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The impact of Design Thinking in innovation: A case study at Scania IT

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Abstract

Innovation is the valuable outcome of new idea implementation. New technologies are disrupting industries, and innovative implementations bring competitive advantages.
However, what is the perception of design and innovation in organizations such as Scania IT and how can design practices develop innovation? This thesis goal is to explore how Design Thinking methodologies are being used in innovation processes within the automobile industry and specifically SCANIA IT.

How innovation is fostered and supported, which frameworks and processes are being used to generate, evaluate and develop new ideas and services. The research question that this thesis aims to examine is the following: What is the perception of design and innovation in their current work practices, and how can Design Thinking support Scania IT service design innovation processes? In the paper data and results of the on-premises study is presented. A total of nine interviews and two workshops with a total of 17 participants were conducted. The thematic analysis that follows reveals a matrix of topics and concepts.

Sammanfattning

Innovation är det värdefulla resultatet av implementering av nya idéer.
Ny teknik stör industrier och innovativa
implementeringar ger konkurrensfördelar.
Men vad är uppfattningen om design och innovation
i organisationer som Scania IT och hur kan designa praktiker
utveckla innovation? Målet med detta examensarbete är att utforska hur
Design Thinking-metoder används inom innovation
processer inom bilindustrin och specifikt
SCANIA DET.

Hur innovation främjas och stöds, vilka ramar och processer som används för att generera, utvärdera och utveckla nya idéer och tjänster. Forskningsfrågan som denna avhandling syftar till att undersöka är följande: Hur ser uppfattningen ut om design och innovation i deras nuvarande arbetssätt och hur kan Design Thinking stödja innovationsprocesser för Scania IT-tjänstdesign? I papper presenteras data och resultat från den lokala studien. Totalt genomfördes nio intervjuer och två workshops med totalt 17 deltagare. Den tematiska analysen som följer avslöjar en matris av ämnen och begrepp.

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ABSTRACT

Innovation is the valuable outcome of new idea implementation. New technologies are disrupting industries, and innovative implementations bring competitive advantages. However, what is the perception of design and innovation in organisations such as Scania IT and how can design practices develop innovation. This thesis goal is to explore how Design Thinking methodologies are being used in innovation processes within the automobile industry and specifically SCANIA IT. How innovation is fostered and supported, which frameworks and processes are being used to generate, evaluate and develop new ideas and services. The research question that this thesis aims to examine is the following: What is the perception of design and innovation in their current work practices, and how can Design Thinking support Scania IT service design innovation processes? In the paper data and results of the on-premises study is presented. A total of nine interviews and two workshops with a total of 17 participants were conducted. The thematic analysis that follows reveals a matrix of topics and concepts.

KEYWORDS

HCI, Design Principles, Design Thinking, Design Sprint, Service Design, Agile, SCANIA

1 INTRODUCTION

Design Thinking has become a source of inspiration In the pursuit of innovation. Organisations, Information Technology(IT) managers and professionals are inspired by Design Thinking and its techniques. As demands to evolve and competition intensifies, IT organisations look for ways to constantly innovate and develop user-centric products and services that better address their user needs. Design Thinking in combination with popular and widely adopted development and project management methodologies such as Agile make their way into organisations as a way to introduce and foster innovation.

What these methodologies have in common is their user-centric approach. By being user-centric an organisation can assess early in the product or service development process their users' needs and eventually deliver valuable services that help them achieve their strategic goals [33]. Innovation is key, that is how they gain competitive advantage in their respective markets and where the actual challenge lies, in its implementation. Specifically we would like to explore how traditional industries and organisations such as Scania in the automotive industry can innovate and digitally transform [34].

Traditional industries are picking up the pace on digital transformation, companies shift from traditional industries to become IT providers and we see more and more adoption of Agile and design thinking frameworks. We see large establishments from the automotive industry such as Toyota making leaps into becoming a software provider [12], and this is depicted in their vision to innovate by becoming Service providers rather than just automakers. From the organizational perspective, the automotive industry actively searches for ways to become more competitive and innovative, both in terms of commercial services and internal processes. Innovation therefore becomes a prerequisite to be competitive, but what is innovation. Innovation is the implementation of a reasonably good idea. Therefore, to innovate you need a good idea and a plan to implement it.

