

# Corporate resilience through generic AI-based workflows in strategic product planning

Iris Graessler<sup>1</sup>, Deniz Oezcan<sup>1\*</sup>

<sup>1</sup>Paderborn University, Heinz Nixdorf Institute, 33102 Paderborn

\*Corresponding author. E-Mail address: deniz.oezcan@hni.upb.de

---

**Abstract:** In increasingly volatile and uncertain markets, corporate resilience has become a critical capability in strategic product planning. Companies face significant challenges in systematically monitoring and interpreting heterogeneous environmental data originating from diverse sources, formats, and temporal contexts. While predefined workflows and decision trees can support strategic analysis, they often lack the flexibility required to cope with dynamic market conditions and foresight-related data from extreme dispersed and heterogeneous sources. This paper proposes a method to enhance corporate resilience through the application of generic, reusable AI-based workflows in strategic product planning. The approach integrates Data Science and Artificial Intelligence methods into modular, visually modelled workflows that enable hybrid human-AI decision-making. Based on a systematic literature review and an analysis of industrial challenges, key success factors and resilience criteria are identified. These insights are used to develop a method that supports internal and external analyses, scenario-based strategy development, and adaptive implementation monitoring within a generic workflow structure. The method leverages techniques such as machine learning and generative AI to process structured and unstructured data, identify patterns, and support real-time strategic assessments. Validation with decision-makers from medium-sized companies demonstrates improved transparency, repeatability, and cross-functional collaboration compared to predefined workflows.

## Keywords:

Strategic Product Planning, Artificial Intelligence, workflow, resilience, decision-making

---

## 1 Motivation

In an increasingly volatile and uncertain business environment, corporate resilience has emerged as a key strategic capability in Strategic Product Planning (SPP). Good resilience enables companies to anticipate decisions in advance and create scope for decision-making in areas where scope for decision-making is very limited due to uncertainty. A major challenge is monitoring environmental influences and their impacts on the company [1]. Although data such as public statistics and trend descriptions is available, it is extremely diverse in terms of data formats, access channels, geographical and temporal contexts. Additionally, time-series data can be decisive, but only available in diverse temporal resolutions and with unclear semantic. Such extreme data is therefore only usable with enormous effort. Predefined workflows and decision trees enable to manage these complex influences but are inflexible and rigid [2]. Dynamic markets in particular require flexible and adaptive analysis mechanisms to support informed real-time decision-making. Innovative approaches in the field of Data Science (DS) and Artificial Intelligence (AI) supported systems, have potential to automate processing of heterogeneous environmental data and provide access to new insights using information in real-time assessments [3]. Developing such methods for hybrid decision support are essential for ensuring the future competitiveness and sustainable product planning and engineering in companies [4]. Therefore,

a method is needed for providing guidance for internal and external analysis, scenario-based strategy development, and adaptive implementation monitoring in a modular workflow structure in SPP.

The structure is as follows: Motivation is followed by state of the art in the relevant areas. Section three describes research questions and approach. The fourth section covers the development of the method. First the industrial challenges are analyzed and followed by a systematic literature review. Success factors are derived from review, which serve as basis for developing the method. The penultimate section presents the validation and discussion. This is followed by short summary and outlook.

## 2 State of the Art

The state of the art covers the three relevant sub-areas of this paper: SPP, corporate resilience in strategic decision-making and graphical workflow-based decision support in this context.

**Strategic Product Planning (SPP)** refers to the continuous, methodically guided business process in which companies align their product portfolios with long-term market, technology, and customer requirements, identify future product ideas, and make systematic decisions about product development [5]. SPP goes beyond pure operational project planning and encompasses a holistic analysis of opportunities, risks, and competitive advantages in order to achieve sustainable competitive advantages and set concrete engineering tasks [6]. SPP uses many methods to support decision-makers in important decision-making processes. One key method here is the scenario technique [7]. Comprehensive data models and integration of processes provide the basis for holistic insights in SPP [8, 9].

**Corporate resilience** is a central concept in management and strategy research discourse that describes the ability of companies to not only survive disruptions in an uncertain, complex, and volatile environment, but also to adapt, learn, and remain competitive. Resilience is strategically embedded in decision-making and management processes to enable continuous adaptation, risk absorption, and restoration of performance [10]. In an organizational context, resilience is understood as a dynamic capability that encompasses multiple levels—individuals, teams, structures, and external networks—and requires active adaptation to environmental uncertainties. This strategic perspective makes resilience an important design goal in SPP, not only as a response to crises, but as a proactive component of long-term corporate planning [11].

