Design & Innovation

The implications of embedding design within innovation processes

Master thesis

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The implications of embedding design within innovation processes

This thesis is written with the aim of obtaining the degree Master of Science (MSc) in Strategic Product Design at the Delft University of Technology

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Preface

This graduation thesis forms the concluding piece of the Strategic Product Design master programme as well as it forms the end of my student 'career' at the Delft University of Technology's Industrial Design Engineering faculty.
The seeds for this graduation project were sowed when I was provided the opportunity of doing an internship within Unilever's Disruptive Design Studio. It made me realise that, in order to be of value within companies, organisations or innovation processes, design should also be embraced outside the realm of the one design project that I was involved in. By executing this research project I got the opportunity to research the role of design on a meta-level and to find out what happens within organisations after they have started to use design within their innovation projects and processes. As such, it has also provided me with the opportunity to rethink the (potential) role of design and the practitioners of design within the overall innovation process, a valuable opportunity since I am at the dawn of entering the working life with a head full of design luggage.

This project would not have been there without the inspiring accompaniment of Frido Smulders and Frithjof Wegener and therefore I would like to express my gratitude towards both of you for helping and supervising me from the outset and throughout. Frido, thank you for picking up the gauntlet that was thrown down by Frithjof and me prior to starting off this project. I enjoyed the conversations we had as well as your views on the subject over the course of this project, it provided me with a fresh perspective on design and the innovation process. Frithjof, thank you for acting as my mentor already before the official start of this project. During our meetings, your straightforwardness was much appreciated and you helped me to find my (theoretical) focus when I, once again, found myself at the other side of the universe.

Since this graduation project comes to an end through the fulfilment of this master thesis, time has also come to wrap up my 'career' as an Industrial Design Engineering student. I have been lucky to find myself in the company of some extraordinary people and it is therefore that I would like to thank them.

First of all, I would like to thank my parents for supporting me in every way possible, not only during my studies in Delft but also during my youth that I have spent in and around Buttinge, Zeeland. I could not have wished for more! Jesse, Jonathan and Joël, thank you for being there as brothers: I have an infinite amount of respect for the way you carried – and still carry – the burden of my presence for more than a quarter of a century.
To 'de Staalmeesters' Adriaan, Ivo, Juul en Vincent, thanks for all the radical experiences: it really spiced up the Delft voyage and the good thing is that many of these voyages are yet to come. Also a 'thank you' for Edmée and Jimmy, thanks for the infinite hours of SPD quality time we have had over the past three years.

Right now it is time to jump on the bandwagon that is called the labour market and, citing Sir Henry Newbolt, to *"play up, play up and play the game."*

Pepijn van der Zanden
Delft, September 2018

Executive summary

Companies and organisations that are operating in the marketplace are, on a day-to-day basis, exposed to a vast degree of competition, which eventually can lead to situation with a lot of market turbulence and disruption taking place. Perry (2017), for instance, shows that only 60 companies were present in the Fortune 500 in 1955 as well as in 2017, meaning that 88% of the companies from 1955 either went bankrupt, merged with (or were overtaken by) other firms or were not able to meet the Fortune 500 revenue threshold anymore. Anthony et al. (2016) and Zook (2014) state that many companies have not been able to adapt or to take advantage of changing market situations as they fail to scout and invest in new areas of growth or keep applying existing business models to new market segments.

Lately, design has received increased attention from companies that want to anticipate on present or future market turbulence. Besides the formation of inter-company alliances, merger & acquisition activities, servitization of a product portfolio or the co-operation with startups, design is seen as a way to overcome creative destruction, helping companies to maintain their competitiveness in the marketplace. Both business scholars and design (management) scholars have described the added value of design and design thinking to businesses, organisations, (innovation) processes, products and services. However, the fact that the added value of design and design thinking is mainly described by anecdotal cases of businesses and organisations that successfully make use of design and design thinking seems to ignore the process that precedes the situation whereby design is fully operationalised in and adds value to innovation processes.
It is therefore that this research project is executed with the aim of exploring the implications of design when being embedded in a company's innovation process. Based on current collaborations between the Delft University of Technology's IDE faculty and various businesses, three companies have been found suitable for examination in the context of this research project. As a result, three cases can be described
through conducting empirical research, whereby further insights into these cases are provided through conducting two rounds of interviews.

The data sets stemming from the interviews show that in each of the three cases a design project is seen to be initiated by a non-design project brief, that design is positioned in the Fuzzy Front End of innovation processes and that design is seen to be employed in a separated type of department. Besides, two out of the three cases present an emerging disconnection between the design output and the innovation process that is already put in place. A further exploration of the latter shows that this disconnection can be traced back to a barrier that is positioned within the higher ranks of the two companies as well as a barrier is perceived in the way companies have set-up their organisational structure with regard to the design output.
It is suggested that design should become an 'implemented reality' and it should be incorporated into the 'thought processes of a company's organisational structure' when companies want to successfully make use of design with the aim of arriving at outcomes other than their current innovation processes are producing. Therefore, companies should adapt, revise and/or redesign each aspect of their innovation process that is either preceding or coming after the embedded design element in order to fully facilitate an innovation cycle.

1 Project overture

Every year Fortune magazine compiles the Fortune 500: a ranking list that sorts out the 500 biggest companies based on their yearly sales revenue. The origins of this list dates back to 1955 and therefore it provides room for a comparison between the 1955 Fortune 500 ranking list and the most recent ranking list published in 2017. In doing so, Perry (2017) shows that only 60 companies were present in the Fortune 500 in 1955 as well as in 2017, meaning that 88% of the companies from 1955 either went bankrupt, merged with (or were overtaken by) other firms or were not able to meet the Fortune 500 revenue threshold anymore. In line with this Anthony et al. (2016) have presented an analysis of company presence within the S&P 500 (stock) Index over the past 50 years. From the publication it becomes clear that in 1965 companies stayed in this Index for an average of 33 years, whereas in 1990 this average had narrowed to 20 years and it is forecasted that this average will further drop to 14 years in 2026.

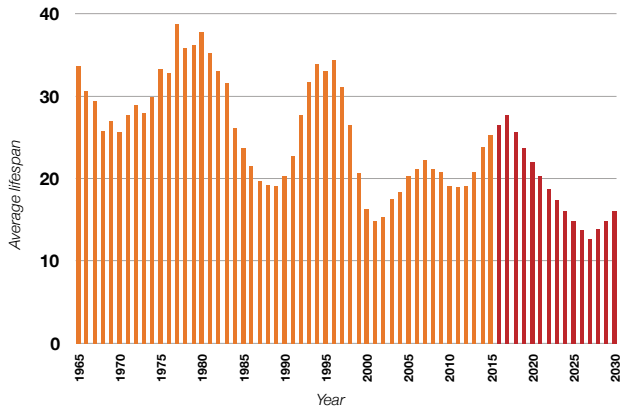

Figure 1 *S&P 500 lifespan chart (Anthony et al., 2016)*

The heavy alterations in both the Fortune 500 list and the S&P 500 Index show that over the past decades a lot of market turbulence has been taking place and apparently many companies have not been able to properly respond to such turbulence. Against this background, the lifespan chart (figure 1) of Anthony et al. (2016) can be seen as an indicator for marketplace change and the decreasing company lifespan then accounts for an intensified change rate within this marketplace. This observation is shared by Zook (2014), who sees companies losing their leadership positions at an unprecedented pace, with the extinction of slow, inflexible and bureaucratic businesses taking place in record numbers.

According to Anthony et al. (2016), such events are caused by companies that are not able to adapt or to take advantage of changing market situations as they fail to scout and invest in new areas of growth or keep applying existing business models to new market segments. With the above-mentioned observations in mind one might draw parallels between business cases such as the ones of Kodak and Nokia one typically refers to when explaining the effect of market disruption on a company. These well-known examples of companies that fell prey to disruption in the marketplace belong to a long list of companies that have been encountering similar events in past decades. This seems to resonate with the creative destruction theory of Schumpeter (1942) that describes such market disruptions. Here, emerging new markets ignite a process of industrial change that forms the basis for a constant revolution from inside out, constantly destroying the old economic structure, while constantly creating new ones. Although there is a considerable amount of companies that have failed to deal with such an ongoing wave of Schumpeterian destruction, many other companies have been able to reinvent themselves in order to maintain their competitiveness and stay relevant in the marketplace. Over the years, companies – in various ways – have been able to achieve such competitiveness by changing or refuelling their innovation processes, whereby all of these refuelling efforts are undertaken with a similar goal in mind: to arrive at outcomes other than the outcomes that are generated by their current innovation processes.

Forming alliances

The formation of alliances is seen as an effective organisational form for succeeding in innovation efforts (Chammanur et al., 2016; Huston & Sakkab, 2006; Li et al., 2017). The alliance model can be regarded as a relatively open approach to innovation efforts (Cooper, 2008; Grönlund et al., 2010), whereby external companies/partners are 'invited' to contribute to the innovation process that is already in place.

Merger & acquisition

Li (2017) and Sevilir & Tian (2012) state that the expansion of innovative activities by high-tech firms is primarily driven by the acquirement of new technologies. Philips & Zhdanov (2012) resonate

this view by concluding that (mainly large) firms make use of mergers and acquisitions (M&As) in order to obtain access to innovation. This is driven by the large firms' decision not to get involved in a 'R&D race' but, instead, let smaller firms put effort in R&D, then followed by the acquisition of these small and innovative firms.

Shift towards servitization

Companies are incentivising the addition of services to their product portfolio as a means to grow overall sales revenues and profitability, while it is also capable of improving overall firm value (Eggert et al., 2014; Fang et al., 2008; Salonen, 2011). Besides, shifting to the partial servitization of a company's product portfolio can seen to be driven by the urge to maintain a certain level of competitiveness in the marketplace (Durugbo, 2014; Meier et al., 2011). Furthermore, the move towards servitization can also be ignited due to an increased focus on customer needs (Ostrom et al., 2010).

Startups

A specific type of forming alliances is the collaboration between corporations and startups, as is explained by Mocker et al. (2015) who state that corporations are getting involved into the startup scene to rejuvenate their innovation culture and processes.