Research Objective and Research Question

The main objective of this thesis is to research the role and impact of Design Thinking, its co-existence with Agile specifically in the Scania IT ecosystem and its impact in fostering innovation. In the study SCANIA IT is the premise for this in-depth case study. In the context of Scania IT, the aim is to investigate how innovation is fostered and supported, which frameworks and processes they use in their operations, and how they evaluate, design and develop new ideas and services.

By a comparison between literature and what is actually practiced in the organisation this study will be able to provide an insight into the use and adoption of Design Thinking and Agile for the SCANIA IT New Technology team. This study was carried out in collaboration with the New Technology (IXDA) team in Scania IT, who assisted with networking, guidance and workspace.

The research question that this thesis aims to examine is the following: *How can Design Thinking and its implementation, support innovation processes in the automotive industry?*

2 BACKGROUND & RELATED WORK

SCANIA CV AB

Scania is one of the world's largest heavy goods vehicle manufacturers. Scania AB is 100% owned by the German automotive company Volkswagen Group, forming part of its substantial commercial vehicle subsidiary, TRATON SE. This research is performed within Scania IT which is a company that works within system development, IT operations and infrastructure for Scania AB's global business operations. The company is a subsidiary of Scania CV and owned by Scania CV AB.

Innovation

To define Innovation, innovation is the valuable outcome of the implementation, either brand new, invention, or additional to an existing product or service. One definition of innovation is provided in The Innovators Book [16] which defines it as, "Innovation is the act of generating more value for the customer and the business by fulfilling a job to be done better than anyone else". To achieve Innovation within the development processes organisational strategies adopt methodologies and practices such as Design Thinking and Agile to be able to compete in the demanding modern markets [20]. Design Thinking is perceived as a mindset as well as a set of tools, it can either exist as a Design Methodology or can be regarded as a problem-solving process, same goes for Agile, software development teams either adopt the ideology and manifesto behind it and introduce their process or adopt one of the accessible processes and methodologies such as Kanban [13].

Innovation in Scania. Large corporations such as SCANIA foresee to adapt to the fast-changing environment of their industry by undergoing a significant transformation from being a traditional truck manufacturer to a sustainable transport solution provider.

Digital Transformation. Human Computer Interaction (HCI) methods and tools are being used to better understand and design services and products to bring digital transformation within IT organisations Chilana et al.[5]. Digital transformation requests IT and business to work together in order to meet business requirements, create an environment of continuous improvement and drive innovation [25]. In terms of HCI concepts, development based on User-Centred Design preaches for development for the user, and by the user, thus the incorporation of multiple iterations in the development processes [21], which creates a practice that can be used to help digital transformation. In particular, practices such as Design Thinking are being adopted more and more [22] and prove to be beneficial for the digital transformation of modern companies [3].

Innovation via Design Thinking

Innovation can be supported and fostered via the interpretation of the way designers think, work and plan for non-designers, this is what we call Design Thinking. Design Thinking is an iterative process based on the design process that includes understanding the user, defining the problem, challenging assumptions and testing solutions. Design Thinking provides a solution-based approach to solving problems [30]. It is a way of thinking and working, as well as a collection of hands-on methods [7], Also Design Thinking can act as a mental model for innovation [20].

Design Thinking in Practice

Albeit 'how designers think' [19] might be the inspiration for what we call Design Thinking, it helped Design Thinking to gain acceptance in fields such as business, management, manufacturing and others are advocating the design process and mindset in order to solve complex problems.

The Design Thinking Process

The Design Thinking process consists of several stages, similar to the design process that Human Computer Interaction designers and researchers are familiar with. [29]. While many different versions have existed in literature, one of the most followed and implemented is the one presented by the IDEO institution [24]. This process shares a similar approach to the design creative process also known as 'the Double Diamond' [31].

The Design Sprint

Several new methodologies, tool-sets and practices have emerged from Design Thinking, such as the Design Sprint [17]. A design sprint is a product design framework that aims to answer business, design and product questions through design, prototyping and testing ideas with users and customers [17]. The Design Sprint was developed by Google Ventures [11], and it has become a widely used methodology by product teams worldwide. The framework, request intense effort usually conducted by a small group that, depending on the scale of the question or their flexibility can range from 1-5 days. The design sprint borrows elements from the design process, the scientific method and contextualises them with the agile philosophy.