**Graphical workflow modelling** serves to interact with complex decision-making logic, data flows, and process steps comprehensible to human actors, thereby increasing both transparency and user acceptance [2]. Visual decision support system approaches typically combine structured representation techniques such as flowcharts, influence diagrams, or low-code platforms with AI methods to make data analysis and decision logic accessible [12]. Graphical AI workflow modelling must address not only technical integration problems but also organizational knowledge and domain expertise to bridge the gap between expert knowledge and algorithmic processing. Visual models not only support the configuration of AI components, but also promote human-in-the-loop interactions by enabling decision-makers to directly interpret and control assumptions, data paths, and algorithms. [13,14]

## 3 Research Questions and approach

Key objective of this research is a method for improving corporate resilience through the application of generic, reusable workflows that integrate AI into SPP. The method combines conceptual modelling with digital tools for visual workflow design, enabling decision-makers to structure, simulate and adapt planning processes across organizational contexts. It helps to combine the benefits of established methods and DS/AI contributions in terms of hybrid intelligence. This paper contributes answers to three research questions (RQ):

- RQ1: Which criteria are proposed in literature to assess corporate resilience in the SPP process using generic, AI-based workflows?
- RQ2: What success factors are relevant for the effective integration of generic AI-based workflows into strategic product planning to cope with extreme data?
- RQ3: What advantages does the method offer compared to predefined workflows?

In order to answer these three research questions, motivation and industrial challenges (1) are discussed, and a systematic literature review based on the PRISMA approach [15] is conducted (2). This review focuses on generic, reusable workflow design in SPP and its added value. The success factors from relevant approaches are recorded and used to define a method (3) that provides guidance for internal and external analysis, scenario-based strategy development and adaptive implementation monitoring in an AI-based workflow structure using DS/AI methods. The method is developed in the EU data science project CREXDATA. It is validated and discussed with decision-makers in medium-sized companies (4) by identifying strategic weaknesses, increasing adaptability and ensuring long-term profitability. The integration of graphical workflow tools into strategic decision-making improves transparency and repeatability and enables cross-functional collaboration and digital hybrid decision support in SPP, shown in Figure 1.

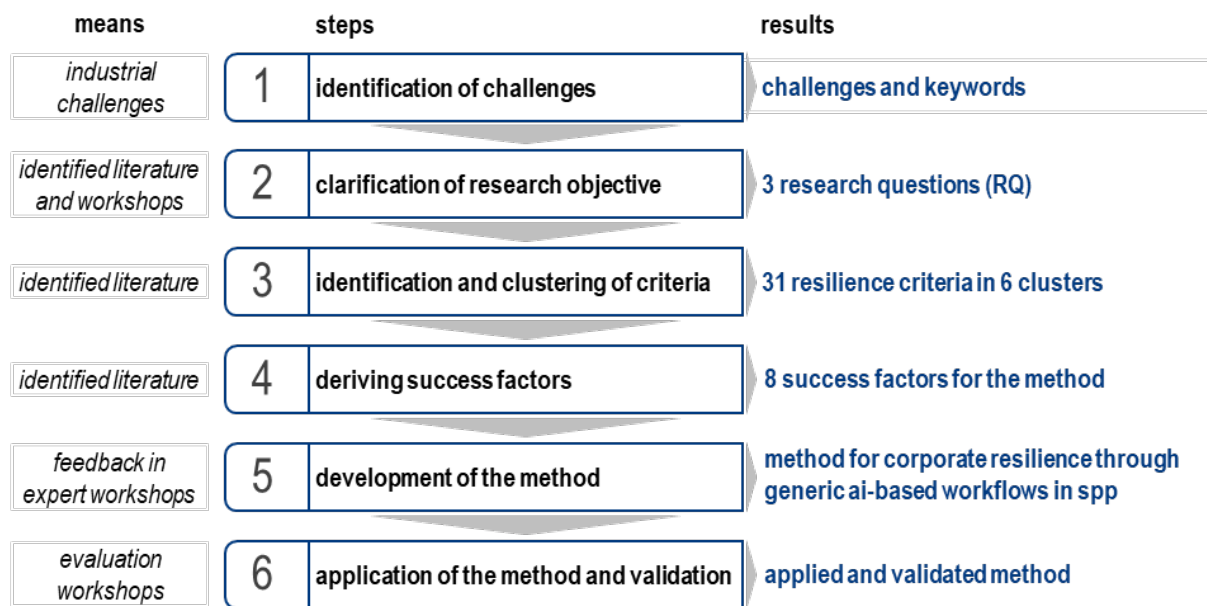


Figure 1: Scientific Approach

## 4 Development of the method

The aforementioned approach systematically links rigorous scientific research with industrial practice. First, the industrial challenges in SPP are analyzed to identify the practical problem context (4.1). Based on these findings, a systematic literature review is conducted to identify relevant concepts and criteria related to corporate resilience and AI-supported decision-making (4.2). The findings are then clustered and summarized into a set of relevant success criteria that address the identified challenges (4.3). Finally, these success factors are operationalized through the development of a modular, AI-based workflow method for strategic product planning (4.4).

