Digital Transformation of an OEM Development Process from a Socio-Technical Perspective: A Case Study

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Abstract: Based on the RFLP concept (requirements, functions, logic, product) of model-based systems engineering, a function-oriented approach can enable a universal, data and model-driven knowledge management system for product development. Additionally, this approach can automate development steps and ease communication between disciplines. However, the impact of function-orientation on the established organizational structures remains unexplored. This case study investigates the effects of digital transformation towards function-orientation on the knowledge management system of a large corporation from a socio-technical perspective. OSTO® system model (open, socio-technical, economic) is employed to analyse and redesign the socio-technical system to observe the possible effects. The results show that the main limitations of the development department lie within the information and decision-making systems. RFLP-based function-oriented development can address these limitations, resulting in an efficient, universal, data-driven knowledge management system.

1 INTRODUCTION

The automotive industry currently faces multiple challenges regarding new technologies, including electromobility and autonomous driving. Vehicles as products are changing considerably to address these challenges, which results in increased complexity, where multiple disciplines (mechanics, electronics, software) are intertwined. These changes in the product necessitate the development process to adapt to the improved product, increasing the complexity of the process as well (Udo Lindemann, Maurer, & Braun, 2009). The organizational structure of an original equipment manufacturer (OEM) plays a significant role in the process complexity (Kreimeyer & Lindemann, 2011). A shift in mindset where the development focus is on the vehicle functions can provide an adequate solution. Function-oriented development offers a new approach where the focus is on the functions as opposed to components. Such an approach can help designers manage the product and process complexities by (among others) a universal data-driven data structure and enabling easy communication between disciplines (Albers et al., 2019; Jacobs et al., 2022).

Function-oriented product development methods are being explored in research and industry (Albers et al., 2019; Albers et al., 2020; Denger, Fritz, Kissel, Parvan, & Zingel, 2013; Jacobs et al., 2022; Politze & Dierssen, 2008; Renner, 2007). However, introducing and implementing such an approach in an established organization is not yet fully understood. This shift in development approach also indicates a digital transformation because function-orientation can only be implemented if the existing knowledge management system is remodelled accordingly. Information systems play a significant role in knowledge management, as they facilitate the information and knowledge capture, storage, organisation, and retrieval in the organization. It is important to analyse the existing socio-technical system to understand how a function-oriented

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concept can be implemented and its possible effects. Hence, this paper aims to uncover the effects of the digital transformation towards function-oriented development on an OEM (specifically its knowledge management system) using a socio-technical system model. This is done by analysing the current state of the development department, defining the ideal function-oriented development approach, redesigning the organization in a way to accommodate function-oriented development, and observing the possible effects. The results of this case study provide valuable insights for knowledge management systems and the organizational development of OEMs.

2 STATE-OF-THE-ART FROM AN HTO PERSPECTIVE

Function-oriented development in this case study refers to a development approach where the focus is on product functions that result in a certain product behaviour expected by the customer. In this context, function-oriented development is used for complex, mechatronic products. The complexity of a product stems from the number of components and interdependencies between them. Mechatronic products consist of a significant number of mechanical, software and electronic components. Due to the complexity of the product, this approach necessitates a well-suited and -structured knowledge management system.

There are multiple approaches to function-oriented development. RFLP (requirements, functions, logic, product) approach of model-based systems engineering is the most common (Jacobs et al., 2022). There is no standardized definition of function-oriented development. However, there are some technological characteristics that the most prominent approaches have in common: model-based approach, solution neutrality, and functions as a communication basis (Uhri & Isenhardt, 2023).