Besides the above-mentioned ways of anticipating to market disruption, companies have started to explore and use design and design thinking as an alternative approach for fuelling innovation efforts (Carlgren et al., 2016; Martin, 2010; McCreary, 2010). Whereas initially involved with aesthetics and functionalities, design is now being explored beyond its traditional role, with companies and scholars see design being applied to other kinds of problems, providing companies with new opportunities, increased growth strategies and a more thorough strategy or business model (Fraser, 2009; Cooper et al., 2009; Na et al., 2017). Additionally, it is proposed that companies with a design-centric approach to innovation outperform those who do not (Rae, 2013, 2016).

1.1 Design in the innovation process

Design, being a way to approach innovation, has received increasing attention from both from a business perspective (Brown, 2008; Hobday et al., 2011; Martin, 2009) and from the perspective of design scholars (Kolko, 2015; Lockwood, 2010; Sharma & Poole, 2009; Von Stamm, 2004). As design is researched, explored and defined from multiple directions difficulties are found in arriving at a unified definition of design and design thinking (Kimbell, 2009, 2011; Johansson-Sköldberg, 2013).

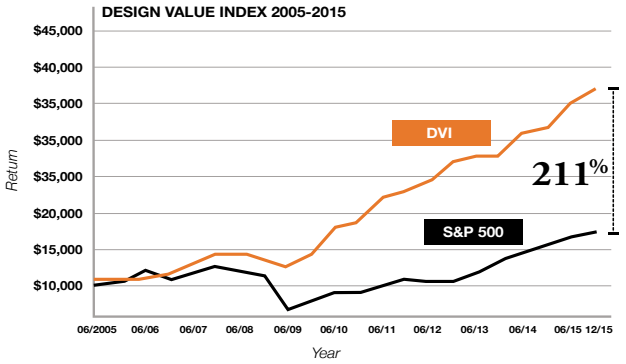

Figure 2 *Design-centric companies outperforming the S&P 500 (Rae, 2016)*

However, there is one unified element that can be found in the above-mentioned bodies of literature that are researching the use of design and design thinking outside its traditional realm. Here, it is about the observation that both from a business as well as from an academic perspective design is described in a way that regards it as being already successfully operationalised within businesses, organisations or innovation processes. Such an *ex-post* perspective provides scholars with the opportunity to draw clear cut conclusions about the perceived added value of design. However, having an ex-post situation also means that an *ex-ante* situation has been present: a situation whereby companies either are on the verge of using or just started to use design within their current innovation processes.

Having in mind the above-mentioned observation one could then wonder what happens when design – used with the aim to refuel companies' current innovation processes – is being implemented within innovation processes. In other words: what implications can be perceived when companies embed design within their innovation processes, with the aim of arriving at outcomes of those innovation processes?

1.2 Defining design

As was mentioned above, there are multiple perspectives on the definition of design and on the role of design in relation to the innovation process and therefore no clear and unified definition of design can be provided here. It is therefore that a description of design is formulated for the sake of being used throughout this research project.

Regarding the description of design within this research

project, Von Stamm's (2004) definition of design's position within the context of innovation is used as a point of reference. Here, the author state that design can be seen as a conscious decision-making process that helps to transform information (an idea) into an outcome that is either tangible (a product) or intangible (a service). In line with this, Hatchuel (2001) and Hatchuel & Weil (2009) see design as an activity that generates new concepts or objects. Added to these view, Sharma & Poole (2009) state that design is an activity that helps to translate an idea into a realisable form.
From the perspective of these definitions it can be concluded that design, within this research project, is perceived as an activity or process that can transform an idea into tangible or intangible outcomes, whereby these generated outcomes can be seen as new concepts or objects. With this perspective in mind, it is deemed necessary to also add the following notion of Rodgers (2013), stating that one common denominator of design is the centrality of the user and an openness towards the human condition.

1.3 Research questions & research objectives

As can be derived from the project overture, the companies' and scholars' increasing attention for the use of design within innovation processes justifies a research project that aims to find out what the implications are when companies start to embed design within their innovation processes. It is therefore that the following research question is formulated and it will be the main driver of this research project.

What are the implications of embedding design within innovation processes?

It becomes clear that in order to be able to answer this main research question several of its constituting aspects need further examination as well. It is therefore that two sub-research questions – either focussed on the design aspect and on the innovation process aspect – are formulated.

- **How do companies organise their innovation processes?**
- **How is design positioned within these innovation processes?**

This research project aims to explore if and what kind of implications arise when design is embedded within existing innovation processes. Simultaneously, answering the research questions of this project allows for formulating a set of preliminary recommendations that are aimed at increasing the chances for companies to successfully embed design within innovation processes as well as it can help design schools to better anticipate on preparing students that have to deal with the embedment of design within innovation processes. Lastly, the recommendations provide possible research directions for scholars that plan to research the relation of design and innovation processes.

1.4 Research methodology & approach

The research project as presented has an exploratory character from the outset and throughout since it is aimed at providing a better understanding of the implications of design's embedment within innovation processes rather than to provide conclusive evidence or a final answers to the posed research question. Since the exploratory character could cause a change of direction due to emerging new data or new insights, this research project is therefore best served with a qualitative research approach as is proposed by Silverman (2013) and Braun & Clarke (2013). Such a qualitative research approach enables the researcher to adjust its research along the lines of the evolving project so that it can suit the project's needs such as to accommodate unanticipated ideas that are brought forward by research participants.

The explorative character of this project causes the empirical research part to be executed in an explorative manner as well, whereby the use of an interview format is determined to be most suitable since it allows for the collection of data gathered in the context of a company's specific innovation processes. The interviews will be conducted during the empirical part of the project, aimed at exploring the implications of embedding design within a company's innovation process. By doing so a deeper insight in the current positioning and application of design within the innovation processes is gained, while at the same time it is tried to be found what the embedment of design brings about in companies' innovation processes.

1.6 Case selection

In order to arrive at a set of suitable participants and companies, one clearly needs to search for companies that are involved in the trajectory of changing their innovation process and its outcomes, with design being used in order to arrive at change these innovation processes. A suitable set of companies can be found within the IDE faculty's Strategic Design research programme due to the fact that the programme

contributes to generating knowledge, strategies and methods that add value to the improvement of innovation processes. This knowledge and, more specifically, the ability to transform this knowledge into solutions that improve (innovate) the innovation process attracts companies such as KLM ("KLM en TU Delft", 2017), Vanderlande ("Cooperation agreement", 2017) Ford ("TU Delft starts collaboration with Ford", 2016) and Unilever ("Samenwerking Unilever van start", 2014) to collaborate with the IDE faculty. From the perspective of those companies there seems to be an apparent need for the development of new product propositions or, at least, a need for enabling their innovation processes to generate different outcomes than they currently do. The use of design within their innovation process is envisioned to be the catalyst for that.

The fact that design, through the Strategic Design research programme, is used as a means to play a role in changing the produced outcomes of several innovation processes provides a suitable starting point for the empirical study. Three cases can be presented as a result of convenience sampling that was done within the Strategic Design programme's PhD candidates, namely Unilever, KLM and Ford. Here, all of the candidates are – in some way – researching the role of design in the innovation processes of these companies, whereby each of the three PhD candidates are designers by education. The latter enables initial data collection that takes into account the perspective of design within the innovation process.

1.7 Data collection

The exact type of interview format has to be further determined since multiple variations exist. Patton (2002) and Robson & McCartan (2016) distinguish three main types of interview formats, namely:

- Standardised open-ended interview (structured)
- General interview guide approach (semi-structured)
- Informal conversational interview (unstructured)

For the first round of interviews it is decided that an unstructured interview format will be used for data collection, meaning that there is an increased reliance on the natural flow of the evolving conversation. This interview format is chosen because it helps to arrive at an initial understanding of the situation that companies are facing when embedding design within their innovation process. Although having an unstructured character, Lofland et al. (2006) mention the importance of using an interview guide when an interview is executed in this way. Such an interview guide does not have to be an extensive or detailed list of questions as is used during a (semi-)structured interview, but at least it should include the things that are planned to be discussed with the person being interviewed.

A second round of data collection will take place with the aim of finding out more specific details about the insights found during the first round of interviews. In this second round, interviews are conducted with employees of two of the case's companies, therefore adding a company perspective to the design point of views that are postulated during the first-round interviews. Here an interview set up is used again but this time a semi-structured interview approach is used, which means that the interviews are conducted by using a semi-structured interview guide. The use of such an interview guide, together with the semi-structured interview approach, enable the interviewer to deviate within the constraints of the interview questions, while providing more flexibility than a fully structured interview (Hill et al., 1997; Hill et al., 2005). Besides, a semi-structured interview gives the opportunity to further elaborate on specific details or explore conflicting outcomes.

During the first part of this empirical study, interviews were done with PhD candidates (design researchers), whereby the interview duration ranged from 50 up to 70 minutes. The second part of the empirical study was done with a product owner and an innovation director, with the interviews each having a duration of 60 minutes. All of the empirical research's interviews were conducted with consent of recording.

2 Empirical research

2.1 Case descriptions

The first-round interviews are aimed at providing insight in the innovation processes as they are currently operationalised within all three of the cases. At the same time, the interviews provide insights in how design is embedded and is being used within the innovation processes that are tied to the three cases.

First, an overall *ex-ante* description of Unilever's, KLM's and Ford's innovation processes will be given, whereby the innovation processes are described prior to the embedment of design in these processes. Then, an *ex-post* description of design, being embedded within each of the three innovation processes, will be given, allowing for a comparison between the three cases.
At last, the differences and similarities among the three cases are examined, which makes it possible to provide a first overview of the implications that arise when design is embedded in the innovation processes of Unilever, KLM and Ford.