### 4.1 Industrial challenges

Companies operate in an increasingly uncertain environment, which under current conditions is no longer characterized by isolated crises but by continuous disruption. Strategic planning is no longer as

promising as it was in predictable situations due to the new conditions. According to a recent study, only 8% of the companies surveyed are able to maintain their plans over a period of more than one year in a volatile environment [16]. Cross-industry studies emphasize that strategic decisions in SPP must be actively reconsidered in order to remain competitive in the long term and to be able to place products on the market. These developments highlight the industrial challenge: SPP today must not only anticipate customer requirements and future scenarios, but also have the ability to respond continuously to external shocks and highly volatile data environments [17]. Classic sequential planning models and rigidly predefined workflows reach their limits here because they are not sufficiently flexible, adaptive or data-centric. Companies must design their SPP in such a way that it is not only efficient, but also robust against uncertainties, adaptive to change and transparent in decision support [18,19]. AI-based, generic workflows represent an innovative approach to addressing these requirements by integrating techniques such as machine learning, predictive analytics and interactive modelling to navigate complex data conditions and specifically strengthen corporate resilience.

#### 4.2 Systematic literature review and criteria identification

Based on the industrial challenges, a systematic literature analysis is conducted to answer the RQs defined in section 2. In a first step, criteria to assess organizational resilience in the strategic SPP using generic, AI-based workflows are identified. The research approach is based on the PRISMA guidelines [15]. For research, the databases of Scopus, Web of Science, Science Direct and IEEE Xplore are used to identify relevant literature. Four thematic clusters feed the search string for the databases:

1. organizational resilience, corporate resilience
2. strategic product planning, development
3. artificial intelligence, data science
4. workflow, decision support, modelling

The search results in a total of 353 hits. The literature is narrowed down to 87 results by focusing on strategic decision support and relevant work from the last 10 years. From these 87 results, 16 articles are relevant by skimming and scanning. The analysis and recording of success criteria answers RQ1 by an overview of criteria for assessing corporate resilience in the SPP process using generic, AI-based workflows is shown in Table 1.

Table 1: Criteria for assessing corporate resilience in SPP

| <i>Nr.</i> | <i>Criteria</i>           | <i>Source</i> | <i>Nr.</i> | <i>Criteria</i>            | <i>Source</i> |
|------------|---------------------------|---------------|------------|----------------------------|---------------|
| 1          | customer focus[18]        | [21]          | 17         | generation of capital      | [22]          |
| 2          | external collaboration    | [21,22]       | 18         | location & marketing       | [22]          |
| 3          | digitization              | [21,22]       | 19         | proactivity                | [19,23]       |
| 4          | crisis management         | [21]          | 20         | environmental uncertainty  | [19,22]       |
| 5          | innovation                | [21,24]       | 21         | change management          | [19]          |
| 6          | corporate culture         | [20,21]       | 22         | product excellence         | [19,24]       |
| 7          | leadership                | [21]          | 23         | adaptability               | [19]          |
| 8          | digitalization of service | [24]          | 24         | redundancy                 | [23]          |
| 9          | strategic collaboration   | [22,24]       | 25         | diversity                  | [23]          |
| 10         | customer intimacy         | [24]          | 26         | prudence                   | [23]          |
| 11         | agile use of resources    | [24]          | 27         | embeddedness               | [23]          |
| 12         | improved revenue model    | [24]          | 28         | customer loyalty           | [20,24]       |
| 13         | vertical integration      | [22]          | 29         | continuous experimentation | [20]          |
| 14         | quality management        | [22]          | 30         | risk taking                | [20]          |
| 15         | business certifications   | [22]          | 31         | financial reserves         | [20,22]       |
| 16         | globalization             | [22,23]       |            |                            |               |

The identified 31 resilience-related criteria from the literature are systematically categorized into six higher-level dimensions representing distinct but complementary resilience capabilities in SPP. The categorization follows a functional logic, assigning each criterion to the dimension in which it primarily contributes to resilience, thereby avoiding conceptual redundancy while preserving analytical clarity. Six resilience capabilities are visualized in Figure 2, which enables corporate resilience, action planning, and decision making. This takes place in the SPP of the generic product life cycle. The six resilience capabilities are classified in the image, starting from the right to left, using graphical workflow modelling.

### **C1 – Anticipatory Capability**

Anticipatory capability describes the ability in SPP to identify relevant changes in the market, technology and environmental context at an early stage and to systematically integrate them into strategic decision-making processes within the company. The focus here is on the forward-looking analysis of customer needs, market trends and external uncertainties, as well as the continuous alignment of product and corporate strategy with future requirements.