Model-based approach, in contrast to document-based, proposes that the information exchange should be based on models instead of documents during development (Jacobs et al., 2022). Advantages of a model-based approach include visualization of the design problem, decreased susceptibility to errors, higher system reliability, improved comprehension of the system, easier design reuse, real-time collaboration on a model, and potentially reduced development cost and time (Bergmann, 2014). Solution neutrality is the definition of functions independent of a solution alternative where functions and solutions are considered separately. This allows for out-of-the-box thinking and the reuse of existing functions for different products (Renner, 2007). Additionally, the solution neutrality of the functions helps the descriptions of the functions to be domain-independent and thus, serve as a communication basis for multiple disciplines (Albers et al., 2019). The complexity and interdisciplinarity of mechatronic products necessitate strong interdisciplinary communication. Functions should be formulated in a discipline- and solution-independent manner to be comprehensible to all relevant disciplines. This will allow the designers to understand the system they develop and its context within the product and communicate between different domains (Denger et al., 2013; Jacobs et al., 2022).

While technological aspects of function-orientation have been explored, the research on human and organizational factors is limited (Uhri & Isenhardt, 2023). Yet the importance of the human, technological, and organizational (HTO) factors (Eklund, 2000) for the success of a new technology or process are emphasized in function-orientation (Albers et al., 2020; Politze & Dierssen, 2008; Renner, 2007) and in socio-technical design research (Mumford, 2000). Designers are encouraged to include the customer perspective of the functions to develop a user-oriented product (Albers et al., 2020). Product ontologies can help to achieve this (Politze & Dierssen, 2008). Understanding the system and its adaptability are integral to the success of the product (Renner, 2007). Organizational barriers between teams, non-standardized and ambiguous terminology for development artefacts (within an organization or the industry), differing structures and workflows and emphasis on data protection that hinders data flow are some of the significant challenges faced during the implementation. Differentiating between users and decision-makers and adapting strategies for both (including change management strategies) can help with these challenges (Renner, 2007).

Factors that could support the digital transformation towards function-oriented development from an HTO perspective include mindset change, user-friendly interfaces, step-by-step transformation, alignment with the existing structures, and management support (Uhri & Isenhardt, 2023). Designers should be open to new development approaches for a successful implementation. This can be done by adapting change management methods and showing the importance of the transformation for the survival of the company. User-friendly design of not only the tools but also the methods, structures and processes can help the implementation. Step-by-step transformation towards function-orientation is essential for the acceptance of the new methods. Alignment to the existing structures also helps with the acceptance, allowing the reuse of existing structures. Without management support, no new process can be implemented. They must be shown the benefits and necessity of function-oriented development. (Uhri & Isenhardt, 2023)

3 RESEARCH GOAL

The current state of research in function-oriented development states the benefits of such a framework on the development process, which include customer-oriented products, shorter development times, stronger cross-disciplinary collaboration, fostering innovative solutions, complexity management, data consistency and traceability, and remaining market-competitive (Uhri & Isenhardt, 2023). However, the research mainly focuses on the technological side of the framework.

According to the socio-technical design research (Eklund, 2000; Mumford, 2000), as well as the human factors research in engineering design (Ernst, 2014), the success of a new framework within a company mainly depends on the considerations of human and organizational aspects as well as technological factors. Implementation of a new development framework heavily relies on the existing processes and organization, yet the effects of function-orientation on the established socio-technical system are not yet known. Hence, this case study aims to predict the potential implications of the transformation towards function-oriented development on the company for its successful implementation. This research paper aims to answer the following research question (**RQ**):

RQ: *What are the possible effects of the digital transformation towards function-oriented product development on an established OEM (specifically on its knowledge management system) from a socio-technical perspective?*

4 METHODOLOGY

OSTO® is a cybernetic system model where organizations are considered open systems with closed feedback loops (Hanna, 1988). The model is helpful to analyse existing systems and observe the possible effects of a change at any stage of the system. Additionally, the model allows the designers to consider multiple design elements as well as their interdependencies. Thus, they can depict and analyse a complex system. The model was initially formulated by Hanna (1988) and further developed by Rieckmann and Weissengruber (1990) and Henning and Marks (1996).