2.1.1 Unilever

Unilever's innovation process is mainly driven by an approach that resembles Cooper's work on stage-gate processes (Cooper, 1990; Cooper, 1994). Within Unilever's way of product innovation several Go/Kill/Hold/Recycle points (gates) are integrated, whereby each gate marks a critical moment of deciding on the product-in-development. Besides using a stage-gate system, the overall shape of Unilever's innovation process is characterised by a funnel that has a wide shape at the very beginning of the funnel and that gets narrower at the end of the process, when the product-in-development approaches market launch. Wheelwright & Clark (1992) state that the shape of such a funnel stems from the fact that a broad range of product and process ideas are entering the funnel – subsequently being subjected to investigation – whereas only a small portion of those initial ideas are ending up being part of "the full-fledged development project." In the case of the latter, the Go/Kill/Hold/Recycle gates makes sure those ideas are properly examined before entering the narrow part of the funnel, then being exposed to the expenditure of significant resources in order to be transformed into a commercial product or process.

Unilever is regarded as a marketing-led company since its processes are centred around the company's brands and the accompanying brand visions. As such, Unilever's marketing department informs the R&D department about what type of products to develop, with each of these products having to resonate with the prevailing brand vision. Therefore it can be seen that the company's innovation process derives its input for initial product and process ideas from the marketing department. The initial ideas as formulated from the marketing department are then transferred to Unilever's R&D department, which develops products through the employment of their Discover-Design-Deploy process ("Working in Unilever R&D", 2018).

Figure 3 shows the stage-gate, funnel-shaped innovation process Unilever currently has put in place. It can be seen that there is an ongoing process that underlies the innovation process, which can be defined as the operational processes of the marketing department's, since Unilever is a marketing-led company. From this operational process new market opportunities or business needs – derived from the current product portfolio – emerge which are subsequently being 'inserted' in Unilever's R&D trajectory. When progressing through the funnel several stages and gates are encountered, whereby the positioning of the gates resonates with the R&D process steps 'Discover-Design-Deploy'. The more a product approaches the 'Deploy' section of the innovation funnel, the more it is ready for its market launch: realisation of the latter means that the newly developed product will be 'adopted' within Unilever's daily operational processes. When such a newly developed product gets absorbed in the operational process a full innovation cycle is completed.

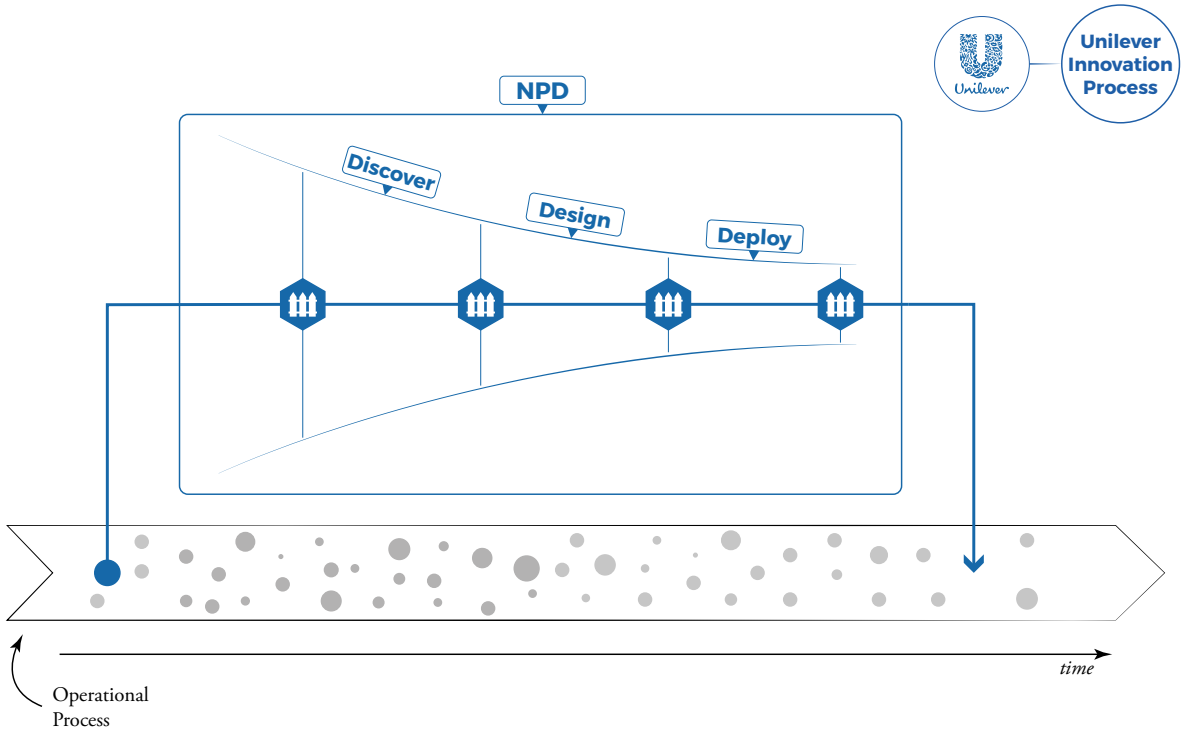

Figure 3 *Unilever's innovation process*

Design within Unilever

The design element that is present within the Unilever organisation is positioned within the company's Disruptive Design Studio (DDS) which resides within Unilever's Discover department, as can be seen in figure 4. Within the DDS, through a five-month design process, (student) design teams develop a product-service proposition that includes a prototype, a business plan and an implementation strategy. This is done by making use of the DDS process: a design process approach that is derived from the Creative Problem Solving (CPS) process developed by Tassoul & Buijs (2007). The DDS process consists of three diamond-shaped process steps whereby the broad part of such a diamond stands for the diverging process step (broadening the problem scope, generating ideas), while the narrow part of the diamond reflects the converging process step (synthesising the findings and insights from the problem scope, selecting ideas and conceiving a concept). Three phases can be identified here: the problem definition phase (re-formulating the initial challenge into a design brief), the conceptualisation phase (generating ideas, selecting ideas and development of concepts) and the embodiment phase (further elaborating on the chosen concept, finding acceptance within Unilever and planning of concept implementation. After completing a full cycle of the DDS process, the developed product-service proposition flows into the DDS display that contains similar product-service ideas. The aim of the propositions within this display is to enter Unilever's regular product development process, the stage-gate funnel, so that it can be developed further, eventually finding its adoption within the company's operational processes.

In figure 5 an overview of Unilever's innovation process together with the design element can be seen, whereby for various parts of the process the below-mentioned, corresponding quotes from the case interview are shown.

In the Unilever case it can be seen that the initial demand is driven by actual business needs, be it emerging market trends or a technological area in need of further exploration. The demand for these business needs finds its origins in the company's marketing department, whereas Unilever's R&D department has to come up with appropriate solutions for these needs.

> *"It always starts with an internal Unilever stakeholder, having a bunch of papers, in laymen terms that is called a 'brief', that is handed over to an agency, to R&D or to who it may concern...supply chain...and it states: do it."*

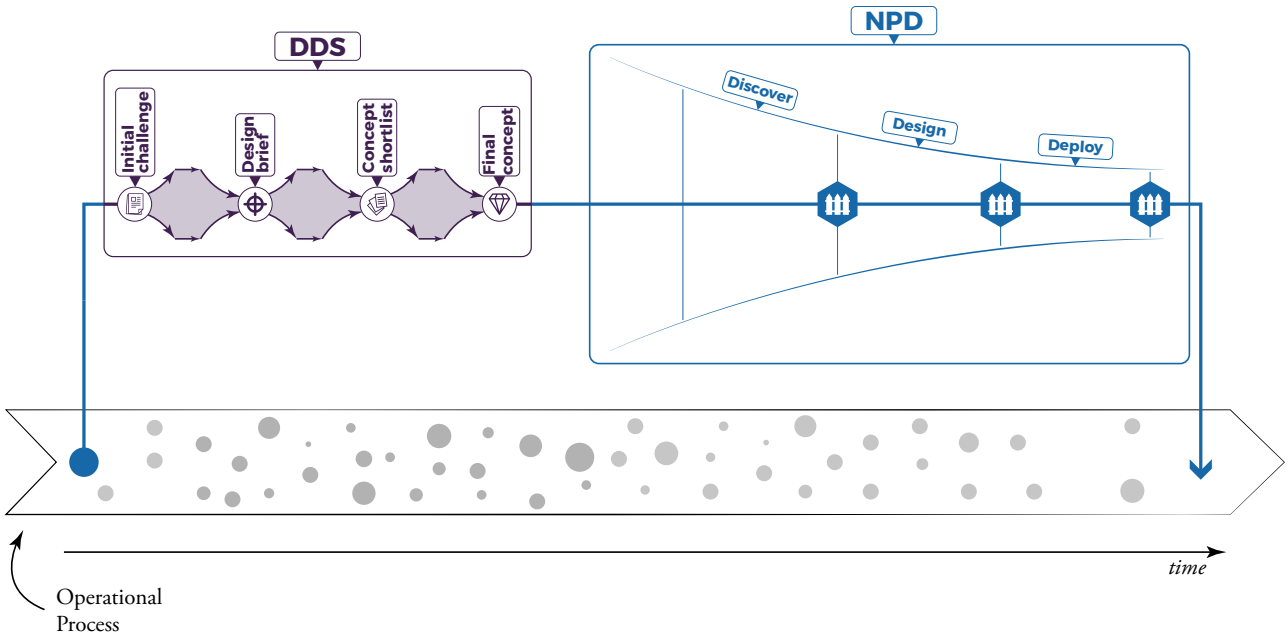

Figure 4 *The position of design within Unilever's innovation process*

Unilever's DDS teams are developing products that eventually have to move into Unilever's current stage-gate funnel, therefore the DDS department is positioned in front of it. From the interview it becomes clear that first a product-service is developed by the DDS team and subsequently is reviewed before moving towards Unilever's formal innovation process (the stage-gate funnel). After their design process, the DDS teams present a (working) prototype, a business model and an accompanying narrative that proves the concept's raison d'être while it also explains how the design output should be introduced to the market:

> *"...the students are making a prototype, a business model... they are making the idea as concrete as possible so that one can estimate its value in a very early stage of the innovation process..obtain a better understanding..."*

The type of output that is generated by the DDS teams differs from the regular product ideas that are usually entering Unilever's stage-gate funnel and therefore the company faces difficulties in deciding on the viability of the propositions coming from DDS:

> *"...if you take a look at all of the student projects, they all are being presented to marketing and they say 'no, no, no, this is not possible because it cannot be introduced to the market within a week'."*

A reason for this can be found in the fact that the DDS' product-service ideas are examined in a similar way as it is done within the stage-gate process that takes care of Unilever's portfolio of core products. While these core products and the overarching stage-gate funnel are aimed at incremental improvements, the product-service ideas coming from the DDS department are seen to carry with them a higher amount of risk.