### **C2 – Adaptive Decision-Making Capability**

Adaptive decision-making capability describes the ability of organizations to flexibly adapt strategic product decisions when conditions, assumptions or targets change. In the context of early stages of product development, this adaptability is crucial, as strategic decisions are often made under conditions of high uncertainty and subsequent corrections are only possible to a limited extent.

### **C3 – Robustness under Extreme Data Condition**

Robustness under extreme data condition describes the ability in SPP to remain capable of acting even under conditions of incomplete, contradictory or highly volatile data. This explicitly includes the

capability to process such extreme data, instead of neglecting it. This robustness is particularly relevant in dynamic markets where valid decision-making bases are often only available to a limited extent.

#### C4 – Transparency and Explainability

The cluster of transparency and explainability focuses on the traceability, documentability and comprehensibility of strategic decision-making processes. Transparency is a key prerequisite for acceptance, trust and organizational learning ability, particularly when using AI-based analysis and decision support systems.

#### C5 – Learning and Feedback Capability

The learning and feedback capability describes the ability of organizations to systematically learn from past decisions, experiments and their results, and to integrate this knowledge into future strategic product decisions. Resilience is understood here not as a static characteristic, but as a dynamic, learning-based process.

#### C6 – Cross-Functional Integrability

Cluster of cross-functional integrability describes the ability in SPP to integrate different functional, organizational and external perspectives into consistent decision-making processes. This ability to integrate is particularly crucial in the early stages of product development, as market, technology, cost and organizational aspects must be considered in parallel.

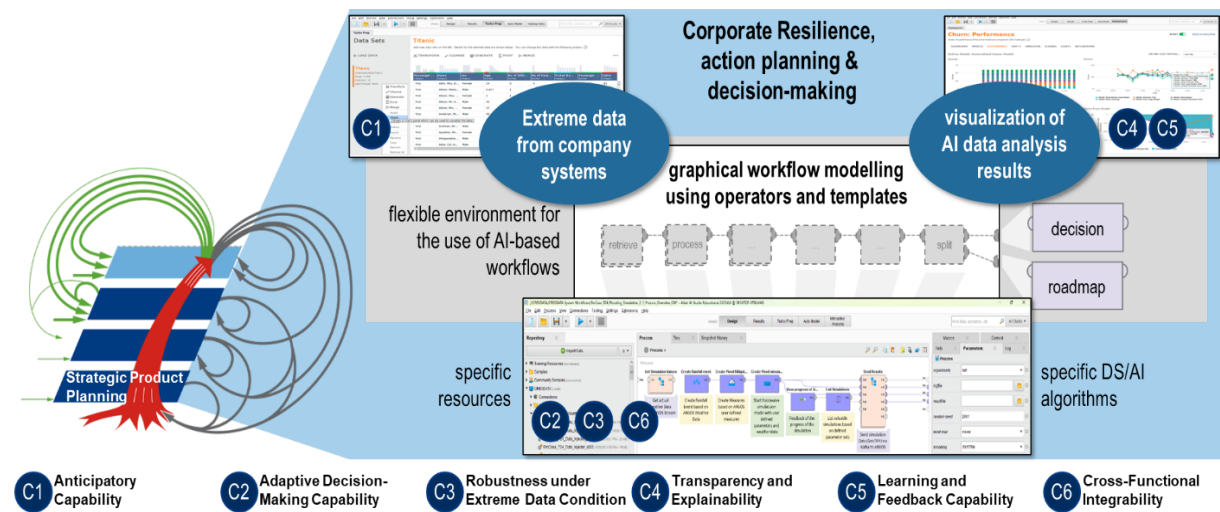


Figure 2: Resilience cluster for corporate resilience through AI-based workflows in the generic product life cycle

The 31 criteria identified in the literature are systematically assigned to six capabilities in Table 2. The six capabilities provide the conceptual basis for analyzing corporate resilience in the context of SPP, as these criteria describe what characterizes resilience in SPP (RQ1).

Table 2: Clusters of organizational resilience assessment criteria

| Nr. | Resilience Capabilities                  | Categorized Resilience Criteria |
|-----|------------------------------------------|---------------------------------|
| C1  | Anticipatory Capability                  | 1, 10, 19, 20, 22, 28           |
| C2  | Adaptive Decision-Making Capability      | 5, 11, 21, 23, 26, 30           |
| C3  | Robustness under Extreme Data Conditions | 4, 24, 27, 31                   |
| C4  | Transparency and Explainability          | 3, 8, 14, 15                    |
| C5  | Learning and Feedback Capability         | 5, 29, 30                       |
| C6  | Cross-Functional Integrability           | 2, 6, 7, 9, 13, 16, 17, 18, 25  |

### 4.3 Relevant success criteria

The six capabilities of corporate resilience identified in the SPP are examined to derive success factors of the proposed method. Investigating success factors for integrating generic, AI-based workflows aims to establish the framework conditions, mechanisms and modelling principles necessary for the resilience clusters derived in RQ1 to be effective in real-world scenarios involving dynamic and highly volatile data. These success factors are clear and address technological and organizational aspects. They describe how generic workflows must be designed, implemented, and utilized to enhance an organization's adaptability, robustness, transparency, and learning capacity. Cross-cutting success factors can be derived from the six resilience capabilities.