OSTO is an acronym for open (offen), socio-technical (soziotechnisch), and economic (ökonomisch) aspects of a system. The system is open, enabling it to interact with its environment. The social part of the model refers to the parts with human involvement, which comprises the organizational structure, information and decision process, reward and control system, motivation of the employees and the organizational culture. The technical part refers to the physical and material parts of the system, which include the tools, methods, machinery, infrastructure,

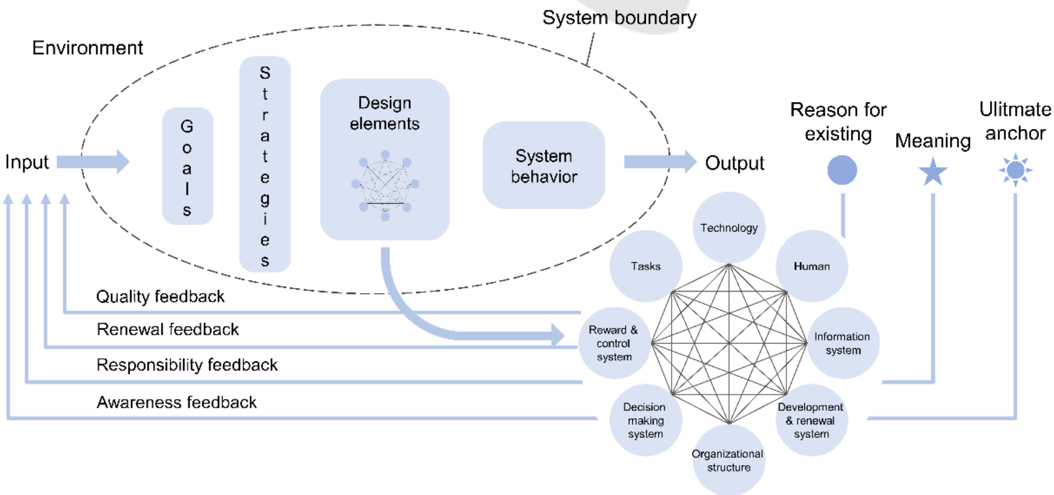

Figure 1: An overview of the OSTO® system model (based on Henning & Marks, 1996; Rieckmann & Weissengruber, 1990).

and processes. The economic parts of a system comprise all the activities that result in the economic efficiency of the system, such as budgeting, investments, revenue trends, and controlling.

Figure illustrates the OSTO® system model in the structure variation (Henning & Marks, 1996; Rieckmann & Weissengruber, 1990). Less relevant components, (meaning, ultimate anchor), and their feedback loops (responsibility and awareness) are not considered in this case study. An organization includes a significant number of components (for instance in input, output, and system behaviour). It is important to only focus on the components that are relevant to the goal of the analysis. Sections 4.1 and 4.2 describe the OSTO® system model used in this study (Henning & Marks, 1996; Rieckmann & Weissengruber, 1990).

4.1 OSTO® System Model Components

System Boundary: The system boundary separates the system and its environment and can be physical, temporal, social or psychological. Correct identification of the system border is essential to defining and describing the system accurately. Since the system is open, it can interact with its environment.

Environment: Anything that is outside of the system boundary and the system interacts with is defined as the environment. In terms of an organization, the environment can include customers, political conditions, the market, and society in general.

Reason for Existing: The reason for existing describes the purpose of a system. It describes why the system exists and which environmental need is fulfilled by the existence and output of the system.

Input: The input of the system comes from its environment and its feedback loops and can include both material and immaterial items.

Goals and Strategies: The goals of a system are derived from the reason for existing. The strategies are derived from the goals and aim to describe the steps to achieve the goals.

System Behaviour: The system behaviour describes all the actions that result in the system output and outcome. The behaviour can be altered by changing the design elements.

Output & Outcome: The output of a system describes all the desired and non-desired items a system produces. Output includes both work results of a system, as well as immaterial outputs such as motivation of the employees or amount of workload. Outcome refers to the financial output of the system.