> *"…[they] are examining products in the way they are also do that at the other side of the business, with their core products, their current portfolio. Then again they are going to have that yes/no discussion again, in that sense you are differently involved with risk, there is no discussion about risk because it [the DDS product-service ideas] are risky anyway."*

It can be seen that the DDS output is examined from the perspective of the incremental, low-risk stage-gate funnel and as a result the output barely moves into Unilever's stage-gate funnel that is already put in place:

"You can calculate that, like: how many of those concepts land within the idea phase of Unilever's funnel?...I think that about eight or nine [out of ten] concepts keep lying on the shelf, those are not successful and the rest of the ideas move through..."

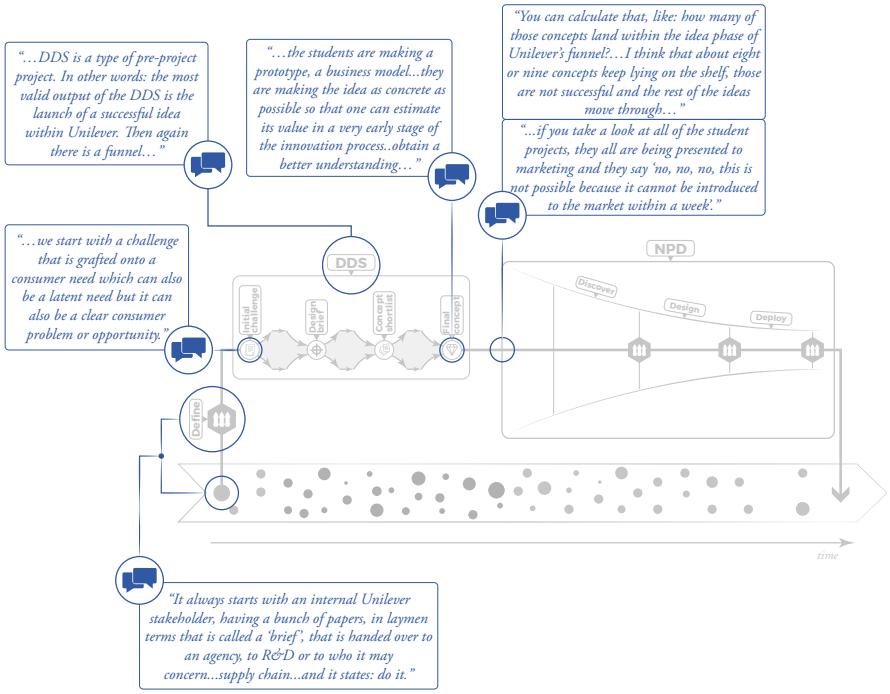

Figure 5 *Interview quotes describing various events within Unilever's design-embedded innovation process*

2.1.2 KLM

KLM's business is centred around the delivery of services within the aviation industry and therefore the company's approach to their innovation process differs from the innovation processes of Unilever and Ford. The fact that KLM is a service-oriented company results in the back-end of the organisation (KLM's operational department that is involved in making the company's operational processes work) that heavily relies on the use of people, whereas Unilever's and Ford's organisational back-end tends to rely on production through robots and machines. Within this KLM case, there is a focus on the KLM's operations department that houses the sub-departments Flight Operations, Operations Control and Fleet Services (Jochems, 2015).
The innovation process that is taken into account here is driven by the operations department whereby there is an initial call for an emerging problem that needs to be solved by another internal department (e.g. KLM's digital studio, which develops digital services, tools and information systems for the KLM organisation). The latter then develops a solution for the emerging operational problem through the use of scrum and agile ways of working.

By looking at the visualisation of KLM's operational innovation process (figure 6), it can be seen that, again, there is an ongoing operational process (the daily process that the operational department takes care of) that brings forward an emerging problem which is in need for a solution. The problems-to-be-solved usually are determined by an operational manager who, for instance in the case of a digital solution for an operational problem, addresses KLM's digital studio. Within such a digital environment one develops digital products and services through the use of agile and/or scrum ways of working, hence the 'scrum loop' that is integrated in the visualisation. The scrum way of working allows for short iterations of work (sprints) which gives product (software) development teams a certain framework for delivering software applications on a constant basis (Sutherland & Schwaber, 2013). The method allows for planning the sprint cycle(-s), a daily synchronisation session, a demo of the developed result and a review of the sprint session. When all of these milestones and ceremonies are accomplished successfully and when a solution is proposed to the operational manager, the working solution can be implemented within the daily operational activities. This is represented by the output of the 'scrum loop' that runs back into the operational process.

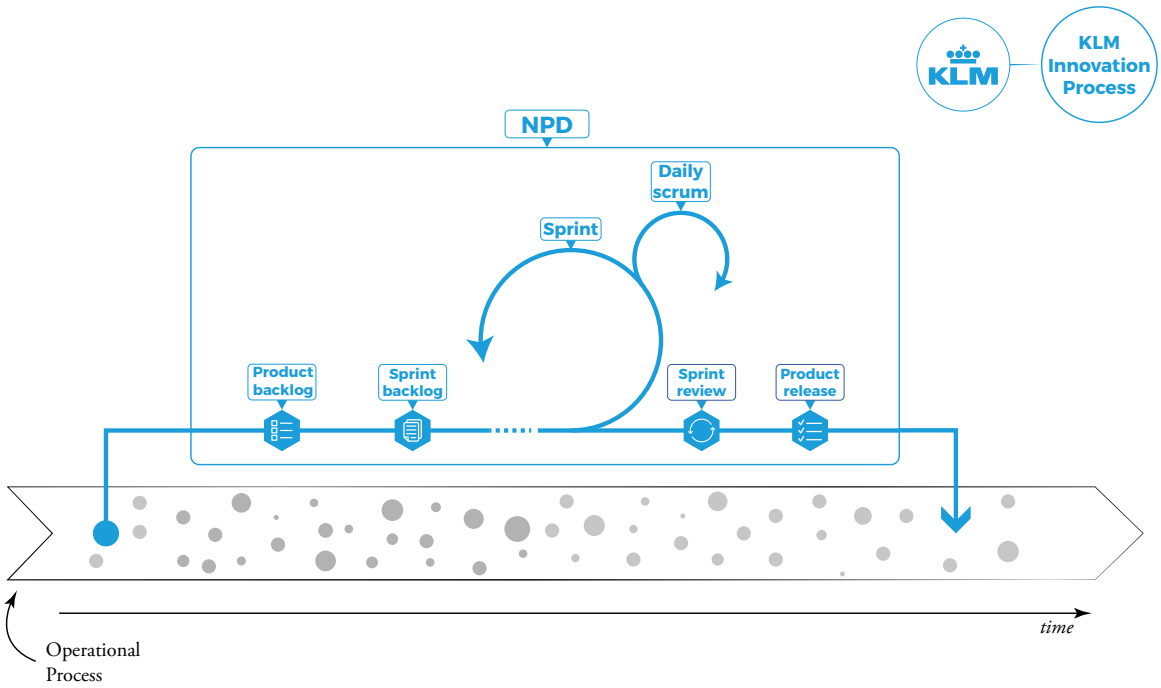

Figure 6 *KLM's innovation process*

Design within KLM

KLM has initiated (in collaboration with the IDE faculty) the KLM X-team, which has evolved from a testing and prototyping environment (the X-gate) into an independent department (the X-team) that uses the X way of working as their project approach. This X way of working consists of six stages:

The Ambition phase
The ambition phases's aim is to formulate a shared ambition, which is done together with all the stakeholders involved in the operational problem that is introduced to the team.

The Sherlock phase
The Sherlock phase allows for creating a (shared) understanding of the topic through the use of data and (design) research methods to find out the root cause of the problem at hand.

The Mickey phase
During the Mickey phase both diverging (using a creative ideation phase) and converging (selecting ideas from the ideation phase, composing a concept) steps take place, whereby at the end of this phase an action plan for the Lego phase is created.

The Lego phase
The Lego phase provides room for the formulation of hypotheses and measurement metrics in order to be able to test the prototype. In this phase also a Minimum Viable Product (MVP) is developed that allows for testing the formulated hypotheses.

The Dummy phase
In the Dummy phase the final prototype is tested on a large scale and a definite set of test output is generated.

The Mirror phase
The mirror phase is the final phase of the X way of working and here the hypotheses are being confirmed or rejected, while at the same time it is decided whether the developed product is ready to be released into the operational process.

The presence of a design element can be observed within the X-team and their project approach (figure 7). As stated earlier, the projects that are handed to the X-team mostly have an operational character in the sense that these projects are actual emerging problems stemming from KLM's operations department:

> *"They [X-team] receive a problem from an operational manager"*

The KLM case shows that problems are mainly initiated from an operational point of view, whereby an operational manager brings forward an emerging problem that stems from the operational process and which needs to be solved.