Development

Information Technology (IT) has become more relevant and essential than ever, and it has become an enabler of services and products. People have high expectations regarding provided services [10], value, cost and time have become essential deciding factors. Thus, the organisational strategy considers that crucial ingredients of success are the fast

and efficient software development processes that provide solutions to proven users' problems. The usage of Agile Software Development methodology in project management has proven to be quintessential for the achievement of the goals as mentioned above.

Agile is a software development approach that is used to construct software iterative and incrementally; each iteration has the characteristic that it produces value to the users of the product. Agile is performed in a highly collaborative fashion, and it is considered cost and time effective. The Agile approach based on a vision developed in 2001 by a group of Software Development professionals. In this meeting, this group laid down the basis of this software development process, its manifesto [13].

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

These statements showcase the vision of this approach and position it more as a mindset rather than a development process. Therefore, after the declaration of the above manifesto, many procedures and methodologies have emerged, such as Scrum, extreme Programming (XP), Feature Driven Development (FDD), Dynamic Systems Development Method (DSDM), Adaptive Software Development (ASD), Crystal, and Lean Software Development (LSD) and so forth [13].

Agile and Design Thinking

Exploring the incorporation of Design Thinking as a development process in the Agile software development mindset and practices. While the two processes differed in nature and were developed in different environments and disciplines, the author can see that they can be integrated as their basic concepts and philosophies have no fundamental differences. Design Thinking is a human-centric approach to development, and this coexists with the thought that software can be as well a product that has the mission of satisfying user needs. In principle, these methodologies share several similarities. Both aim to deliver a fast solution that fulfills a human need, moreover both propose a framework that can be associated with product and service development and project management [18], their processes can be generally associated with four steps, which are: analysis - design - implementation and testing.

Similarities between the two methodologies, have been discussed by Lindemberg et al. [23]. their core features are 'user-centricity', 'iterative learning and development processes', and 'extensive team communication'. Research by de Paula et al.[9] has addressed the user-centred design approaches in Agile [9] [6]. Adikari et al.[1] highlighted the implications of Design Thinking in Agile User Experience.

Finally, most relevant to this study and the purpose of Scania would be the research conducted by Lindberg[23] on the integrated framework of Agile and Design Thinking that can operate in the context of digital transformation, in addition Plattner et al. stressed the impact of Design Thinking in Innovation, and how it can impact both organisational cultures and processes [24].

3 METHODOLOGY

In order to answer the research question, a series of different studies were performed. First, the author spent five months with the team where he observed current practices and participated in various meetings and exercises. Later, the study continued with semi-structured interviews (N=6) with a diverse group of participants with technical, design and managerial backgrounds; finally, the author facilitated two workshops (N=5 and N=12) to learn how design methodologies such as Design Thinking and Design Sprints are implemented. For the purpose of this research, the author used qualitative methods to understand the perception of design and innovation in their current work practices and which opportunities lie for Scania to innovate more.

Case Study of current practice

To understand how design principles and practices enable Innovation in IT services ecosystems, a case study of practices in the context of the Scania IT offices was conducted. The primary focus of this study was to investigate current practices in different teams and groups within the Scania ecosystem, their benefits and drawbacks, and finally potential requirements for an innovation framework that will allow Scania IT to design and implement innovative IT services.

Formative Pre-study

Initially, a set of three (N=3) informal interviews were conducted. These interviews lasted approximately 35 minutes and were used to identify themes and common pain points to formulate and specify the research goal of this thesis within the New Technology Group in Scania IT. Respondents had varying levels of expertise and seniority. They were asked a series of semi-structured questions that covered issues around design, innovation and idea generation. These interviews, in addition to numerous informal conversations in the workspace, pinpointed that the focus of this research should shift from its initial scope of identifying ideation techniques to classify challenges and hindrances and eventually recognise requirements for future innovations, specifically in the Services domain.

Interviews

Once these interviews were analysed, an interview guide was formed, based on which six (N=6) [32] interviews were conducted within Scania AB, including Scania IT and other departments in the group. These interviews lasted approximately forty-five (45) minutes each.

(1) A general background of the participants in terms of their experience in the organisation.
(2) Their perception on Innovation and their experience with innovation in Scania.
(3) Their perception on Design and their familiarity with Design Methodologies.
(4) Their opinion on the role of the designer within the innovation and service development process.
(5) Their experience and opinion on Agile and other software development frameworks as well as their connection with design.

