Paradigm Academic Press
Art and Society
ISSN 2709-9830
OCT. 2024 VOL.3, NO.5

Systemic Perspective on Companies and the Digital Transformation: A Prototypical Methodological Approach as a Solution to Complex Business Problems

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doi:10.56397/AS.2024.10.04

Abstract

Due to changing market conditions, customer needs and environmental influences, organisations are facing increased pressure to transform in today's world. The consequences of the COVID-19 pandemic have made many organisations aware of the importance of digital transformation in order to remain successful even in times of disruptive change. However, the pandemic has also shown how connected and complex the world is.

The aim of this work is to answer the question of what a possible systematic method for dealing with complex business problems might look like. Dealing with complexity is a critical factor for any organisation and determines how resilient it can position itself in the face of dynamic environmental influences.

To answer the research question, a prototype was first developed based on Niklas Luhmann's systems theory, from which a systematic method was derived. The prototypes were then further developed and validated in qualitative expert interviews. A systems theory approach was chosen because it claims to construct a holistic picture of the company as a social system and thus to capture the interactions of all system components. Qualitative interviews based on a semi-standardised approach were used to test the prototypes for comprehensibility, applicability, and validity. German experts in the fields of system technology, change management and digital transformation were interviewed.

Keywords: digital transformation, complexity

1. Introduction

Companies are currently facing the challenge of digital transformation, which is reorganising business models, business areas and core competencies (Schallmo & Williams, 2023). These sometimes disruptive changes have led to far-reaching changes in all industries. For example, companies are inevitably becoming more complex due to innovative approaches based on new technical possibilities or ever-increasing global networking as new regions and business areas are opened up (Heywood et al., 2010).

In the recent past, the COVID-19 pandemic has impressively demonstrated how interconnected the world already is. A key term that summarises this interconnectedness of all systems and processes is complexity. It is therefore important to deal explicitly with complexity and explore how it can be successfully managed in the context of digital transformation.

The study therefore examines how a fundamental systemic approach can be developed that describes a company and its environment as a system network from the outset in order to be able to deal with complexity in a

sustainable manner. The research question of what a systematic method for solving complex business problems in the context of digital transformation might look like is investigated in this article.

Chapter 2 looks at the theoretical foundations of complex business problems in the context of digitalisation. Chapter 3 shows the qualitative research approach. Chapter 4 presents an empirically validated prototype for solving complex business problems based on Luhmann´s system theory. For the validation 14 German experts from the area of systems engineering, change management and digital transformation. have been interviewed. Chapter 5 summarises the main findings and shows possibilities for further research.

2. Foundations of Complex Business Problems in the Context of Digitalisation

Industrialisation and globalisation also increase complexity due to growing interconnected networks, elements and systems. The stronger such interdependencies are in an organisation, the more difficult it is to identify the causes of complex problems (Burkhardt, 2017).

In view of the increasing complexity and unpredictability, it is becoming ever more important for companies to transform themselves digitally in order to meet these challenges. This forces companies to align their strategy, structure and personnel with new requirements. If companies do not transform themselves accordingly, new competitors will enter the market within a very short space of time who have better adapted to the dynamic environment with improved business models (Wolters, 2016). Digital transformation can be seen as a catalyst for growth and sustainable success in order to remain competitive in the future and make the organisation more resilient to external influences (https://www.accenture.com/gb-en/insights/digital-transformation-index, last access 06/11/24).

The digital transformation is a global and social phenomenon that will have a lasting impact on the strategy and business models of organisations. Companies face various challenges and risks that need to be considered in the change process (Gabriel, 2023).

The balancing act between strategic and operational considerations is therefore a complex challenge (Dahm & Walther, 2019). New technological trends have far-reaching consequences for the economy and society. Managing directors must therefore identify the entire business potential along the entire value chain (Bowersox et al., 2005, Rusnjak & Schallmo, 2017). The necessary change processes profoundly affect existing company processes and organisational structures, resulting in a company-wide impact (Kreutzer, 2017). However, the challenge lies not only in assessing the importance of digital technologies, but also in designing a suitable digitalisation strategy and managing the transformation process accordingly (Oswald et al., 2022).

The challenges of digital transformation that have already been discussed cannot be overcome on a departmental or specialised basis. In order to overcome complex problems, interdisciplinary knowledge exchange and interdisciplinary collaboration are required (Appelfeller & Feldmann, 2023). However, many companies find it difficult to approach digital transformation holistically and systematically derive fields of action. Organisations often do not have enough time, money or expertise to tackle digitalisation initiatives effectively. This is why they prefer to solve a specific but isolated problem instead of pursuing a holistic approach (Lang et al., 2023). It is therefore important to always discuss digital transformation projects in the context of environmental requirements (Rahnfeld, 2021).