Table 3: Success Criteria

| Nr. | Success Factors                                            | Description                                                                                                                                                                              | Resilience Capability                                                                |    |    |    |    |    |    |
|-----|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----|----|----|----|----|----|
| SF1 | Modular and Generic Workflow Design                        | AI-based workflows must be modular in structure and generic in design so that individual analysis, evaluation or decision-making modules can be flexibly combined, replaced or expanded. | <table><tr><td></td><td>C2</td><td>C3</td><td></td><td></td><td>C6</td></tr></table> |    | C2 | C3 |    |    | C6 |
|     | C2                                                         | C3                                                                                                                                                                                       |                                                                                      |    | C6 |    |    |    |    |
| SF2 | Human-in-the-Loop Integration                              | The effective integration of AI workflows requires the explicit involvement of human decision-makers in analysis, interpretation, and decision-making processes.                         | <table><tr><td></td><td>C2</td><td></td><td>C4</td><td>C5</td><td></td></tr></table> |    | C2 |    | C4 | C5 |    |
|     | C2                                                         |                                                                                                                                                                                          | C4                                                                                   | C5 |    |    |    |    |    |
| SF3 | Visual Workflow Modelling and Explainability               | Visually modeled workflows increase transparency, traceability, and organization-wide comprehensibility of AI-supported decision-making processes.                                       | <table><tr><td></td><td></td><td></td><td>C4</td><td></td><td>C6</td></tr></table>   |    |    |    | C4 |    | C6 |
|     |                                                            |                                                                                                                                                                                          | C4                                                                                   |    | C6 |    |    |    |    |
| SF4 | Integration of Heterogeneous Data Sources                  | Ability to systematically integrate structured and unstructured internal and external data, such as extreme data.                                                                        | <table><tr><td>C1</td><td></td><td>C3</td><td></td><td></td><td></td></tr></table>   | C1 |    | C3 |    |    |    |
| C1  |                                                            | C3                                                                                                                                                                                       |                                                                                      |    |    |    |    |    |    |
| SF5 | Scenario-Based and Iterative Decision Logic                | Successful AI workflows do not support singular “optimal” decisions, but enable scenario-based, iterative evaluations.                                                                   | <table><tr><td>C1</td><td>C2</td><td></td><td></td><td>C5</td><td></td></tr></table> | C1 | C2 |    |    | C5 |    |
| C1  | C2                                                         |                                                                                                                                                                                          |                                                                                      | C5 |    |    |    |    |    |
| SF6 | Continuous Learning and Feedback Mechanisms                | AI-based workflows must incorporate feedback loops to continuously improve foresights, models, and decision-making logic.                                                                | <table><tr><td></td><td>C2</td><td></td><td></td><td>C5</td><td></td></tr></table>   |    | C2 |    |    | C5 |    |
|     | C2                                                         |                                                                                                                                                                                          |                                                                                      | C5 |    |    |    |    |    |
| SF7 | Organizational Data and AI Governance                      | Clear rules on data quality, model use, responsibilities, and decision-making rights are essential for sustainable use.                                                                  | <table><tr><td></td><td></td><td>C3</td><td>C4</td><td></td><td></td></tr></table>   |    |    | C3 | C4 |    |    |
|     |                                                            | C3                                                                                                                                                                                       | C4                                                                                   |    |    |    |    |    |    |
| SF8 | Cross-Functional and Cross-Domain Collaboration Enablement | AI-based workflows must actively support cross-functional collaboration, for example through shared data models and collaborative interfaces.                                            | <table><tr><td>C1</td><td></td><td></td><td></td><td></td><td>C6</td></tr></table>   | C1 |    |    |    |    | C6 |
| C1  |                                                            |                                                                                                                                                                                          |                                                                                      |    | C6 |    |    |    |    |

RQ2 is addressed by identifying eight success factors that enable the effective integration of generic, AI-based workflows into SPP. These factors include modular workflow design, human-in-the-loop integration, visual and explainable workflow modelling, heterogeneous data integration, scenario-based decision logic, continuous learning mechanisms, organizational AI governance, and cross-functional collaboration support. Together, these success factors operationalize corporate resilience by embedding adaptability, robustness, and transparency directly into strategic planning workflows.

