
16	After starting out with an extremely simple hacked together frontend, we saw the large potential and followed up with a rebuild of the system into an architectural component.
17	We pivoted from a monolith architecture to using micro-services.
18	We had to pivot our frontend usage of technologies from React to plain HTML/CSS to allow for better performance and maintainability.
19	We had to completely change our IT as a result of our service drastically being changed. We realized that customers were asking for something different than we have expected.
20	We rearchitected a rich desktop client to allow the product to be completely modularized based on licensing.
21	We integrated blockchain technology into the core of our architecture to enhance the product.
22	We pivoted from a WordPress based service to a custom build Ruby on Rails web app.
23	We pivoted our technology while shifting from being a mobile a/b testing platform to an app localization platform (native mobile SDKs that connect to a cloud backend, managed to a web dashboard) targeted at mobile app developers and publishers.
24	When we were recognizing that our existing solution is not scaling, and the desired solution was not possible with the chosen tech stack, we decided to pivot our technology.
25	We switched our main database engine in use to another one.

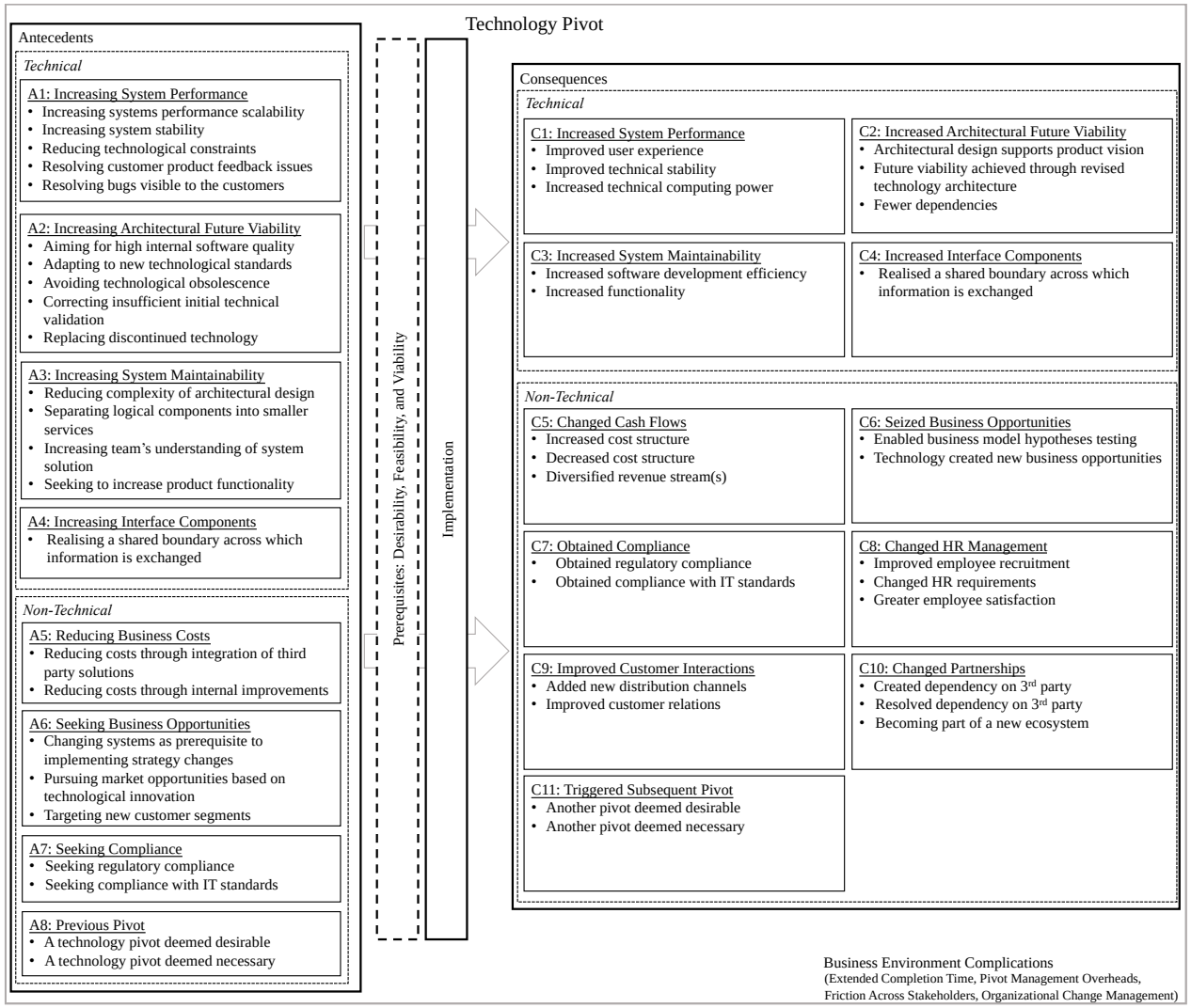
26	We pivoted from a single web platform to an integrations based approach, integrating smoothly into our customers' stacks to gather information there and collect it on our web platform.
27	We pivoted from an monolithic web app using Ruby on Rails to a single page application using React and Rails as the API.
28	We switched the core-banking system and card processor of a legacy partner bank to a top-notch provider for core banking and processing and building parts of the system on our own.
29	We switched from a React based web app to a cross-platform engine (React Native) that allowed us to have an iOS, Android and web app at the same time.
30	We introduced machine learning algorithms to augment (human) behavior, i.e. our stylists get help and constraints how to pack boxes for our customers (curated fashion shopping).
31	We switched from a SaaS offering (API) to building an open source development framework.
32	Business was not scaling properly, after customer onboarding, keeping them engaged was difficult. Delivering the promised value proposition was very hard. The user expectation could not be met. So we decided to reduce served use cases. We zoomed in on the most important functionality and removed the rest of the technical functionality.
33	We pivoted our frontend to React after using Sencha ExtJS for everything before.
34	One of our core libraries (glue library) inside our monolith architecture was not supported anymore. Therefore, we want to resolve this dependency and simultaneously switch to micro-services.
35	We pivoted the way we processed our machine learning workflow. We were doing it as batch processes and changed it to streaming processes. At first, we took the technology available at that time and then, once we grew, switched to a streaming framework.
36	We started by building a clinical solution for senior homes. Soon we realized selling clinic also includes very complex processes as it requires attorneys to review contracts. We switched to non-clinical solution to get our foot in the door quickly and had to pivot our technology accordingly to this strategic change.
37	Our application created system loads that were too high on end devices, so that a distributed solution with a dedicated backend was needed.
38	We switched from a monolith to a microservice architecture.
39	We performed a classic move from using a monolith to a micro service architecture.
40	We pivoted from MongoDB to using Rocks DB for our application.
41	Moving from a monolith to a micro-service architecture. This has been an on-going effort of first building new functionality in micro-services and then on the side deconstructing the monolith.
42	We switch from a self-developed UI framework to an off-the-shelf solution, i.e., AngularJS.
43	We pivoted our backend service from a LAMP stack to a distributed cloud based solution.
44	We switched our frontend to use React instead of Rails.
45	Acknowledging that the CRM UI part of our business was dead, as the market changed. We pivoted our CRM UI part into a chatbot solution. Changing the technology through a pivot into an onboarding through a Chatbot system.
46	We pivoted to a reactive clean architecture for our Android application.
47	Our core library (Tango) was not supported by Google any longer. Therefore, we needed to replace it with a new library (ARcore).
48	We switched from a Node.js monolithic approach to a micro-service design to improve performance and reduce reported bugs at our customers.
49	We switched from a stand-alone mobile app (database on device) to a solution with a mobile app and a dedicated backend. This needed to be done, in order to be able to better integrate (the captured data) into the business processes of our customers.