Against this backdrop, it is crucial that companies see themselves as part of a dynamic environment. Digital transformation requires dynamic capabilities in order to implement changes in value creation processes and organisational tasks and achieve competitive advantages. For complex problems, however, the strategic management literature recommends understanding digital transformation as a systemic concept and thus making it a strategic priority (Hess et al., 2016, Ellström et al., 2021). A systemic approach ensures coherence and minimises the inefficient distribution of resources. A company is therefore a socio-technical system that must consider the interactions between technological, organisational and social elements (Menzefric et al., 2023).

In order to develop a systematic method for tackling complex problems in the context of digital transformation initiatives, it is first necessary to categorise the digital transformation into the ‘corporate system’ on the basis of relevant specialist literature. The aim is therefore to establish a theoretical framework based on systems theory concepts that views the company as a system that interacts with its environment. In this way a systematic method is developed that goes beyond isolated and unconnected individual elements and instead ensures a holistic approach. The development of such a systematic method is based on an understanding of systems theory.

Niklas Luhmann is responsible for the introduction of systemic thinking into social science theory. In his 1984 work ‘Social Systems: Outline of a General Theory’, he coined the term ‘system’ and made the claim of a metatheoretical explanation. Niklas Luhmann explains the concept of a system on the basis of its environment. Luhmann explains that the environment is everything that the analysed system is not (Rahnfeld, 2021). The system is therefore the difference between the environment and the system. Nevertheless, the concept of environment must be understood as highly variable, as environment and system are mutually dependent and

cannot exist without their respective counterparts (Luhmann, 1984).

Simple basic principles are required to understand elements in organisations as modules and to provide a uniform and consistent system architecture that can contribute to complexity reduction. The basic principles here are aimed at the determinants of complexity (variety and connectivity) (Koppenhagen, 2014). Frequently observed problems in companies consist of the new integration of ideas or structures in order to react ad-hoc to challenges that arise. These are merged with old ideas and structures, which can lead to a considerable increase in complexity. In contrast, a series of simple basic principles to which all system elements conform increases the probability that new elements can be integrated into a system without greatly increasing its complexity (https://hbr.org/2020/01/taming-complexity, last access 06/11/2024). In addition to trivial systems, in which basic principles such as uniform interfaces, modular abstraction, compliance with standards or high cohesion (functions and components contained within a module should be strongly interrelated) can be easily implemented, non-trivial systems can also be designed according to these basic principles. In this way, the systemic, constructivist approach may be employed as a foundation for organisational development, and can be utilised as a basis for determining the value and practicality of specific methods or practices (Meseck, 2021).

A solution-orientated systemic approach would address the question of how the business model can and must be changed at a time when technology is having a long-term impact on the business itself. This illustrates the systemic approach of viewing the company holistically as part of its environment and thus continuously recognising and reacting to irritations. Looking at the environment and asking how the current situation can be seen as an opportunity and how this can have a positive impact on the current business model helps to deal with environmental influences in a more resilient and sustainable way. The way we perceive our environment is strongly influenced by its structure and communication. Derived from this, this means that a company is restricted by itself. It can only perceive what its structures allow it to see.

3. Research Approach

The research approach utilizes a qualitative methodology, specifically expert interviews, to explore how complex business problems can be systematically addressed during digital transformations. This method was chosen to generate new insights and theories, rather than testing predefined hypotheses. The process involves two main steps: first, a deductive approach is used to develop prototypes based on systems theory, particularly Luhmann's concept of complexity reduction. The first prototype outlines a systemic representation of a company, while the second develops a systematic method for solving complex business challenges. In the second step, an inductive approach validates these prototypes through semi-structured interviews with experts. These interviews provide subjective perspectives, enhancing the method's credibility. The findings are synthesized to refine the method, which is then tested through a practical case study to assess its applicability.

The prototype is based on the interpretations of the author of Luhmann's works and of people who have edited Luhmann's texts. It is therefore necessary to validate the prototype through expert interviews in order to ensure methodological validity.

To validate the literature-based prototypes, it is necessary to identify a certain number of test subjects who also have the necessary technical expertise to provide qualified answers during the interviews. The number of people to be interviewed is based on the scientifically recognised sample size of ten to 20 people for qualitative survey studies (Döring & Bortz, 2016). As part of the empirical research, 14 people were identified who were available for data collection as part of an individual interview. The areas of systems engineering, change management and digital transformation were identified as relevant specialist areas for the validation of the prototype.