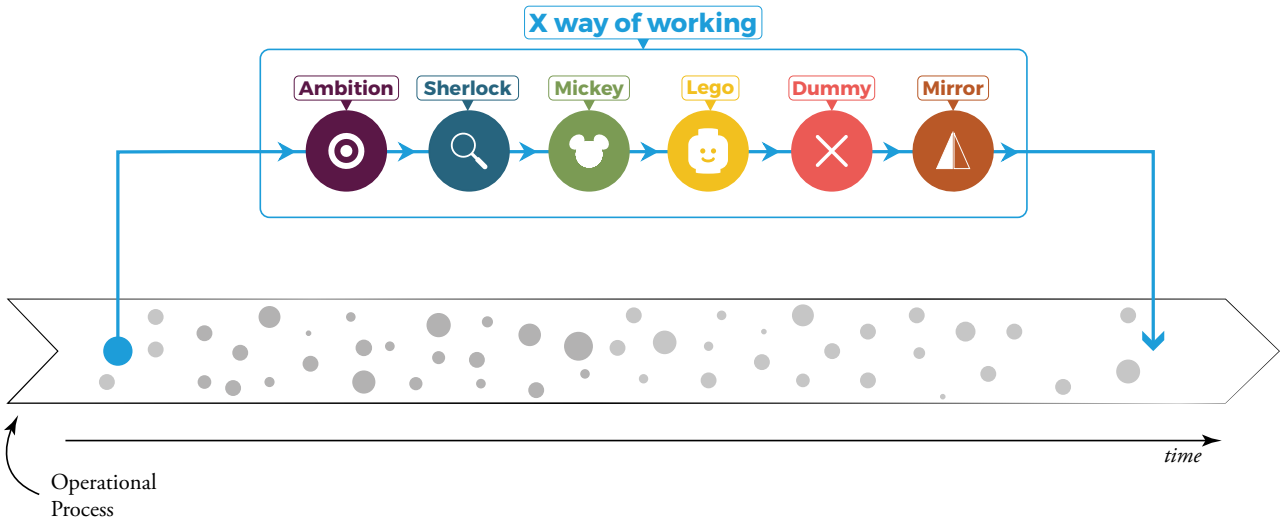

Figure 7 *The position of design within KLM's innovation process*

"So these types of projects...very often there is just some manager who states: 'I think we need this application, go make it for me'..."

Through the X way of working, the problems as presented are approached, reformulated by the X-team, validated through prototyping and testing and eventually a solution is handed over to the operations department. Besides, design within the KLM case is mainly embedded in the first half of the X-team's process covering the Ambition, Sherlock and Mickey phases of the X-way of working.

"...they [X-team] do that by means of the Disney method. That is a design way of working. And the Sherlock phase, the research phase. Then not only the physical processes are taken into account, but there is always an employee journey and a customer journey that is being made..."

Here, design is used on a process level in order to broaden the scope of the initial problem, identify opportunities related to the identified problem and get involved in diverging and converging actions in order to arrive at a concept. This concept then will be developed and tested further during the last, lean startup-like phases (the Lego phase, the Dummy phase and the Mirror phase) of the X-team process:

"It [design way of working] is especially in the beginning, that Mickey phase, that creative phase, the moment they have finished that and have decided to generate a solution, from that moment onwards it becomes more like a lean startup than that it is about design."

Regarding the output that is generated by KLM's X-team, a barrier between the released prototype and the actual implementation of that prototype within KLM's operational processes is perceived. This barrier takes place at the moment when the X team's prototype is released to the people responsible within the operational departments to implement change.

"A release means: we have tested, we have results and we know that with those results the problem mostly will be solved. We have a document where we explain how the idea exactly works and that is handed over to...the people who are responsible for implementing change within the departments. Those people receive the document together with the prototypes and the explanation and that's it. That is what they call 'release' and this [dropping down a set of papers] is what almost always happens..."

Because of this, only a small portion of the solutions that are developed by the X team are eventually implemented into KLM's operational process.

"There is an extremely small amount that is being implemented and that is exactly where this valley of death is situated. This happens a lot."

Figure 8 shows an overview of KLM's innovation process whereby, again, the corresponding quotes from the case interview are shown for specific parts of the process.

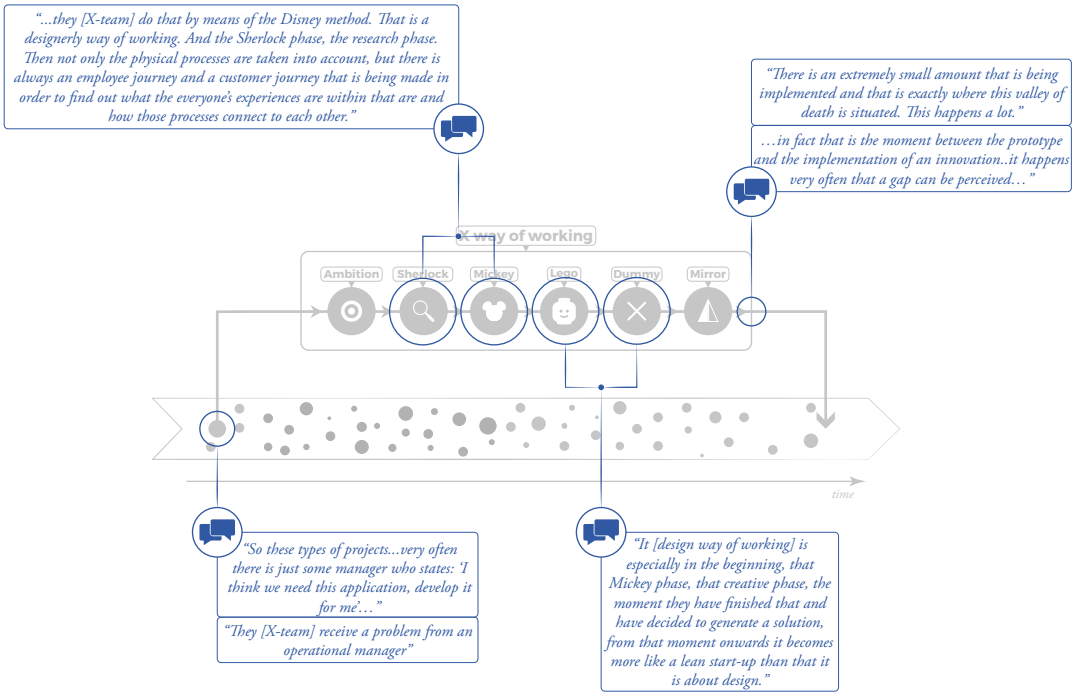

Figure 8 *Interview quotes describing various events within KLM's design-embedded innovation process*

2.1.3 Ford

Ford is currently structuring its innovation efforts by making use of two stage-gate type of processes: the first process is called the Global Technology Development System (GTDS) which is in its turn 'informs' the Global Product Development System (GPDS) (Šurinová, 2009; de Jong, 2017). The former system is put in place to structure the development of new technologies and the latter system is responsible for developing new vehicles, whereas both development systems are set-up to ensure a defect-free deliverance of both technologies and vehicles. The GTDS can be seen to consist of 5 consecutive gates that take care of the development and preparation of a technology so that it eventually can be implemented in Ford's GPDS. The following gates are put in place in the GTDS process: Kick-Off; Requirements, Concept Development & Selection; Concept Readiness; Application Readiness, Implementation Readiness. The GTDS allows for multiple projects to run simultaneously, whereas the various projects are progressing through its stages and gates with different speeds. During development, GTDS projects can be abandoned or left out due to wrong timing or because such a project turns out to be inappropriate for further use. When eventually being fully developed, technologies stemming from the GTDS are incorporated in the GPDS, the latter being responsible for the proper integration of all separately developed parts and technologies into one coherent vehicle.

Ford's current product innovation process is shown in figure 9. Comparable to the other two cases an ongoing operational process is put in place, delivering the input for the product development departments. The input from the operational process can be seen as a call for developing a new technology and/or a subsequent new vehicle in which the newly developed technology can be implemented. Such an initial call for product development first enters the GTDS and therewith it also enters Ford's product innovation process. As mentioned earlier both the GTDS and the GPDS are regarded as stage-gate processes and therefore the operational call is seen to sequentially move through the development process. When the GTDS delivers a finalised output it will feed into the GPDS, which means that a newly developed technology (GTDS) is implemented in the vehicle development process (GPDS). When also the GPDS process has been fully run through a finalised output (a vehicle with the accompanying technology) can be presented and is ready to be part of Ford's daily operational processes. This is the case when the manufacturing and sales processes of the newly developed product are fully ramped up.

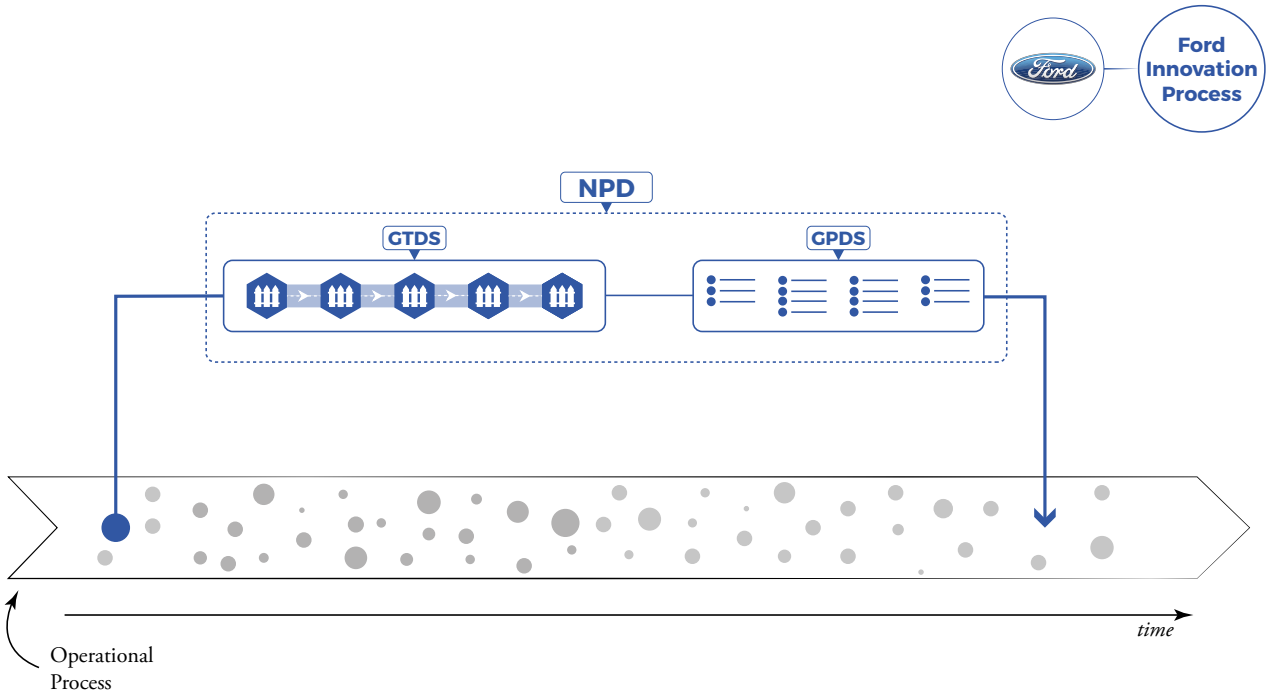

Figure 9 *Ford's innovation process*

Design within Ford

Ford currently puts effort in the implementation of human-centred design: from executive level this way of working and thinking is actively stimulated among Ford's departments, as Ford's CEO (Jim Hackett) has stated that human-centred design is a core principle for the company. This way of working is embraced due to the fact Ford wants to be an automotive as well as a mobility company, whereas a user-centred design methodology is seen as a way to integrate mobility solutions into their existing products and services ("Ford CEO Jim Hackett reveals details", 2018; de Jong, 2017).