### 4.4 Development of the method based on the success factors

The synthesized success factors are used to create a guide for internal and external analyses, scenario-based strategy development, and adaptive monitoring within a modular workflow structure. Internal analyses include, for example, SWOT analysis (strengths, weaknesses, opportunities, threats) and analysis of production KPIs, while external analyses include market-specific KPIs and key figures. A

modular workflow structure enables the monitoring of KPI systems and the internal operation of independent operators for market analysis, risk assessment, and strategy monitoring for SPP. The operators are standalone, reusable building blocks that enable both internal and external analyses, support scenario-based strategy development, and ensure adaptive monitoring. Each operator fulfills a clearly defined function, is interoperable with other operators, and integrates both AI-supported analyses and human decision-making processes (human-in-the-loop) [25]. The method, which is shown in the middle of Figure 3, integrates scenario-based strategy development by simulating and evaluating alternative strategic options under varying assumptions. AI-supported models identify patterns in historical and current data, while decision-makers can interpret and adjust the results. This enables flexible, robust decisions even in cases of extreme data heterogeneity or uncertainty. Adaptive monitoring is achieved through continuous monitoring of selected KPIs within the operators. Feedback loops and learning mechanisms dynamically adapt models, parameters, and strategy paths to changing internal and external conditions. Through this integration of analysis, simulation, and continuous adaptation, the method supports both operationalized resilience and transparent and traceable decision-making. Overall, the method enables a modular, scalable, and reusable workflow architecture that efficiently combines internal and external analyses, scenario-based strategy development, and adaptive monitoring. Through the clear assignment of functionalities to operators, the identified success factors (SF1–SF8) are directly operationalized, enabling robust and adaptive SPP.

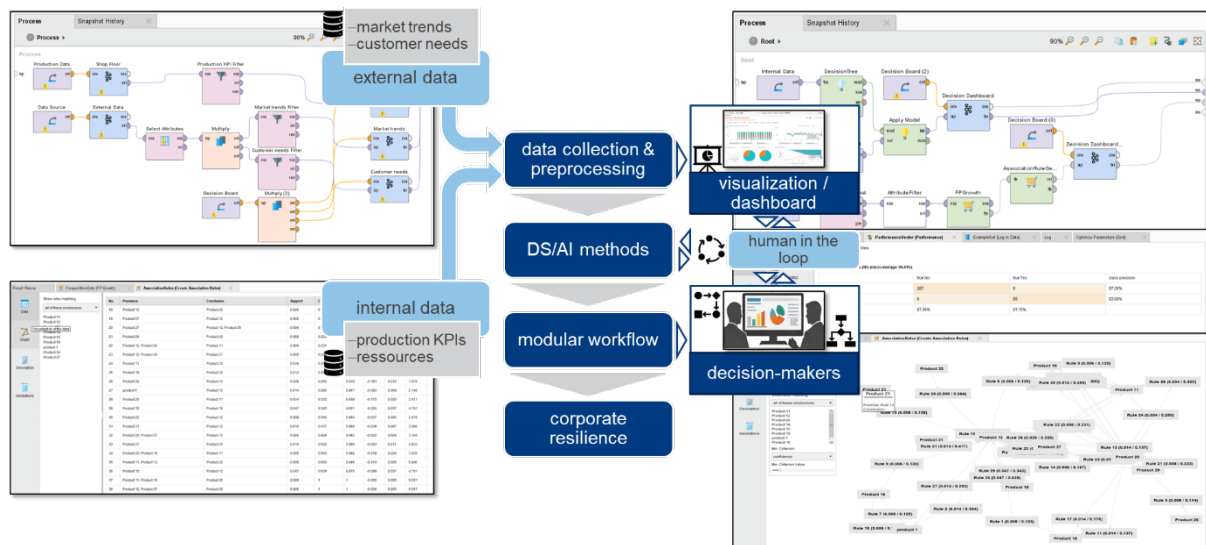


Figure 3: Method for corporate resilience through generic AI-based workflows in SPP

## 5 Validation and discussion

The developed method was validated through application and qualitative evaluation with decision-makers from medium-sized companies. Focus of validation was on evaluating the practical applicability, perceived benefits and limitations of the modular, AI-based workflow approach under real decision-making conditions, rather than on quantitative performance benchmarking. An important result of the validation was the perceived improvement in the decision-making process in SPP through the integration of graphical, modular workflow tools. Decision-makers emphasized that the visual representation of analyses, data flows and dependencies significantly improved transparency. Compared to predefined or static workflows, the modular approach made assumptions, data sources and analysis steps explicit, thereby increasing the traceability of strategic decisions. In addition, participants highlighted repeatability and consistency as key benefits. The reuse of generic workflow operators enabled comparable analyses across different planning cycles and strategic decisions. This directly answers RQ3 by showing that the method offers structural advantages over predefined workflows, which are often