Feedback Loops: Feedback loops are an essential part of the model. The loops ensure that the time dimension is considered, and the system adapts, develops, and stabilizes according to its output and reason for existing. Quality feedbacks respond to the quality of the output. Renewal feedback gives the response from the environment on the reason for existing.

Design Elements: Design elements are the core of the model and describe the individual components that make up the system. They are interconnected and a change made in one element has consequences on all the other elements and the system as a whole.

The **human** element comprises all the personnel of an organization as well as their roles and relationships. The **technology** element includes all the material equipment needed to produce the system outcome (e.g., infrastructure, materials, property…). **Organizational** structure refers to the procedures and processes of the organization for its operations. The **tasks** element describes the tasks the organization must finish and their structure and division into subtasks for the organization to function. The **decision-making system** describes all the mechanisms that are relevant to the decision-making process (e.g., relevant roles, hierarchies, tools, processes etc.). **Information system** comprises all the relevant mechanisms for information retrieval, storage, transformation, display and communication with their reasons. **Reward and control system** regulates the human, process, and technical behaviour of a system with reward and control mechanisms (e.g., monetary incentives, acknowledgements, responsibility, personal development etc.). **Development and renewal system** controls the performance and adaption capacities of a system and helps an organization to develop further.

4.2 Study Design

The analysis of the system was done using the OSTO® system model with method (OSTO) and field (vehicle development) experts. The workshop format is taken from Rieckmann and Weissengruber (1990) and adapted for this study. Two workshops were conducted to analyse the system. The diagnosis workshop was done "backwards", i.e., starting from the system boundary and output, working through the reason for existing, system behaviour and design elements, and concluding in system goals and strategies. In contrast, in the redesign workshop, the goals and strategies were defined first, and the system output was predicted at the end.

In this case study, the system was the development department of an OEM, which produces vehicles (a complex mechatronic product). Specifically, the knowledge management system was analysed within the socio-technical context. Since the investigated subject is a major corporation with tens of thousands of employees, the analysis gives an overview of the company structure and does not represent the intricacies of all departments. Additionally, the analysis focus lay on the areas that required improvement, and not on the organization as a whole. Thus, the many (positive) aspects were overlooked.

The goal of the diagnosis workshop was to determine the limitations within the development department of the company that can be addressed by function-oriented development. Based on the results from the diagnosis, the system was redesigned to accommodate function-oriented development. The ideal system was described, and the organization was adapted to achieve this ideal. The model also allowed the experts to predict the possible behaviours and outcomes of the system when the changes are implemented.

5 RESULTS AND DISCUSSION

5.1 Results of the System Diagnosis

The diagnosis began with the **definition of the system boundary**. In this case study, the system boundary was set as the entire vehicle development department. The department includes structures that encompass requirements management through to integration and testing of the virtual product. Departments that lie outside of the system are other departments of the company, government policies, market, end customers and society in general. The company and product strategy and production planning departments are in direct contact with the system through inputs and outputs.

The next step was to **determine the system inputs and outputs**. The system gets its input from the end customers through the product strategy department, which determines the customer requirements. Additionally, the previous product concepts are also taken in as input, as well as the quality feedback and quantity predictions from the production planning. The main system output is the description of a production-ready product and all the relevant data for its production. However, there are also unintentional outputs. One noteworthy output is the insufficient interdepartmental information transfer. This causes the production planning department to generate a certain amount of information again, which results in redundant work and possible errors in the system.

Afterwards, the **reason for existing** was defined. The reason for existing of the development department is to fulfil the need of the production planning department for the production-ready product description. This description meets the product requirements provided by the company strategy department (regarding market value, sustainability, feasibility, cost-effectiveness etc.).