Ford uses a stage-gate type of process for both technology development (GTDS) and for vehicle development (GPDS). However, de Jong (2017) states that the development of mobility services requires an approach that deviates from the stepwise-oriented GTDS and GPDS processes as the current engineering- and technology-driven capabilities cannot fully cover the knowledge gaps that emerge during Ford's transformation towards an automotive and mobility company. It is therefore that the Ford Smart Mobility subsidiary is founded as a part of Ford's Research and Advanced Engineering department, whereby the subsidiary mainly focusses on experimenting with various mobility solutions with the aim of eventually being developed into business propositions that can feed into the company's GTDS and GPDS processes.

In order to come to business propositions that can feed into Ford's installed innovation process, the Ford Smart Mobility subsidiary works through a process that contains the following elements.

- Customer-centric research
- User experience research
- Business model innovation
- Prototype

The design element is positioned in front of Ford's formal innovation structure (GTDS and GPDS) due to the fact that it is capable of searching for suitable opportunities that can help Ford to diversify in the marketplace. As can be seen in figure 10, the developed mobility service propositions, after being finished, move towards the technology development process (GTDS).

From the IDE faculty, both graduation projects as well as master courses are set up in collaboration with Ford, whereby the outcomes of those IDE design projects currently are mainly used as an inspirational grindstone for several management levels within the Ford organisation. By doing so, Ford tries to vertically break down their horizontal silos, which the company sees as a necessary thing to do in order to enable mobility services to be brought to the marketplace.

> *"…these projects are showed to various people within the organisation and to various levels of the organisation. Yes, that is going well, lately there was a meeting with the innovation champion of one of the projects, coming from the USA to gain new inspiration…in that way they try to break the company's horizontal silos."*

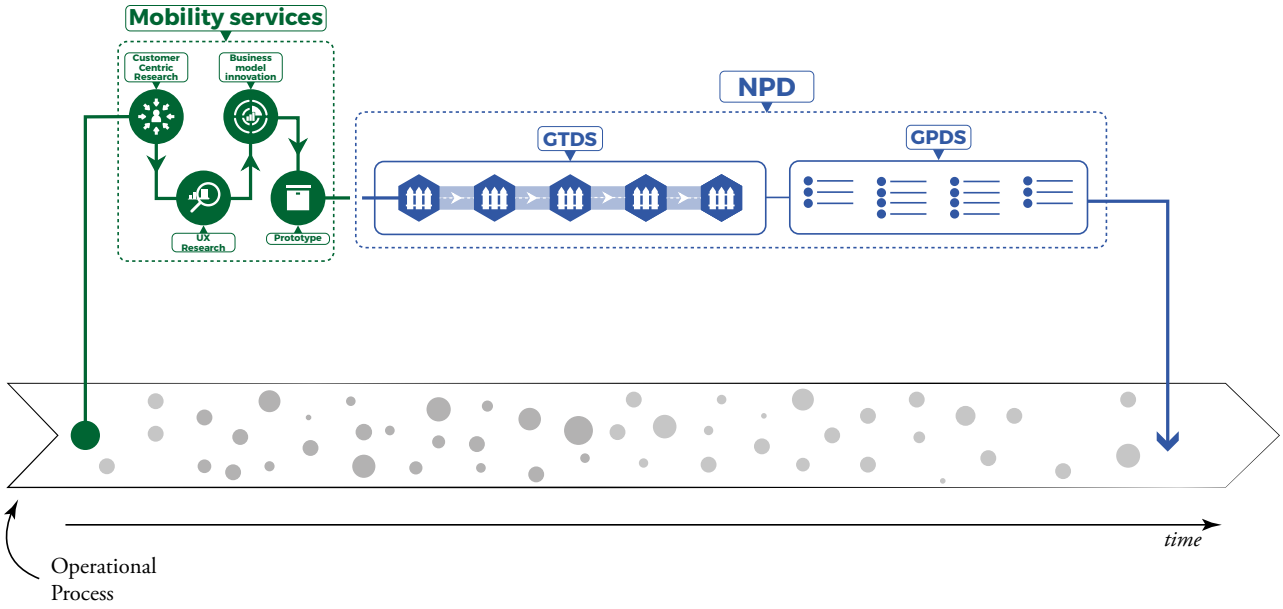

Figure 10 *The position of design within Ford's innovation process*

The Ford case interview describes the demand for exploring the future of mobility services which eventually can complement Ford's current automotive portfolio. This demand comes from Ford's R&D department which mainly employs engineering capabilities and therefore the open-ended type of question regarding the future of mobility services is interpreted from the engineering point of view that merely aims to increase efficiency and reducing failures:

> *"...the problem that they have over there is that there are only engineers and they do not know how to design: 'what do we have to do with that soft data, that Fuzzy Front End?… they want to ask us [the IDE faculty] the question 'how to diversify and distinguish yourself in the marketplace…?"*

A main insight from the Ford case interview is that design is used to explore the opportunities within the field of mobility services. Here, design contributes to explore and broaden the problem space that is initially provided by Ford's operational process, going through a design process with the accompanying diverging and converging movements in order to eventually arrive at a concept that presents a particular perspective on opportunities within the field of mobility services. As de Jong (2017) describes in his thesis on Ford Service Innovation, the ultimate aim is of the mobility service concepts is to eventually be incorporated into Ford's current innovation process, which consists of two GTDS and the GPDS

From the Ford case, it becomes clear that there are two perspectives on the future of mobility services. On the one hand, the Ford R&D department houses the several teams of engineers that are working on chassis design, the latter being a part of Ford's current automotive portfolio. The presence of the engineering mindset within the R&D department results in a heavy focus on efficiency:

> *"...within this engineering mindset it is all about 'how to make something more efficient?'... how they approach the autonomous car is about how to bring people from A to B in the most efficient way, so it has to do with the smallest amount of time and largest capacity."*

On the other hand, the R&D department is involved in the search for answers to the open-ended question of mobility services and the future of these services:

> *"They want to ask us [the IDE faculty] the question 'how to diversify and distinguish yourself in the marketplace… That is a very open-ended question and that is were design plays an excellent role because in the Fuzzy Front End it is looking at what places the opportunities can be found."*

The possible disconnection that can be perceived is about the fact that the interpretation of the soft data from the servitization and FFE-like projects has to feed into the stage-gate funnel of the chassis design departments which are mainly employ an engineering perspective on efficiency.

2.2 Case examination

Based on the interviews that were executed, three cases have been described whereby, for each of the cases, the existing innovation processes as well as the way design is embedded within these innovation processes have been outlined and visualised. Although each of the three cases bring forward different types of industries and a differing focus on either product-oriented or service-oriented innovation processes, several similarities and differences can be denoted when examining the embedment of design within each of the three cases.

2.2.1 Non-design project initiation

The quotes in figure 11 show that a certain demand stemming from the companies' operationalised processes (marketing-driven (Unilever), operations-driven (KLM) or engineering-driven (Ford) process) ignites the call for a new innovation cycle. This call then forms the input for the design elements that are embedded in the innovation processes of Unilever, KLM and Ford.

2.2.2 Design within the FFE of the innovation process

In all three cases 'design' mostly seems to be positioned in what is seen as the typical Fuzzy Front End (FFE) part of a company's innovation process. The origins of defining the FFE dates back to the 90's with Smith & Reinertsen (1998) stating that the FFE can be defined as the fuzzy zone that lies between the moment when the opportunity is identified and the moment when considerable effort is devoted to the development trajectory. Murphy & Kumar (1997) add to this that the front end of innovation can seen to be positioned between the generation of an idea on the one hand and the approval for either further development or its termination on the other hand.