50	We took out all offline writing functionality for our app. In consequence users can't write offline, but writing together and semantic conflict resolving is improved.
51	We abandoned the current frontend framework and switched to a new frontend framework.
52	We pivoted towards React as a frontend framework, for being able to better organize our tech-team.
53	We are pivoting our core business from events to a blockchain based technology platform. As a result, we need to pivot our technology. While the problem we are solving remains the same, the technology platform allow us to scale faster, provide more value.
54	We were focusing on travel sports players and then started to focus on football players with our product. Subsequently, we needed to pivot our technology to allow for this change.
55	We pivoted our technology stack with technologies that are used more often and are better documented and maintained.
56	We pivoted our technology from an event sourcing approach with temporary databases (often only in memory) to ephemeral events and persistent databases.
57	We pivoted the creation of data insights by switching to a DWH structure, collection of user behavior in a data lake, preparing machine learning and big data analysis. This included, transforming the system architecture from direct API communication to an events-based architecture.
58	We pivoted the technology used for development of our mobile application.
59	We were switching the architecture from a batch approach to a stream processing approach.
60	We were changing our infrastructure from a containerized but self-managed architecture on AWS into a fully orchestrated Kubernetes Cluster on GCP while migrating all data and services.
61	We were pivoting our frontend, prior using PHP for programming and decided to switch to Node.js
62	The UI for our single-page-application was split into multiple dedicated single-page-applications as part of the technology pivot. Maintaining these separately we hoped for certain benefits (performance, team-coordination).
63	We replaced the whole stack with a new micro service architecture, this included a change from php to python.
64	We pivoted our technology to increase system performance and allow for new new tech features.
65	We were working on our new application, but we realized along the way that a mobile app was making things so much harder. Thus we decided to stop developing the mobile app and started working on a desktop version.
66	We switched from native app development (Android / iOS) and Parse as a Backend-as-a-Service to a web-based platform (React) with a self-managed backend.
67	Added active online tracking protection as a complementary feature to private web search within our own browser, that as a result required a significant technological adaptation.
68	We had to switch the existing machine learning framework to a custom-build solution.
69	We pivoted from a monolith architecture to using micro-services.
70	The company started with the goal of building an app-store for the web, where developers could buy app components and install them with one click. Thanks to the technology pivot were able to turn it into a marketplace for WordPress themes and widgets.
71	We were switching from web-development in Node.js to application development in C++.
72	We moved from using React on the frontend side of our SaaS to a Java Script based single application frontend.
73	We switched from React/Redux to Elm on the frontend side.