The next step was to **observe the system behaviour** that leads to the system output. It should be emphasized that this list is not exhaustive and only the relevant behaviour patterns were examined that require improvement. A significant amount of development-relevant information exchange happens on an informal level and is not always systematically documented. The information storage and sharing are heavily dependent on the individuals and not standardized. A personnel change may indicate that the information and expertise are partially lost, and additional effort is needed to gather the information again. Another behaviour observed was in the decision-making system. Some decisions are mainly based on the expertise of the employees. While domain expertise is very valued, major changes in product requirements and boundary conditions show that expertise alone may not always result in optimal decision-making. Thus, among expertise, multiple factors must be considered for the decision-making system. The company produces a commercially very successful, high-quality, and reliable product. Thus, up until recently, next-generation products have been heavily based on previous products. While this is a successful path to produce similarly high-quality products, changing requirements and boundary conditions must be considered for a successful market launch and competitiveness. Therefore, over-reliance on previous projects may not be enough to create a successful, customer-oriented, innovative product. Innovative ideas can initially meet with scepticism, especially if similar projects were unsuccessful before.

The subsequent step was to **determine the design elements** that caused the system behaviour. The design elements were focused on the identified behaviour patterns and mainly aimed to solve the limitations of the company. It is not an exhaustive list and only the most significant findings are listed here. The information systems are not consistent and universal within the company. While this is to be expected to some degree (different departments utilize domain-specific databases and tools), the interfaces are not always sufficiently defined and structured. The system is specifically designed in this way for data privacy. This results in information being shared only when asked and with a valid reason, and not automatically shared with the necessary parties (need-to-know principle). There is a focus on expert knowledge, which is very valuable but not always accessible and discoverable. This results in a loss of knowledge when the expert switches their role, department, or company. Informal yet significant information exchange is not always documented and thus can be lost easily. There can be a somewhat risk-avoidant culture within the company, where the previous product design is taken as the benchmark and improved upon when necessary. This is a valid approach, as long as the next generation of products still fulfils the customer requirements. Since the requirements are changing rather rapidly, this approach alone is not enough to remain market competitive.

The final step of the diagnosis was the **identification of the goals and strategies** of the system. The main goal of the development department is to create a high-quality product. Other related goals include using and optimizing the existing concepts, and the safety and security of the product, process, and company. The strategies to reach these goals include using successful previous product concepts as the basis for next product iterations, using proofs-of-concept for all innovative ideas, using standards for quality measurement, IT security through company hardware and software and the need-to-know principle for all data.

The OSTO® model helped to understand the relevant and critical underlying mechanisms of the organization and structure the system components of the development process. The chain of events and information were observed and categorized. A structured look at the system highlighted the parts that need to be improved. The redesign workshop helped to reorganize and improve the system in the right direction.

5.2 Results of the System Redesign

The redesign workshop began with the **definition of the ideal system**. The expectations and goals for function-oriented development were listed. In the redesign workshop, the system was adapted in a way to fulfil the listed goals. Function-oriented development aims to create transparent and permeable systems and use functions as a communication basis across different disciplines, potentially resulting in (semi-) automated workflows. The automation shall help decrease the workload, thus creating time that can be used to generate innovative ideas. With different creativity techniques, a mindset for new, innovative solutions and transparency between subsystems and disciplines can be achieved. These goals can also help to evaluate different solution ideas objectively, thus increasing the number of innovative ideas incorporated into the product.

After defining the ideal system, the **system boundary was set**. In this case, the boundary remained the same, the entire development department. The next step was to **define the reason for existing**. The reason for existing was improved to not only include the product quality and efficiency but also the process and company quality. The new reason for existing of the development department is to fulfil the needs of the top management of the company, which is a product development process that fulfils the determined quality, cost, and efficiency criteria. By shifting the focus from production planning to top management, the entire company is aimed to be shaped to be efficient, in terms of costs, quality, and time. This not only includes the product but also the processes and structures within the company.

The next step was to **identify the goals and strategies**. Not all goals and strategies were irrelevant or required alteration, so some of them remained unchanged. The main goal is still to generate a high-quality product. Additional goals that were defined here were producing innovative products, as well as an efficient and flexible development process. Similarly, the strategies that fulfil the existing goals were kept. The old strategies that do not fulfil the new goals were removed. The new set of strategies includes the reuse of existing concepts if necessary; reducing workload for generating time for innovation; generating a cost, quality, and time-efficient development process; using standards for quality measurement (and defining these standards if they do not yet exist); and traceability and transparency on the process, product, and organization.