Each interview allowed participants to introduce new issues to the discussion that they regarded as important as well as to empathise on their pain points. Respondents had varying levels of seniority and domain expertise, ranging from IT, Sales, Design and Production. Participants were asked a series of semi-structured questions that covered issues of Design, Product development methodologies, Services and Service Design and way of working.

Workshops

Two workshops were carried throughout this research. The first one aimed to use and experiment with some of the service design methodologies used in order to define the design problem and the second aimed at the solution design and a possible implementation plan. During the first three hour workshop five participants (N=5) were asked to do the Journey Map exercise [2] and then discuss and define the design problem. The second workshop where twelve participants (N=12) used the Google Design Sprint process to evaluate the implementation and performance of such a methodology within the team and to support them in planning a solution. The author facilitated and organised a Design sprint as part of the development process of an internal IT service [Figure 1], to observe how this methodology could eventually stand within the innovation process of this team and in addition to explore how the version adopted by Scania IT was serving its purpose. Both of these two workshops implemented Design Thinking practices.

For the Design Sprint, the author utilized the seminar format developed by the Scania IT Improvement office which suggests four (4) days and a variety of exercises adapted by Jake Knepp's book Design Sprint [17], to go through. The reason was to explore the current implemented way of the Design Sprint and not make any alterations. As conceived

Figure 1: Design Sprint "How might we" exercise

the Design Sprint aims to offer a flexible format that allows teams to adapt it to their needs, and indeed, in this case, the organising team and its project manager adjusted the workshop format based on the time and resources available, these alterations did not change or impacted the scope or the outcome of the workshop. The workshop aimed to assist the New Technology team with the reporting of the development process and plan of a new service. The workshop participants had various levels of seniority and domain expertise, ranging from IT, Sales, IT Governance, Design and Production. It is important to mention that this Design Sprint was part of an actual ongoing project, and it resulted to a prototype and a backlog of activities that was later followed by the team during the course of the project timeline.

Data Analysis

After collecting the data, the author analysed them using a method of qualitative analysis. The specific method used in this thesis was thematic analysis (TA) as described by Guest et al. [15]. Notably, the sources of the raw data (notes and transcribes), were: Informal Conversations, Preliminary and semi-structured interviews, Workshops and survey. The data were then coded and produced a word frequency tree map presented in [Figure 2], and processed via thematic analysis to reveal requirements and challenges.

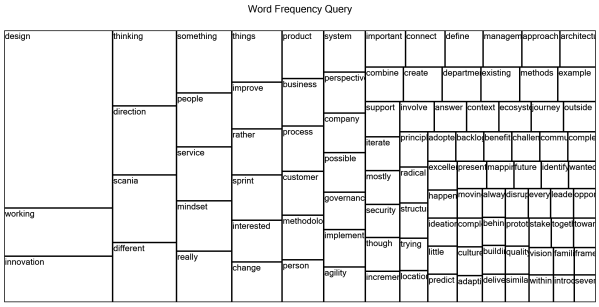

Figure 2: Word Frequency Tree Map

The transcription of the interviews started immediately after the first interview due to the time-consuming nature of the process. All transcriptions followed the same structure and guidelines to ensure consistency, and they were all literal. Thus, it helped the author to continuously interact on the interview processes if any missing aspects were identified. Same approach was followed for the workshop, workshops were recorded and transcribed similarly. The data that was gathered and interpreted with the method of thematic analysis. Thematic analysis is a commonly used method for analysis Richie et al. [26]. Through the analysis of the transcribed, data patterns were discovered and sorted out. This method provided a systematic approach to analyse qualitative data and allowed the author to extract requirements for a framework. The initial analysis of the interviews took a thematic approach guided by the frequency and fundamentals of the issues raised by the users. This produced three main themes that are discussed later in the results section.

RESEARCH RESULTS

Due to the qualitative character of the study and the type of data collected, the results from the Thematic Analysis that have been guided by the research question will be presented. Three major themes emerged from the interview process and two from the first workshop. The themes identified by interviewing six (6) participants are Innovation Process, Way of Working and Design Methodologies, there was further sub categorisation of these themes into nine(9) more which are: Design Definition, Design Perception, Designer Role, Methodologies and exercises, Agile, ITSM and ITIL, Innovation, Innovation at Scania and Innovation Definition. Furthermore, the interview participants will be mentioned as P1-P6, the workshop participants as PW1-PW12, so the author can map which quote belongs to who.