closely linked to specific use cases and difficult to adapt without extensive reconfiguration. Another important positive aspect was the support for cross-functional collaboration. The modular structure enabled different organizational units (product management, production, marketing) to make domain-specific contributions via specialized operators while maintaining a common analytical framework. This facilitated coordination between functions and reduced the coordination effort, which is particularly important in medium-sized companies with limited analytical resources. Decision-makers also appreciated the concept of digital hybrid decision support, which combines AI-based analysis with human judgement (human-in-the-loop). Nonetheless, several limitations were identified during validation. The method currently relies on a qualitative assessment involving a limited number of decision-makers, which limits the generalizability of the results. The effectiveness of the approach depends on the availability and quality of the data. Although the method is designed to handle heterogeneous data sources, incomplete, inconsistent or poorly managed data can compromise the reliability of AI-based analyses and thus the certainty of decisions. The validation demonstrates that the proposed method effectively enhances transparency, repeatability, and cross-functional collaboration in SPP, thereby addressing RQ3. At the same time, the discussion highlights important limitations related to data dependency, organizational maturity, and scalability. These findings underline both the practical relevance and research potential of generic AI-based workflows as a foundation for resilient strategic decision-making.

## 6 Summary and Conclusion

Based on extensive literature research and a review of generic, reusable workflow designs in SPP, aspects of increasing corporate resilience are identified. This is supplemented by the inclusion of challenges from industrial practice. These challenges include the early identification and assessment of opportunities and risks, as well as the use of heterogeneous data sources. DS/AI enables users to solve data-related problems and make quick and transparent decisions. DS/AI approaches such as generative AI in Large Language Models enable automated extraction of information and trends from unstructured external data sources like news articles or market reports. Machine learning algorithms such as supervised and unsupervised learning methods are used to identify patterns and anomalies within KPI analyses that are relevant for risk assessment and strategy monitoring. Six resilience capabilities are identified based on 31 resilience criteria, answering RQ1 based on systematic literature analysis. RQ2 is answered by deriving success factors from these clusters and their correlation with tasks in SPP. Targeting these success factors, the paper presents a method that provides guidance on internal and external analyses, scenario-based strategy development, and adaptive monitoring within a modular workflow structure. Internal analyses include SWOT-analysis and production KPI analysis, for example, whereas external analyses include market-specific KPIs and key figures. This modular workflow structure enables different KPIs to be monitored and independent operators for market analysis, risk assessment and strategy monitoring to be operated internally for SPP. The method has been validated with decision-makers in medium-sized companies. The decision-making process in the SPP process was improved through integration of graphical workflow tools. The decision-makers highlighted transparency and repeatability, based on the success factors, which answer RQ3. They also emphasized cross-functional collaboration and digital hybrid decision support.

## 7 Acknowledgements

The research leading to these results has received funding from the European Union's Horizon Europe Programme under the CREXDATA Project, grant agreement n° 101092749. We extend our gratitude to all collaborators, partners, and contributors involved in CREXDATA for their dedication. Results are reflected by the scope of DFG SPP2443 (coordination, PN521148212).