Afterwards, the new **design elements were identified**. These design elements were added to the existing elements (unless concurrent). RFLP-based function-oriented product development can be implemented within the company to address many of the goals and strategies. This has implications for many design elements, mainly on the information system, human, tasks, and technology. The concept aims to establish a consistent, universal, model- and data-driven knowledge management system within the company (by remodelling the existing system). This, along with function, system, property, and product libraries, can help with the reuse of previous product concepts as well as solution ideas systematically. This development framework also allows the designers to have a better understanding of the system they are developing, specifically within the context of the product. Using the framework, tasks can be (semi-) automated and interfaces can be clearly defined. It also helps to create a traceable and transparent development process where relevant information can be accessed easily. Relevant responsible roles for each RFLP element can be easily identified. Along with the solution-neutral description of the functions, these roles help with the communication between different teams, roles, and disciplines. Instead of a need-to-know principle, a publisher and subscriber concept can help with the interface definitions and ease information access for those to whom it is relevant. The innovative spirit of the company can be increased by using idea collectors and innovation days.

The subsequent step was to **observe the system behaviour**. The system behaviour at this stage was mainly a prediction and cannot be deduced explicitly due to the abstraction of the system and the lack of external validation. Given the design components, the reliance on previous concepts, mainly expert-based decision making and the tendency to reject innovative ideas will most likely no longer be observed. Additionally, the amount of informal information exchange was also expected to be decreased due to the more structured knowledge management system.

Lastly, the **system output was predicted**. The main output of the system (description of a production-ready product and all relevant data) will likely remain, possibly with more innovative product concepts. The main improvement of the output should be the interdepartmental information transfer and the

Model component	Diagnosis workshop	Redesign workshop
System boundary	Vehicle development department	
Reason for existing	Product description that fulfills the product requirements provided by the company strategy	Product development process that fulfills the determined quality, cost, and efficiency criteria
Inputs	▪ Customer requirements ▪ Feedback from production planning ▪ Previous product concepts	
Goals	▪ Generating a high-quality, reliable product ▪ Utilizing and optimizing existing concepts	▪ Generating a high-quality, reliable product ▪ Producing innovative products ▪ Efficient and flexible development process
Strategies	▪ Use successful previous product concepts as the basis for next product iterations ▪ Use proof-of-concepts for all innovative ideas ▪ IT security through company hardware and software and need-to-know principle for all data	▪ Reuse of existing concepts if necessary ▪ Use a time, cost, quality efficient development process ▪ Secure traceability and transparency on the process, product, and organization ▪ Reduce workload to generate time for innovation ▪ IT security through company hardware and software
Design Elements	▪ Somewhat inconsistent, local, not fully digitized, manual multiple information systems ▪ Focus on expertise knowledge ▪ Somewhat risk-avoidant culture	▪ RFLP-based function-oriented product development ▪ Universal, data- and model-driven, traceable, accessible knowledge management system ▪ Publisher-subscriber concept ▪ Innovation days and idea collectors for innovation
System behaviour	▪ Occasional informal and undocumented information exchange ▪ Expertise-based decision-making system ▪ Product based on previous concepts	▪ Systematized and documented information exchange ▪ Expertise and model-based decision-making system ▪ Use of previous product concepts when necessary ▪ More innovation in the product
Outputs	▪ Description of a production-ready product and relevant data ▪ Additional generation of development data due to insufficient interdepartmental information transfer	▪ Description of a production-ready, innovative product and relevant data ▪ Efficient product development process

Figure 2: Summary of the most significant findings from the workshops.

resulting redundant work, which will be improved upon with the proposed items. The efficient development process will also likely be an output. Figure summarizes the most significant (not all) findings of the OSTO® system model diagnosis and redesign.