Interviews and Workshops

Workshops

During the first workshop participants worked on describing the problem they aimed to tackle. A concrete problem definition is essential in the Design process. Participants were asked to define the resources they had in hand, problems they faced in the past, challenges their project is trying to solve. The participants succeeded in defining a problem, a design brief that took into consideration all the different aspects of their work. The second workshop participants experienced a Design Sprint and delivered a development plan as per their goal. In both workshops participants showed none to limited knowledge of Design principles, a shocking discovery was the absent of knowledge within the designers. At the completion of Workshop 1 where the team had to deliver a design brief, participants mentioned how each within their different working expertise they could understand and grasp the design process and potentially implement it in their work routine. When the second workshop initiated, there was apparent confusion between participants on their role. Participants were also concerned about the time allocated for this task. As soon as the facilitator, in this case the author, started the introduction of the design brief during the first day of the workshop, an idea emerged from the audience to not follow the process and rather skip and discuss a plan immediately. Some members of the team argued that the exploratory approach of the design process will help them see the bigger picture of the problem and probably identify further issues to consider. In the second day of the workshop where participants are asked to sketch a potential solution, the majority concluded that this approach allowed them to be more creative and innovate in ways they never thought before because it provided them with an open space to brainstorm and sketch without any set limitations. Specifically, a participant said that "we are limited daily by various factors, today I was able to think out of the box and approach the problem differently. During the next days of the workshop, participants discussed several times the possibility of adjusting this process in their planning activities. In the last day of the workshop during reflection, participants concluded that a Design Sprint could be effective in their planning activities as well as in other parts of their day to day operations as an approach that delivers rapid and innovative solutions, as well as it increases team bonding and communication between employees.

Interviews

Design Methodologies

Define Design: The definition of Design could be considered vague even between designers at Scania; the author wanted to understand the perception around Design and its role in the organisation. For instance, P6 view on Design was that it concerns everything that helps understand the outside world and perception. Design can influence by conveying a message in the right context. In comparison, P3's view was that Design is the ability to make something, to create. Thus, it is to create something from scratch, a way to present ideas. P3 also considered Design, as "what it looks like, how something looks like, how is the User Interface (UI). Very visual, not as a way of creating a product or service."

P2 and P4 definition of Design differed from the rest, P2 believed that Design is the architecture, the beautiful shape of something or the design of it. It is how beautiful something looks like and how it makes them feel. While P4 that Design is how things feel like, the emotions they trigger once you see something tangible and the way it looks and operates. Lastly, P1 shared that they are not interested in

Design, that are more interested in how they can use the design process to drive innovation.

Design Thinking is (not) a Mindset: Overall, the participants had different approaches to Design and definition. Regarding Design Thinking, in particular, most respondents (P1, P2, P4, P6) commented that Design Thinking is a set of tools, tools that offered benefits to the product development process, a set of tools that help you kick start the process of solving problems. Specifically, P1 details a typical project management process and how Design Thinking have impacted it. P1 stated that he had been influenced by Design Thinking is his role as an agile coach and a solutions architect, particularly P1 was interested in defining user needs and exploring user stories. Furthermore, P1 stated that they had incorporated many Design Thinking methodologies to help identify and better understand the user, such as customer journeys, architectural sketch, story mapping and prototyping. Furthermore, P1 saw Design Thinking as a set of tools that contribute to the design element in the product development process.

On the contrary, P5 expressed that Design Thinking primarily is a mindset that is accompanied by tools, Design Thinking other than a mindset is a way to communicate your ideas better. P5 argues that Design Thinking has always existed in Scania but they called it differently, P5 further explains that customer centricity which exists in Design Thinking is in the DNA of the company as well as the presence of the design creative process(double diamond) that resembles Design Thinking has always been practiced in Scania.

P3 had a different approach, for P3 Design Thinking was a mindset just as Agile, and stated the importance of how to implement such mindsets, in particular mindsets always go hand in hand with appropriate tools. *"What you want to do, is to make people start using the methods before the theory, the theory is hard to grasp, once you use the techniques, then you begin to reflect and understand the bigger picture behind it."*

Service Design Thinking: Most of the participants(P1 - P5) where either not familiar with the term or familiar only through an extensive seminar that was conducted within Scania for its employees, as P2 said *" we lack practical experience regarding Service Design, we have worked on a hypothetical scenario but have not tested it on actual cases".* P6 particularly stressed that when it comes to designing services, usually in IT it is linked with Service Design from the ITIL framework rather than Service Design Thinking.