Within this particular part of the innovation process design and, more specifically, a design process is employed to discover the broadness of the initial

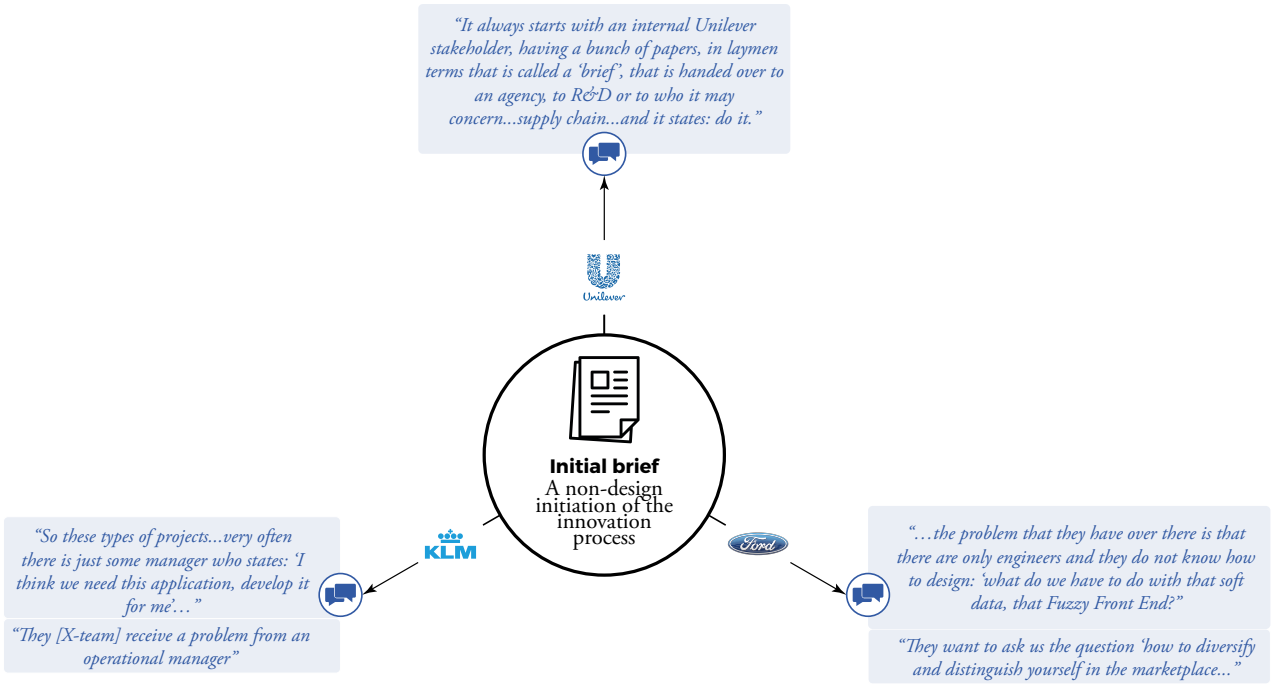

Figure 11 *A new cycle within an innovation process is initiated from a non-design perspective*

The similarity among the three cases is seen in the way the initial problem is identified and formulated prior to be handed over to the 'design element': this is mainly done from a non-design perspective, whereby the 'initial briefs' as formulated are derived from the operational processes. From those processes the initiation of a new innovation cycle is driven by the marketing department (Unilever), the operational department (KLM) or by the engineering department (Ford).

problem brief that is derived from Unilever's, KLM's and Ford's operational processes, to explore and identify opportunities linked to this problem and to eventually come up with solution(-s). Based on the interview quotes that are displayed in figure 12 the position of design within the innovation process of Unilever, KLM and Ford can be put in perspective.

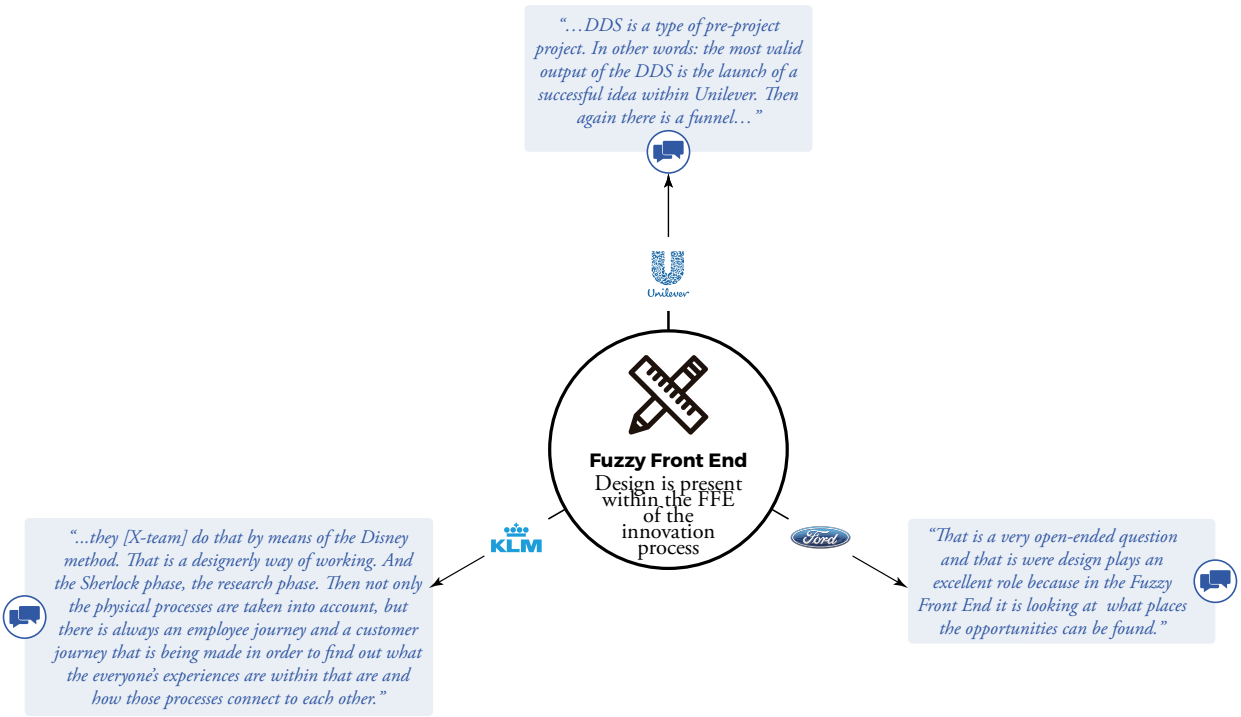

Figure 12 *Design is seen to be positioned in the Fuzzy Front End of innovation processes*

Ford

From the interview quotes it can be concluded that Ford makes use of design to make sense out of the relatively soft FFE data that is part of the search for diversification through the use of mobility services. Because the engineers are mainly involved with risk-reducing and efficiency aspects of the automotive portfolio, they are not found capable of dealing with user-centred insights that are generated during the front end of the innovation process. Instead design is used to make sense out of these insights and to translate these insights into concepts that can eventually flow into Ford's automotive innovation process.

KLM

For KLM design is seen to be present within the first part of the X way of working: the Sherlock phase is used for executing problem-related (user) research, whereas the Mickey phase is used to generate ideas based on the identified and redefined problem. The second part of the X way of working has a lean startup type of approach, whereby prototypes are developed, tested and validated based on the design steps executed within the first part of the X way of working.

Unilever

Within Unilever's innovation process design is seen to be embedded within the DDS due to the fact that within this department student design teams employ a design process in order to generate a product-service idea based on the initial problem brief. The ideas then have to move into Unilever's innovation funnel to be developed further, thus the position of the DDS department and the output of the DDS teams seem to resonate with the above-mentioned definition of the FFE as positioned in the front end of the innovation process.

2.2.3 Disconnection between design output and formal innovation process

The output that is generated by employing design in the FFE can be regarded as a way to supply Unilever, KLM and Ford with new perspectives to the problems as they were initially derived from their operational processes. However, the generated type of output simultaneously presents a subsequent problem, namely that there are difficulties for this output to find traction within the company's innovation processes that are already put in place.

The Unilever case shows that most of the product-service ideas, generated by the DDS teams, are not able to move into the company's stage-gate funnel: those ideas fail to 'land', so to say. As is stated in paragraph 3.1.1 this has to do with the fact that Unilever is inclined to assess the DDS output in the same way as is done with their core product portfolio (aimed at incremental improvements and low risk). The DDS output is then seen to be mostly rejected based on its higher risk level and on the fact that, from Unilever's stage-gate perspective, the output appears to be more like a radical 'improvement'. The disconnection that then follows from this situation can be found in figure 14.

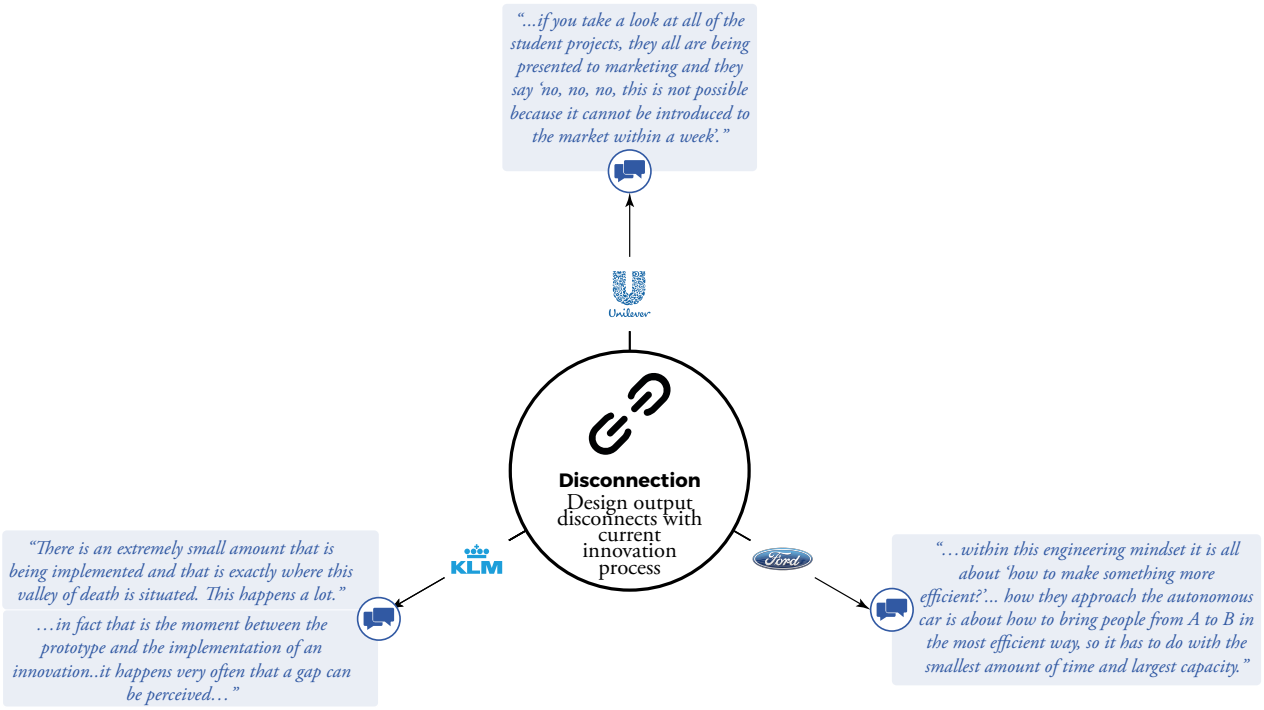

Figure 13 *The design-generated output disconnects with innovation processes that are already in place*

Based on the distilled quotes that are shown in figure 13, it can be seen that there seems to be a disconnection between the type of the design output on the one hand and the company's installed innovation or operational processes on the other hand. The disconnection aspect eventually comes down to a situation in which the design output has, at some point in the innovation process, difficulties with finding traction or being adopted. Therefore this causes the output to not being adopted in the operational processes, the latter meaning that the newly developed product or service is won't be launched to the marketplace.