5.3 Discussion

The OSTO® system model was very beneficial for the examination of the organization in a structured and systematic manner. The workshop format was rather unconventional for the field experts, who have a technical background. The case study improved the system understanding from a socio-technical perspective. While the company provides a state-of-the-art product, humans play a crucial role in the development process and the organizational structure, which is not usually, explicitly addressed. Providing a human-centred process and socio-technical system thinking can support the development of an efficient knowledge management system. This can increase employee satisfaction and identification with the company. These effects can help retain experienced employees and attract new talents, which can mitigate the effects of the skilled worker shortage.

"All organizations are perfectly designed to get the results they get" (Hanna, 1988). The output of the system has been optimized well in the last decades. With the volatility of the automotive industry, the output must be tailored to match the expectations of the market and the customer. This also means that the organization itself must work on its limitations to remain market competitive and fulfil its reason for existing. The goals of the system must change to achieve different results (Hanna, 1988). By adopting the goal to incorporate an efficient development process, the organization can generate an adequate, market-competitive, and innovative product. RFLP-based function-oriented development can help the company achieve this goal by addressing the limitations in the information systems and providing an adequate knowledge management system. The knowledge management system must be remodelled to accommodate the RFLP model, considering the specific requirements of the organization (regarding the product, structures, and processes…).

Some of the HTO-relevant factors of function-oriented development (Uhri & Isenhardt, 2023) were addressed in the redesign workshop. Specifically, the mindset changes in both designers and decision-makers, alignment to the existing structures, and user-friendly interfaces were considered. The redesign workshop set mindset change as a goal for the way towards function-oriented development. New design elements were added to incorporate function-oriented development in the existing organizational structures. The redesign workshop focused on the needs of the designer to generate a user-friendly process. Elements such as improving system understanding, traceability and transparency of the systems, and easier communication between disciplines can help to develop a human-centred process. Though not explicitly addressed, management support and step-by-step transformation towards function orientation are essential and must be considered in the further development of the approach.

This case study includes the development department of only one OEM. Therefore, the results have limited generalizability and applicability. Nevertheless, the results contribute to the development of function-orientation with consideration of HTO factors. The interdependencies between the design elements create a hard-to-predict system behaviour and output. Changes to multiple design elements at once may result in chaotic and unpredictable system behaviour. Thus, it is important to not alter too many elements at once to keep the system in check. The inclusion of RFLP-based function orientation may be at the limits of this rule. Hence, the interdependencies between design elements must be inspected further.

The redesign workshop can be seen as a systematic and thorough yet abstract creative exercise to predict the possible effects. The effects are merely posited by the experts and not empirically tested. These effects may differ when the approach is implemented within the context of the organization.

6 CONCLUSION AND OUTLOOK

This case study aims to observe the possible effects of the digital transformation caused by the implementation of function-orientation on an established OEM and its knowledge management system. The limitations of the system were determined through a systematic analysis of the existing organizational structures. Subsequently, the ideal system that utilizes function-orientation was defined. The existing system was redesigned in a way to accommodate function-orientation and its effects on the company were observed.

It is concluded that the information systems and the designer and decision-maker mindsets are the main areas that can be improved upon. RFLP-based function-oriented development can be used to create an accessible, traceable, data-driven, universal knowledge management system. This approach enables the easy communication of different disciplines on a systematically documented model, which can support the decision-making process (along with expert knowledge). In addition to the existing goal of generating a high-quality product, the company can aim to generate a time, cost, and quality-efficient development process to incorporate and sustain function-orientation within the organization. The socio-technical and systematic look at the organization was crucial to discovering the limitations of the system and providing solution alternatives.

This research contributes valuable insights for the further development of the function-oriented approach and the knowledge management systems including the technological, human, and organizational perspectives. Further research is needed to concretize and empirically test the results. Additionally, further organizations and products can be analysed to validate the results.

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