What is the role of the Designer : Moreover, what is the perception of the Designer role? How are visual, interaction, user experience and service designers are involved in the innovation and development process within Scania? How the participants from their experience, whether its design or product management perceives and experience the role of designers. Participant P6 shared that: *"They are everywhere; the design is the process itself. Which can be part of the process, starting from the beginning, Services designers, User Experience and User Interface throughout the process."* .

Participant P1 shared their experience with Designers, particularly their importance when design processes such as the Design Sprint are exercised by multidisciplinary teams, P1 mentioned *"On the first Design Sprint I facilitated I involved designers. They were good at making sketches, so I thought its good to have these people. On the second design sprint, we brought some designers to create the prototype; then I realised it is a right mix, you need a designer, even though most people can make sketches, you need designers as they can visualise their ideas."*.

In addition, participant P3 in the contrary made a statement regarding User Experience designers, their role is often confused with their User Interface(UI) or Visual Designers. Specifically: *"They come when there is a new assignment or when they are not sure about User Interface. I am trying to step in different parts of the process by introducing new user experience methodologies."*.

Way of Working: During this study, the author was interested in grasping the connection of innovation with design and how design tools and methodologies where being used in product management processes.

In regards to Agile and its connection with innovation participant P1 who had extensive experience with Agile implementation said *"Agile is implementing productivity and hence not innovation.", "agility, in my point of view is more. It has to do with the mindset rather than just the method and way of working."* Another view was of participant P3 who stated that *"Agile mindset is to be more adaptive to change, which comes with the mentality rather than standing in front of a pulse or doing a scrum or sprint. Moreover, innovation requires agility; you have to be agile to be responsive, to understand the behaviour and be adopted, this is how we combine them,"(meaning agile and design)"we have been working a lot making sure that we can be adaptive in the development process, more from design and then supported from agility."*.

All of the participants are experienced in Agile; it is implemented and practised throughout the organisation. But in terms of combining methodologies, P1 and P6 shared from their experience that it is practice nowadays to combine Agile, Design and ITIL but as P6 said "*They all create a different context in your head, it is a matter of proper utilising the information in the right context, for example when you are running a repeated process, like in production, then ITIL is optimal but when you explore new ideas then Agile"*, P1 also shared a similar view *"When you deal with monolithic services and services that are complex and are performed in a repeated manner then ITIL is what you choose"*.

Most of the participants (P1,P4-P6) agree that Scania needs to find a way to automate ITIL processes, use it when dealing with old or outsourced solutions that require it, thus, move to continuous development using Agile and use Design methodologies to benefit from their problem-solving capabilities, iterative character and out of the box dynamic.

P6 mentioned several examples of using the three aforementioned methodologies within their department to develop services, how development teams use Agile to deliver continuously, business teams use Service Design to contextualise their offerings and that Agile and Design Thinking share a lot in common making their adoption easier for teams, as they can use the one that best suits their projects and goals, furthermore, P6 stated that when you build a service, you should focus more on Agile, although some issues need to be addressed in IT such as governance issues or stakeholder management are traditionally addressed through the ITIL framework.

Finally, P1 mentioned in an informal conversation that it is an ongoing project to help more teams adopt Design Thinking and thus, they firmly believe Design Thinking will be implemented as a next step in their development processes.

Innovation Process: The definition of innovation has proven in this study to be very subjective, and each participant had their view on how innovation exists in Scania and what examples they believed showcased that, but all agreed on the statement that innovation is creating value from something new. From the study, other interesting thoughts emerged about innovation and if Scania is innovative in its core. P2 when asked about what is innovation, answered that: *"Innovation for me is something that goes outside your known world; it is when instead of performing an expected thing excellent you do something beyond the foreseen when you bring a new perspective to something you did not think that existed."*

Participant P1 emphasized that innovation needs a structure to foster within such a big organisation, it will not happen automatically, but it needs an organisational backup, specifically: *"Someone needs to be responsible and ask for it, maybe organise some event or internal structure or hub to help people focus more on it".*

P2 and P5 shared their views that innovation needs some structure, P5 mentioned that Scania IT had in the past tried to offer the incentive for its employees to use 20% of their time on new ideas and projects, but the major issue with this novel idea was that it did not align with the rest of the organisation and since Scania's different organisations and structures are interconnected it made the decision to use this 20% time for innovative, collaborative projects almost impossible.