A semi-standardised guided interview[1] was chosen for the validation of the prototypes. These are conducted in the form of individual interviews in order to obtain the subjective assessment of the test subjects with regard to comprehensibility, interpretation and applicability.

4. Empirically Validated Prototype for Solving Complex Business Problems

In the rapidly evolving landscape of digital transformation, businesses are frequently confronted with multifaceted challenges that demand innovative and adaptable solutions. Traditional methods often fall short in addressing the dynamic and interdependent nature of these problems. To navigate this complexity, a new systematic approach has been developed and empirically validated through expert interviews and literature-based techniques. This chapter delves into the intricacies of this prototype, detailing its methodological steps and elucidating how it enables organizations to manage and solve complex business issues effectively. Through this method, companies can derive valuable insights, question existing structures, and develop new ideas organically. This chapter will provide a comprehensive overview of the steps involved in this systematic method, illustrating how it helps organizations navigate the complexities of digital transformation and maintain competitive

[1] The interview guide can be provided upon request.

advantage in a constantly shifting environment.

The systematic method for solving complex business problems, particularly in the context of digital transformation, is validated and considered applicable by participants. It combines literature-based techniques with empirical results from expert interviews, emphasizing the necessity for a flexible rather than rigid approach to address complexity effectively.

The first step, "Understanding the Problem" focuses on reducing complexity by breaking down identified issues to their fundamental characteristics. This step underscores the importance of prioritization, recognizing that multiple problems are often encountered simultaneously. Hierarchization of these problems is an integral part of this process.

The literature-derived insight that targeted "Abstraction" helps reduce complexity is also supported by the participants. In this second methodological step, it is essential not to remain at a high level of abstraction but to vary the level of abstraction according to the requirements. A detailed overview of individual system components is necessary to understand their fundamental principles and their interaction with overarching principles. In the initial prototype, the rationale for outsourcing innovation was critically discussed, with the consensus being that innovation should be embedded throughout the company. Consequently, the step of "Outsourcing Innovation to Subsystems for Centralized Innovation Promotion" has been removed from the current method. Nevertheless, strategically pursuing innovation remains critical for business success, which is addressed in the subsequent step, "Developing New Ideas and Innovations."

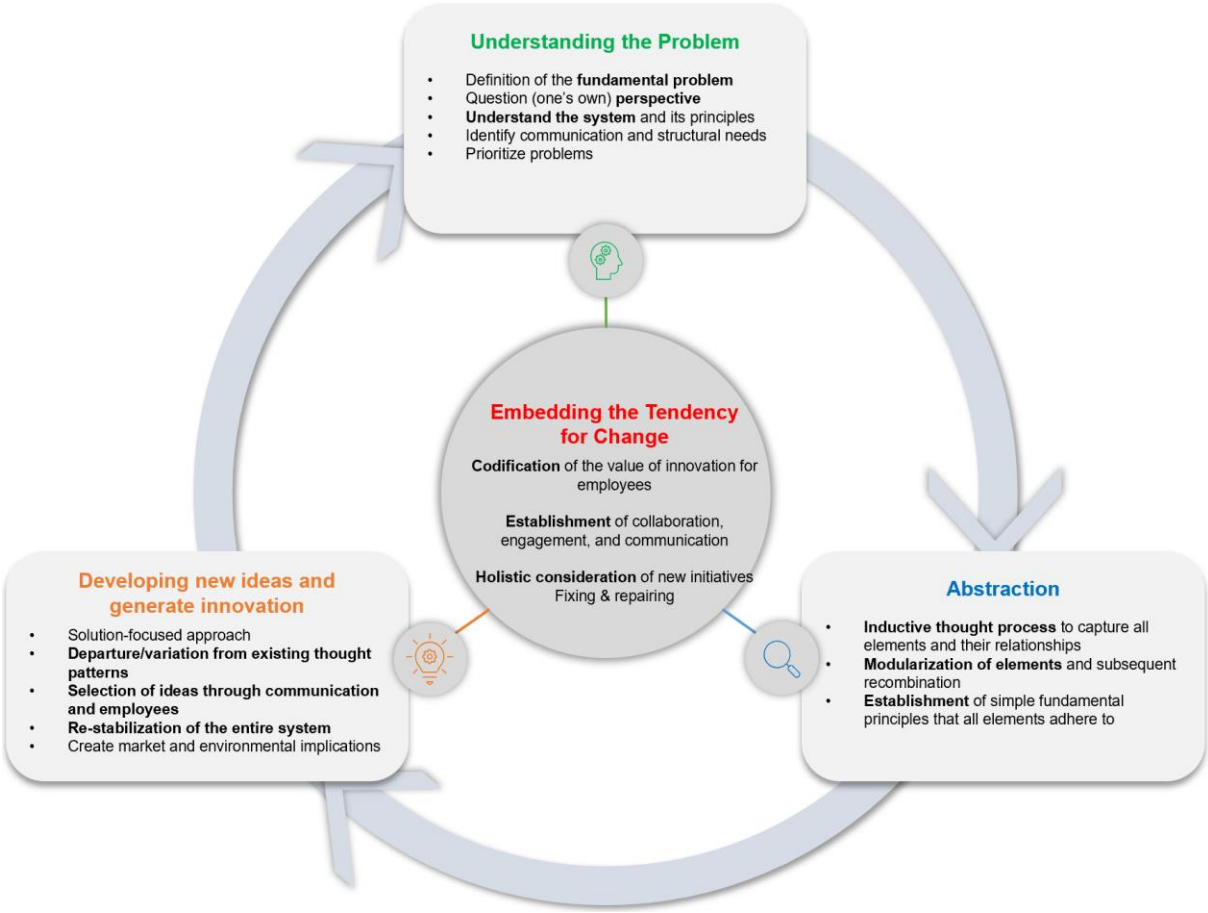
In the third step, "Developing New Ideas and generate Innovations" the method emphasizes understanding issues comprehensively before jumping to solutions. It encourages organic idea development and innovation across the entire organization, as opposed to isolating these efforts in specific units. This approach aligns with the view that innovation should be embedded throughout the company. The method also includes targeted abstraction to manage complexity, as supported by literature. This step necessitates a detailed understanding of system components and their interactions without remaining at a high abstraction level for too long. The need for adaptable abstraction levels is highlighted, depending on specific requirements. Incorporating Niklas Luhmann's evolutionary innovation theory, the method promotes a process of variation, selection, and re-stabilization. This step encourages iterative and adaptive problem-solving to respond to dynamic environments, fostering an evolutionarily oriented approach to organizational innovation. The method acknowledges that complex problems often require iterative solutions to adapt to new influences and develop effective responses.