74	We moved from a PHP frontend to Java Script based single application frontend.
75	We pivoted our application towards usage of Bitcoin as hash-pointer to have a proof of existence.
76	We pivoted the technology for our core features and changed the UX/UI framework.
77	We switched our mobile development from native mobile to Unity in order to become more efficient in programming. Not having to manage two independent code bases and to align features across platforms was a huge relief.
78	At first, we only offered a private web search technology. Then, we packaged that search within an own browser and distribute it. For this, we had to significantly adapt our architecture.
79	We pivoted from a pure on-site solution to a cloud-based one.
80	We pivoted our scraper framework in order to decouple it from AWS technology, improve maintenance and introduce better insight and scalability. Furthermore, VPN management was completely reworked.
81	We were initially using an external technology team for development of our product. At some point, we needed to drop that team, and then hired an internal team that pivoted everything in the application.
82	We were switching from a Backbone to React on the frontend side.
83	We switched from a b2c centered market research platform to a purely b2b focused "employee engagement" software and "decision enabling" system for leadership purposes. As a result of this, we needed to pivot our technology quite drastically.
84	Our initial software application included connecting a hardware device via Bluetooth to the end-device (mobile). We switch towards a dedicated embedded device to reduce the focus from the end-device.
85	Originally, we wanted to help business clients with analyses of their existing data. We realized how little data were available and decided to build a consumer app instead which enables our business clients to collect these data in the first place. For this, we pivoted our technology entirely.
86	We changed from an architecture in which we had very high performance and control to a more abstract framework to improve the development speed and reduce complexity.
87	We started to create business partnerships and switched to B2B solution. As no need existed any longer to aim for an end-user facing product. We were pivoting to the new core-technology part.
88	We switched from an app with user generated content to an app that integrated various external partners (for this we needed to pivot from Apache Cassandra to a custom solution).
89	We pivoted from using iOS based on ObjC to iOS based on Swift
90	We switched from a tech-stack based on PHP & mySQL to a stack based on Java & MongoDB. This was necessary as the first stack had to many discrepancies to the open sources libraries we used.
91	We pivoted from a monolithic architecture to a micro-services architecture.

Appendix M

Table 17: Bohn and Kundisch (2018b) – “Comprehensive Preliminary Theoretical Model”



Appendix N

Table 18: Bohn (2019) – "Anonymized Job Ad Examples not Containing any References to the Technical and Non-technical Antecedents of Technology Pivots"

Example 1: Frontend Developer

About us:

(anonymized) is a fast-growing, Berlin based FinTech start-up. Founded by an award-winning team *(anonymized)*, *(anonymized)* reimagines the next generation mobile-banking platform, a platform for life. *(anonymized)* is building one app to manage all your money, where customers can integrate all their accounts and customise their service through individual experiences.

About the role:

We are expanding our development team and are looking for a motivated individual with some experience in iOS and/or Android development. You'll join a small but successful and highly skilled team and have the chance to gain hands on experience as well as building your skills and shaping the future of an interesting and dynamic startup company.

About you:

Team player, Good knowledge of English, University degree or current enrolment, 1y+ Experience of native and/or hybrid app development in iOS or android, Knowledge of mobile development frameworks preferably react-native, Knowledge of Javascript/NodeJS is a plus, Familiarity with agile development methods.

We offer:

Professional and personal development in a dynamic, vibrant and international environment Ability to impact the future direction of a new, fast-growing company.