P1 additionally explained some examples of the outcomes of Design Thinking exercises into developing new ideas and concepts, how through a Design Sprint and exercises inspired by IDEO they conceived new ideas and approaches to problems.

Moreover, another aspect of Innovation reality in Scania was mentioned by P4 *"We are not trained as a company to think about innovation"*, and P1 added *"well there have been innovations of course, some leaps now and then, Scania has been a great innovator since the 50s with projects such as the the modular architecture of the truck."*

4 DISCUSSION

The objective of this paper is to explore if and how Design Thinking can support Scania IT and similar enterprises to innovate. The design thinking methodologies that are being used and implemented via workshops, Agile or other means act as the vessel with which value is created and hence innovation. Value in Scania IT is delivered through services, services follow specific requirements usually in terms of governance, and are designed for specific users and customers, they provide individual experiences and aim to deliver business goals to justify their existence and use.

Design and Innovation

All study participants, interview and workshops, agreed on and described the definition of innovation, as the effort to create value from new ideas. Innovation exists with new ideas, and ideas must provide value with their implementation. However, the primary question is how Scania can implement Design Thinking to ensure that it can generate new ideas and create a competitive advantage.

Innovation within Scania is not perceived equally across departments, the most common perception is that of changes or improvements made on the production site or the product itself, the truck. Employees from departments that are not immediately related to the production operations do not feel that innovation exists in Scania, and that is primarily due to the context of their work or the hectic workload they experience.

The perception of innovation, and how it is related to idea creation was positive. In particular, participants highlight that the source of innovation is new ideas and that most of the participants had the capacity of developing and exploring new ideas within their working environment, and if there were any limitations, they were mostly external. All but one received full support by their management, and if there was no opportunity to explore the idea within their team or department, they were able to use Scanias' innovation platforms to do so, such as the Scania annual hackathon contest.

However, some concluded that they did not have a process to follow or a framework, how they could take this idea to implementation or if it was of business value for the organisation. This may indicate that the very employees that are expected to innovate at Scania feel insecure about initiating and engaging in innovations processes. Innovations processes are indeed messy and tend not to follow straight lines, however, it appears essential to foster and create a foundation for the employees to feel confident and secure in starting innovation processes. which creates another requirement. Another matter that was indicated by this study was that sometimes, in critical projects, they are faced with the lack of support in generating and sharing new ideas.

Two of the participants had extensive experience in ideation, design and software developments processes, so they shared their experiences in regards to how they were able to use ideation techniques to overcome such difficulties and generate ideas within their teams. It is interesting how a participant shared their experience with the use of brainstorming exercises that were followed by voting exercises such as the "Note and Vote" [17] that helped their team generate a vast pool of new ideas and how this has allowed closer collaboration within their teams.

It should be noted that some of the participants mentioned the role of Design Thinking ideation process when it came to new ideas, Design offers a way to think out of the box and generate new and genuine ideas. In particular, participants mentioned Design Sprints they have been part of, where in the first day they explored different exercises such as "How might we" or Journey mapping and that these exercises [2] were useful in formulating their ideas better. These results suggest that exercises from the Design Thinking methodologies are well accepted and beneficial for these teams.

Design Thinking has always been present in Scania, one of the participants of this study mentions. that Design Thinking connects with the fundamentals of software and IT development processes which Scania IT practice. What they have in common is the focus on user needs, and their feedback process, the participants of this study repeatedly mentioned this, which also was evident in the Design Sprint workshop. Besides, when mentioning Design Thinking participants often considered the term user experience. Don Norman defines "User Experience" as it encompasses all aspects of the end user's Interaction with the company, its services and its products [17]. In order to achieve high-quality user experience in a company's offerings, there must be a seamless merging of the services of multiple disciplines, including engineering, marketing, graphical, Industrial Design, and Interface design".

Design can help with innovation in terms of products, way of working and services. In terms of the role of Design, design methodologies and their implementation, results showcase the adoption of the Design Sprint even in cases where some of the participants are not familiar or not interested in Design. All of the interview participants, agree that the design process [27] can provide a framework to tackle business and development issues and to test ideas.