The final step, "Embedding the Tendency for Change," highlights the importance of collaboration, communication, and engagement. Continuous establishment of these elements supports adaptability and the emergence of new properties within systems. Effective communication is essential for addressing changes and irritations within the company, ensuring that the organization can respond dynamically to its environment.

The method offers a framework for addressing complexity in digital transformation through systematic and cross-system approaches. It aids in deriving insights and logical conclusions from observed phenomena, questioning existing structures, and identifying potential new ideas. The method does not impose technological solutions but instead fosters an environment for organic idea generation and problem-solving. Digital transformation initiatives are seen as enhancing a company's ability to respond effectively to environmental challenges by leveraging available technologies. Understanding which technologies hold potential for solutions and integrating them seamlessly into the system is crucial. The method focuses on the system's structure and self-determined innovation potential rather than on specific technologies.

Leadership plays a vital role in this method, facilitating intelligent and adaptable communication among employees. Leadership is viewed as an organizational capability, shaped by interactions and dependencies within the system, rather than as a personal attribute. The method is visualized circularly to indicate that developing new ideas can lead to identifying new problems, requiring continuous re-evaluation and re-prioritization. The central position of "Embedding the Tendency for Change" underscores its continuous execution within the organization, highlighting that adaptability and continuous learning are essential for responding to a dynamic environment.

By adhering to these steps, the method provides a structured yet flexible approach to managing complexity and driving innovation in a dynamic business environment. This framework helps organizations not only explore new problems but also question existing structures systematically and constructively, fostering an environment where new ideas can organically develop to reduce or avoid complexity.



5. Conclusion and Outlook

In the following chapter, the results of the investigation are analyzed and interpreted, considering both the strengths and limitations of the work to provide a comprehensive understanding of the achieved outcomes. Additionally, an outlook on future research endeavors is given.

The choice of a systemic approach to address the research question is explained by the complementary nature of complexity and systems theory. Both theories are closely intertwined as they deal with the understanding and analysis of complex systems. Thus, the systemic perspective serves as a suitable theory for solving complex problems in the context of digital transformation. The systematic method for solving complex business problems is revisited, emphasizing its key principles. The first step, "Understanding the Problem," involves identifying complex situations and understanding the structure and communication within the company from a systemic perspective. This approach helps in identifying the root causes behind initially observed symptoms by considering the problem within its systemic context. It underscores the significance of constructivism in systems theory by encouraging questioning one's own perspective and those of others. The actions in this step aim to impart systemic principles to the actor, enabling a holistic view of the situation.