Example 2: (Senior) Javascript Developer (m/f) with Angular 2+

Your tasks:

- Frontend conception and development for innovative web based applications for the real estate sector
- Participation in all project stages: design, implementation, test and integration
- As part of a small team you develop technologically challenging solutions
- Participation in implementing the Scrum methodology in your team
- Professional support of younger colleagues
- Internal knowledge transfer

Your profile:

- Specialist in Computer Science Application Development or university degree holder in the field of (media) computer science or similar
- Several years of professional experience as a frontend developer, ideally in the online environment and at least 1 year working experience with Angular 2+
- Profound knowledge of Typescript, JavaScript (ES6), Reactive Programming (RxJs), Node.js, HTML/SASS
- Experience in working with Angular unit tests (TestBed) and integration tests (Protractor)
- Experience in working with GIT, build tools e.g. Webpack/Gulp/Grunt Ionic
- Framework knowledge desirable Redux knowledge desirable
- Very good English skills, German skills will be an additional asset
- Confident personality as well as a structured and independent way of working

We offer:

- A pleasant workspace in the heart of Berlin-Kreuzberg
- Challenging tasks with much room for further development within the company

- An international and highly motivated team with large business experience on the management level within a dynamic PropTech start-up
- Strong team spirit supported by regular team events, internal and external workshops, joint lunch breaks and sport activities
- Water, coffee and tea as much as you wish and free beer on Fridays with table soccer tournaments and playstation sessions
- Extensive onboarding process with regular feedback and quarterly performance reviews to support your individual development Free language courses (English & German)

Our Tech-Stack:

- Languages: ES6 JavaScript, PHP, Python, Java, HTML5, TypeScript, Objective-C, SASS, Kotlin, Swift; Frameworks: Bootstrap, Ionic3/Angular4, Laravel/Lumen, CakePHP, Android SDK; Databases: MySQL, Memcached;
- Servers: nginx, apache2, Node.js; Cloud Storage: Amazon S3, Heroku; Operating Systems: OSX/MacOS, Windows, Ubuntu; Version Control System: Git; Front End Package: npm;
- Text Editor: Sublime Text;
- Code Collaboration: GitLab, Phabricator; Virtual Machine: Vagrant, docker; Virtualization Platform: VirtualBox; JS Build Tools: Grunt; Integrated Development: PhpStorm, Visual Studio Code;
- Source Code: SourceTree, GitKraken;
- Browser Testing: Selenium; Continuous Integration: GitLab CI

If we have aroused your interest, we will be happy to receive your application.

Example 3: Ruby on Rails Fullstack Developer

For our team in Berlin we are looking for Ruby on Rails developers with skills in Ruby on Rails and/or Fullstack Javascript and/or Fullstack Python / Django

++++ Frontend (Sass, React, Angular, agnostic preferred) ++++

We work with different technologies and so will you. You should have several years of professional experience have worked with several clients or projects. A university degree is not required. Also you are motivated to learn on your own and interested in the community. A huge plus would be giving talks and blogging or open source engagement. Excellent English is a requirement. German or willing to learn is a plus. Also you should be able to travel for a couple of days from time to time.

We offer:

- Competitive Salary Bonus (you can participate in the financial success of your projects= reasonable team culture and respect.
- We are nice :)
- Team-oriented workflows
- Very experienced lead developer
- Home office – Options
- Business travel program
- Traffic expenses
- Open Source – work time

What you will do:

- You will work with usually smaller teams on several projects per year.
- We rotate and never work alone. So you will learn a lot and see different stacks from legacy code to modern architecture built by very good developers.
- We build startups or support enterprises in all stages so you have the chance to learn from all of that, extracting best practices and tools.

Depending on your profile you will be able to lead projects and teams after a while. Apply for this position.

Example 4: Software Engineer, Haskell

At *(anonymized)*, the team behind *(anonymized)*, we're hiring our first engineers. We're looking for experienced candidates who are well versed in functional programming and distributed systems. We'd like to speak to people who are empathetic, humble, passionate about their work and strive for excellence. Currently, all of our efforts are focused on building the reference implementation of *(anonymized)*, an open-source protocol and network for decentralized code hosting and collaboration which aims to make open-source development more sustainable. Everything we build is open-source. Our language of choice is Haskell. You will be tasked to build and deploy fault-tolerant distributed systems based on cryptographic proofs, authenticated data-structures and distributed-ledger technologies. You will have to keep up to date with recent developments in the field; the ability to read research papers and produce working implementations is essential. You will have to be an excellent communicator, both in oral and written form. We invest in people primarily, not technologies: if you are a seasoned software engineer but lack experience with some of the tools, technologies or languages we use, we can get you up to speed. At *(anonymized)*, the culture is the people we hire. We have core tenets which you will learn about and help shape, but these revolve principally around how we treat each other and what standards we try to meet when working together. If you'd like to apply, please send us an email at *(anonymized)* with your résumé and links to or samples of work you've done; we especially value open-source contributions.

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