During the Design Sprint workshop that was facilitated by the author, a preliminary discussion at the beginning of the first day the some(N=6) of the workshop participants (N=13) shared that this was their first Design Sprint. The outcome of the Design Spring workshop proved to be beneficial for the team as it provided them a framework to define a problem on a discussed idea, work on its desing and produce a prototype.

While it is essential to identify the benefits of the design process, the role of the designer in most but one of the interviewed teams is limited [14] to a certain extent. This limitation might exist because of the sample of participants, or it portrays a global phenomenon, to explore these phenomena, future research that includes all departments of the Scania group is needed.

Design sprints and facilitation of other design methodologies are primarily conducted by Agile coaches and professionals and only in one case a participant mentioned the active and distinct role of Service and Interaction designers. This positions the need to raise awareness on the impact of Design in business, that is coherent with De Los Rios and Charnley [8] study on the role of Design in business which findings from other automakers suggest that Design can facilitate use and maintenance, facilitates optimised production and boosts service and use experience but it is not capitalised fully within large organisations.

Development and Design

It seems like a profound need to be able to be competitive in terms of product development and still find ways to innovate and be agile. According to the results, there is a noticeable pattern in the needs and considerations of the employees on design and how it can integrate with software development methodologies. Moreover, in the study the use of various conflicting theoretical definitions were observed , each with a different understanding and each within the context that each participant operates, and this is to expected.

It is evident that Scania has adopted Agile across its teams, and there is a growing interest in the integration of Design Thinking via the Design Sprints with their development processes. This points towards the need for synchronisation efforts between Designers and developers [4], as mentioned in the Parallel Track model presented by Silva et al. [28] and is present in the results of this study. The most crucial

factor here is the integration of design principles in the development process.

Agile and Design

When it comes to the use of Design in the Agile enviroment that Scania is creating, the Design Sprint is an excellent example of design processes in an agile way that could introduce Design methodologies in the development processes of Scania IT, this is substantially supported by all of the participants both in interviews and workshop a well as from related work.

Reflections on the Research Methodology

The applied research method, with an inclusive and user-centred approach, has yielded useful results and insights. The observations, together with the interviews conducted, have triggered fruitful discussions, raised awareness about the possibilities design can offer and its role and revealed patterns and approaches for an innovation framework. Though increasing the number of participants from more departments of this organisation would provide possibly more insights on innovations or different approaches; therefore, it could have resulted in more targeted and differentiated results. The workshop provided many insights on the general perception as well as it acted as an example of the use of a design methodology as an idea generation process.

5 CONCLUSION

This study was conducted in order to answer the proposed research question: How can Design Thinking and its implementation support innovation processes in the automotive industry? Based on the conducted study and thematic analysis, the following are a summary of the findings in respect to the research question.

Organisational culture represents a crucial factor for the introduction of innovation throughout the organisation via Design Thinking and agile way of working. Thus, the organisation must establish a culture that encompasses a shared vision with values that create a commitment to learn, experiment and accept failure. Additionally, values of the agile manifesto should be part of the organisational culture in order to allow the implementation and experimentation with Design Thinking.

In a organisational level, there is a need based on the results and the expert interviews on raising awareness about design and its methodologies. These methodologies can assist the organisation in various ways such as planning, problem-solving and service design. This can be achieved with the involvement of design professionals throughout the organisation and training teams that exist throughout the organisation to further help connect Design Thinking and Agile.

Additionally, strong collaboration between designers, engineers and business officers can promote faster and more agile innovation. A service consists of the outcome of business, engineering and design decisions, thus, by promoting a collaboration scheme throughout the organisation will culminate in improved efficiency.

Furthermore, the experimentation with Design Thinking offers an excellent base framework that teams can adopt to help them better structure and plan software solutions, its iteration characteristic and the process steps provide a structure that helps teams and employees form ideas, experiment with low-fi prototypes, iterate, understand their users and their market, test and launch their service. Besides an excellent tool for planning or implementing software solutions it also provides techniques for post-launch phases to help teams ensure their product is maintained, improved and scalable. Design Thinking can be incorporated with Agile as many previous pieces of research and examples from the results of this study confirm. A popular format that can be followed is IDEO's framework, but of course its implementation and adaptation remains on the management of the organisation and the relevancy of the problem to be solved.

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