## References

- [1] R. Stark, G. Seliger and J. Bonvoisin, eds., *Sustainable manufacturing. Challenges, solutions and implementation perspectives*, Cham, Switzerland, 2017).
- [2] J. Deuse, R. Klinkenberg and N. West, *Industrielle Datenanalyse*, Wiesbaden: Springer Fachmedien Wiesbaden, 2024.
- [3] I. Gräßler, J. Pottebaum, R. Stark, P. Nyhuis, K.-D. Thoben and P. Wiederkehr, "Hybrid Decision Support in Product Creation. Improving performance with data science and artificial intelligence," *Industry 4.0 Science*, vol. 41, no. 1, pp. 18-25, 2025. DOI: <https://doi.org/10.30844/I4SD.25.1.18>.
- [4] F. Nyffenegger, J. Ríos, L. Rivest and A. Bouras, eds., *Product Lifecycle Management Enabling Smart X*, Springer International Publishing, 2020.
- [5] I. Grässler, S. Rarbach and B. Grewe, "Modell der Strategischen Produktplanung. Digitale Zwillinge für kreislauffähige Produkte und Produktionsprozesse," *Industry 4.0 Science*, vol. 2025, 2025.
- [6] P. Brandtner and M. Mates, "Artificial Intelligence in Strategic Foresight – Current Practices and Future Application Potentials," in *The 2021 12th International Conference on E-business, Management and Economics*: New York, NY.
- [7] I. Graessler and D. Oezcan, "Quality Key Figures for Developing Future Scenarios," *Human Systems Engineering and Design (IHSED2024): Future Trends and Applications*, vol. -2, 2024. DOI: <https://doi.org/10.54941/ahfe1005553>.
- [8] I. Graessler, J. Pottebaum and P. Scholle, "Integrated Process and Data Model for Agile Strategic Planning," 11th International Workshop on Integrated Design Engineering IDE Workshop, 2017.
- [9] I. Graessler, P. Scholle and J. Pottebaum "Integrated process and data model for applying scenario-technique in requirements engineering," *Proceedings of the 21st International Conference on Engineering Design ICED 17*, 2017.
- [10] W. Su and S. Junge, "Unlocking the recipe for organizational resilience: A review and future research directions," *European Management Journal*, vol. 41, no. 6, pp. 1086-1105, 2023. DOI: <https://doi.org/10.1016/j.emj.2023.03.002>.
- [11] A. Annarelli and F. Nonino, "Strategic and operational management of organizational resilience: Current state of research and future directions," *Omega*, vol. 62, pp. 1-18, 2016. DOI: <https://doi.org/10.1016/j.omega.2015.08.004>.
- [12] A. Kovari, "AI for Decision Support: Balancing Accuracy, Transparency, and Trust Across Sectors," *Information*, vol. 15, no. 11, p. 725, 2024. DOI: <https://doi.org/10.3390/info15110725>.
- [13] R. W. Belk, D. Belanche and C. Flavián, "Key concepts in artificial intelligence and technologies 4.0 in services," *Service Business*, vol. 17, no. 1, pp. 1-9, 2023. DOI: <https://doi.org/10.1007/s11628-023-00528-w>.
- [14] I. Graessler and D. Oezcan, "Graphical AI workflow modelling: Identifying relevant competencies in AI-based automation of business processes," in *Human Systems Engineering and Design (IHSED2025): Future Trends and Applications*, AHFE International: AHFE International, 2025, <http://doi.org/10.54941/ahfe1006785>.
- [15] M. J. Page, J. E. McKenzie, P. M. Bossuyt, I. Boutron, T. C. Hoffmann, C. D. Mulrow, L. Shamseer, J. M. Tetzlaff, E. A. Akl, S. E. Brennan, R. Chou, J. Glanville, J. M. Grimshaw, A. Hróbjartsson, M. M. Lalu, T. Li, E. W. Loder, E. Mayo-Wilson, S. McDonald, L. A. McGuinness, L. A. Stewart, J. Thomas, A. C. Tricco, V. A. Welch, P. Whiting and D. Moher, "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews," *Systematic reviews*, vol. 10, no. 1, p. 89, 2021. DOI: <https://doi.org/10.1186/s13643-021-01626-4>.
- [16] C. Fuchs and R. Tischler, "Resilient Planning in Volatile Markets. Building flexibility and speed into forecasting and planning to navigate uncertainty," *BARC Research Study*, vol. 2025.
- [17] J. Tüllner and J. He, "Global Crisis and Resilience Survey 2023. Die Resilienz-Revolution hat begonnen," PwC, 2023.
- [18] I. Graessler and D. Oezcan, "Identifying future competence demands in production companies for strategic decision-making," in *19th CIRP Conference on Intelligent Computation in Manufacturing Engineering*, 2025.
- [19] K. Dindarian, *Unvorhergesehenes als Chance sehen – Black Swan*Cham: Springer International Publishing, 2024.
- [20] R. Swaminathan, "How Can Resilience Create and Build Market Value?," *Journal of Creating Value*, vol. 8, no. 2, pp. 204-218, 2022. DOI: <https://doi.org/10.1177/23949643221125287>.
- [21] M. Radic, P. Herrmann, P. Haberland and C. R. Riese, "Development of a Business Model Resilience Framework for Managers and Strategic Decision-makers," *Schmalenbach Journal of Business Research*, vol. 74, no. 4, pp. 575-601, 2022. DOI: <https://doi.org/10.1007/s41471-022-00135-x>.
- [22] S. Syamsul Hadi, "New Perspective on the Resilience of SMEs Proactive, Adaptive, Reactive from Business Turbulence: A Systematic Review," *JOURNAL OF XI'AN UNIVERSITY OF ARCHITECTURE & TECHNOLOGY*, XII, V, 2020. DOI: <https://doi.org/10.37896/JXAT12.05/1524>.
- [23] M. Reeves and K. Whitaker, "Innovating Management Innovation," *Strategic Management Review*, vol. 3, no. 1, pp. 157-167, 2022. DOI: <https://doi.org/10.1561/111.00000040>.
- [24] T. Eriksson, M. Heikkilä and N. Nummela, "Business model innovation for resilient international growth," *Small Enterprise Research*, vol. 29, no. 3, pp. 205-226, 2022. DOI: <https://doi.org/10.1080/13215906.2022.2092890>.
- [25] I. Brüggemann, S. Buse and N. Villarreal, *How AI can increase resilience in small and medium-sized companies*, 2025.