The second step, "Abstraction," builds on the comprehensive understanding of the company as a system. It is based on the systemic premise that system components should not be viewed in isolation but in terms of their interactions and feedback loops. Here, the initial prototype is practically applied as a template for developing a systemic representation of the company. A systemically abstract representation reduces complexity by focusing on essential features.

To address complex problems, the method proposes establishing innovation and generating new solutions to keep pace with an increasingly complex environment. This is linked to the autopoietic nature of companies, where they sustain and continuously reproduce themselves. This continuous reproduction requires companies to constantly develop internal processes and relationships. The increasing complexity demands adaptations, with Luhmann's evolutionary innovation theory serving as the theoretical foundation. The process steps of varying thought patterns, selecting ideas, and re-stabilizing the system are central to the innovation process.

The central paradigm, "Embedding the Tendency for Change," equates companies with social systems that are part of a dynamic environment. To adapt to a complex and dynamic environment, continuous change must be

established, based on principles like compatible communication, collaboration, and a holistic view of new initiatives. The goal is to empower employees to communicate and select ideas and innovations. This dimension also emphasizes the importance of structural couplings, facilitating the flow of information between different systems, and the necessity of considering complexity at an organizational level.

The method's effectiveness lies in the organization engaging systemically with itself, gaining a dynamic view of itself and its environment. The method does not provide a structured approach to solving complex problems but develops a comprehensive and dynamic perspective, enabling the organization to address complex issues in a constantly changing context. Some participants have noted that there can be no rigid method for complexity due to its dynamic and nonlinear nature. Complex problems cannot be solved with a single method, as the output of input variables in a non-trivial system cannot be predicted. Although it is not possible to develop a universal method useful for all types of complex systems, methods from systems theory or complexity science can help in dealing with complexity.

Confronting complexity requires awareness that there will be no simple solutions. The approach should not be to correct symptoms by relying on a methodical search for solutions. Instead, methods like the one proposed aim to capture the extent of complexity across the entire company. Complexity, due to its dynamics, nonlinearity, and feedback loops, cannot be understood in the short term. Continuous change and innovation are needed to respond to complex problems sustainably. Complex problems often arise as new issues that have not been encountered before. These cannot be solved with established approaches as they were not developed for the specific problem. There is a constant need to view innovation as a key resource. Innovation is not planned, but suitable conditions (such as agile and creativity-promoting structures in the organization) can be created for it. Operational methods like Design Thinking, Domain Driven Design, or Value Stream Mapping can be concrete starting points to create these conditions.

The systemic view of companies, projects, or products helps to enhance value creation efficiency. Establishing systemic thinking firmly in product, innovation, or business model development has several advantages. For instance, a product is more than just the product itself; it is a coherent, integrated package of experiences and ideas. Understanding the product in its entirety across departmental boundaries can lead to efficiency gains in innovation and product development.

As the world becomes increasingly complex due to digital transformation, our thinking should also become more complex by reflecting on how our roles interconnect. A systemic approach should expand beyond the prevalent customer-centric approach to a system-centric approach. Strategic decisions are always embedded in a context with the entire environment in a systemic approach. The management provides the necessary strategic orientation for the whole system. Understanding digitization not technocratically is crucial, as technology is not an end in itself but is used to achieve efficiency or effectiveness gains. While technology can be experimented with to foster innovation, this should be done methodically and reflectively to achieve learning effects. Domain knowledge must also be integrated from the outset. Communicative compatibility is essential — from IT structures designed with standard formats and protocols, to suppliers and customers, to employees who must be able to communicate effectively. Clear governance and a systemic understanding of leadership are required. Leadership and communication should be seen as organizational capabilities rather than individual skills. Successful digital transformation requires semantic compatibility on a technical level, connecting system elements correctly. A purely product- or customer-centric approach is insufficient and should be complemented by the systemic perspective. The author sees higher value creation potential in a system-focused approach, as innovative products can be integrated into comprehensive IT solutions and platforms.

Addressing complex problems through a system solution requires significant reorganization and cultural change within the company. The dimension "Embedding the Tendency for Change" already integrates this. Further research could explore the benefits of a system-focused approach for developing comprehensive business models and identify reorganization requirements. Future research could also compare theories from design thinking or network theory with systems theory, examining similarities and differences in handling complexity and potential combinations. Additionally, the innovation process could be specifically investigated, exploring how evolutionary innovation can be integrated into a company. Although some operational methods were mentioned, they were not further pursued. Research could explore which specific methods are suitable from a systemic perspective for dealing with specific complex problems.

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