The KLM situation also shows a disconnection problem (figure 15), although there is a considerable difference in the way this disconnection manifests itself when being compared to the earlier-mentioned Unilever case. This difference lies in the fact that the output that is generated by the X-team has to move directly into KLM's operational process instead of that it has to move into a subsequent part of the innovation process, as is the case in Unilever's innovation process. When the solution, generated by the X-team, is released to the operational department a so-called 'valley of death' is perceived. At this moment, whereby the release document containing the solution is handed over to the ones responsible for implementing the solution, the proposed solution fails to get implemented within KLM's operational process.

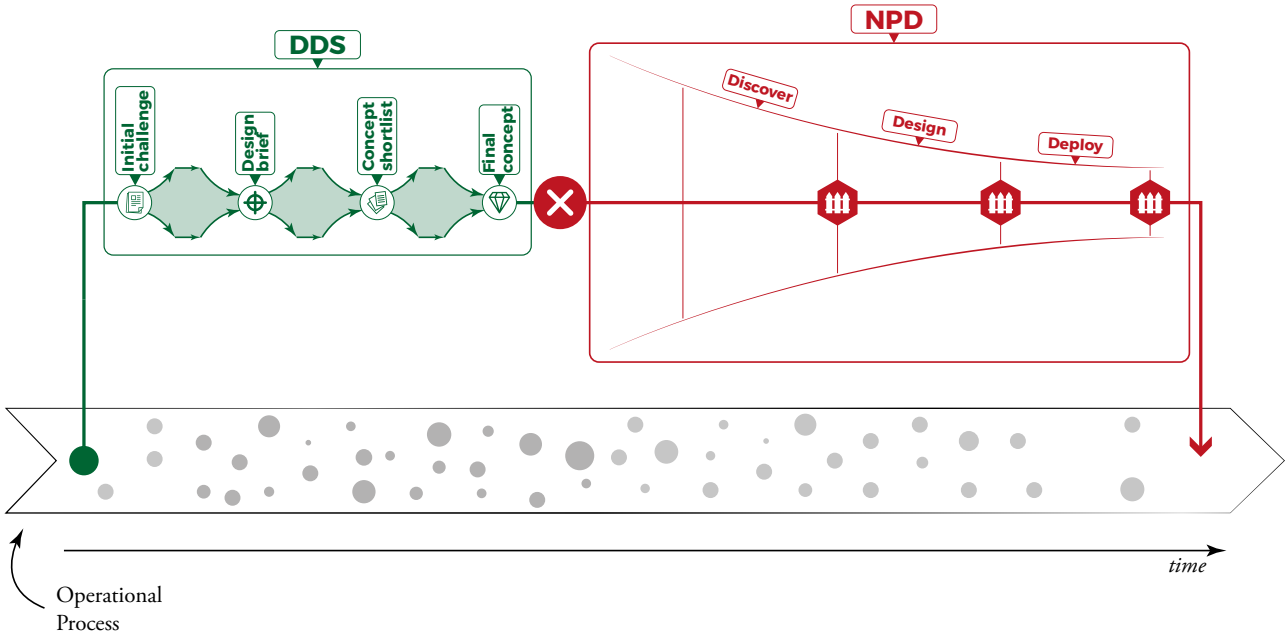

Figure 14 *Disconnection between the DDS output and Unilever's stage-gate funnel*

The interview as executed with regard to the Ford case has helped to outline the company's innovation process and the way design is employed within this process. However, the information gathered from the interview and the desk research did not provide the information for reconstructing the actual implications of design on Ford's innovation since the proceedings of the PhD research are still too preliminary for arriving at such clear insights. However, when taking into account the other two cases, one could predict a future disconnection between the output of the Ford Smart Mobility subsidiary on the one hand and the GTDS and the GPDS stage-gate processes on the other hand. This then could be caused by the fact that the developed mobility solutions, based on the soft FFE data, have to feed into the GPDS, whereby the latter process is set up to deal with engineering-type of problems and therefore not equipped to asses the output of the Ford Smart Mobility subsidiary. In this way it could resemble the Unilever case whereby a similar kind of rejection happens to take place. Further proceedings of the Ford PhD candidate's project should make clear whether this will actually take place.

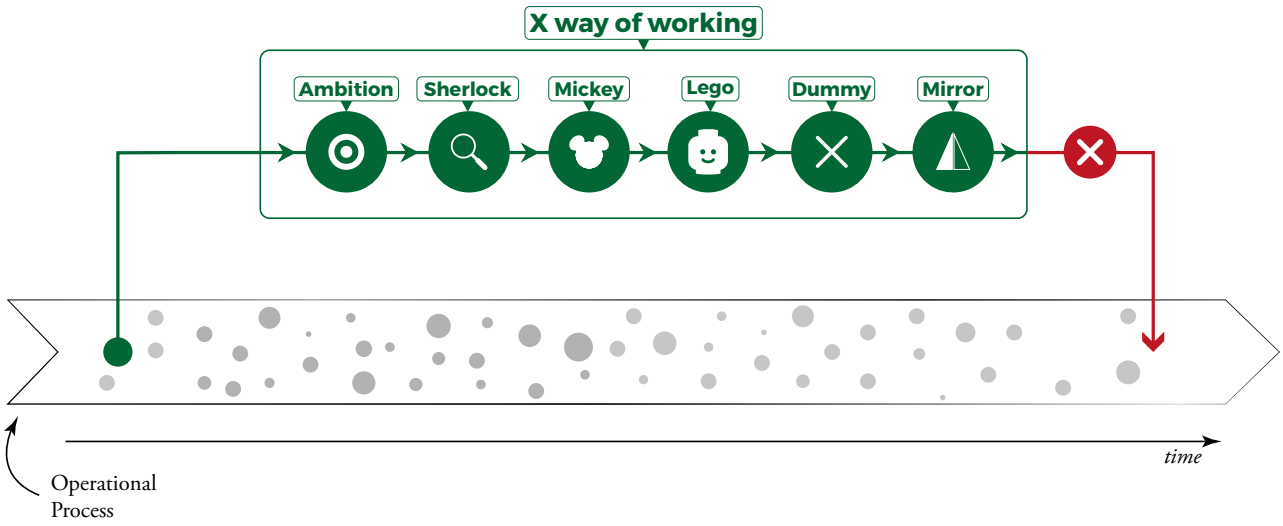

Figure 15 *Disconnection between the X team's output and KLM's implementation trajectory*

2.2.4 Separate department for design activity

Besides the fact that design is employed in a similar role by means of the FFE of the Unilever, KLM and Ford product innovation processes, it can also be noticed that there are similarities in the way design is positioned in relation to their organisational structure. In each of the three cases design an accompanying design process is employed within its own department-like structure: Unilever makes use of the Disruptive Design Studio, KLM uses the X-team and at Ford Europe one has set-up the Innovation Management & Mobility subsidiary (part of the Ford Smart Mobility department) to address emerging opportunities in the field of mobility services.

2.3 Concluding remarks

As can be concluded from this chapter, the first set of findings have helped to outline the innovation processes that are used by Unilever, KLM and Ford, whereas at the same time it is made insightful how design is embedded within these processes. The overview of similarities among and differences between the cases paves the way for zooming in on a specific problematic situation that can be perceived in the Unilever and KLM case. In both cases this problematic situation is about the disconnection problem that occurs when the output, generated by either KLM's X-team or the Unilever's DDS team, has to move further through the innovation process of Unilever or KLM. Within the former innovation process the design output ideally gets adopted within Unilever's regular stage-gate process, whereas in the latter innovation process the X way of working generates an output that directly has to move back into KLM's operational process. However, the envisioned adoption of the design output in either the stage-gate funnel or the operational process does not take place, hence the earlier-mentioned disconnection problem. It is therefore that the next chapter will further address this disconnection problem by focussing on the 'interaction' between the design output on the one hand and the existing innovation processes on the other hand.

3 Disconnection assessment

The first set of interviews that are displayed in the previous chapter have helped to get a first grasp of design's role within a company's innovation process. The problem that has been found here is about the disconnection between the outcome of a design process and the further 'adoption' of this design outcome within the (formal) innovation process that is already in place.

In the following chapter the focus will be put on further examining this disconnection problem within the Unilever and the KLM case, whereby the insights that will gained can be of help to get to the core of these disconnection problems.

3.1 Interview format & set-up

As has already been mentioned in chapter 1, this second interview round makes use of a qualitative approach using an interview format. Contrary to the interviews that were executed during the first round, the interviews in this second round will be executed by means of a semi-structured interview approach. Chapter 1 mentioned that such an approach makes use of an interview guide, whereby its semi-structured character ensures that there is room to elaborate on specific details that could emerge from the interview. Such elaborative freedom is needed since this second part of the empirical research is about further exploring the disconnection problem. Therefore a certain freedom is needed to elaborate on specific topics that might emerge from the interview and to which the interview guide did not anticipate on.

The examination of the Unilever and the KLM case requires interviewees with a clear link to either Unilever's DDS department or the KLM's X-team, since these entities represent the design element within the innovation process of those companies. Such a perspective enables a focus on the design output and the disconnection problem of this output. Whilst the PhD candidates that were interviewed during the first part of the empirical research have provided an overview of the three cases with regard to the embedment of design, the second interview round could benefit from interviewees with a company perspective on the disconnection between design output and the existing innovation processes of Unilever and KLM. Such a perspective can add more depth into the possible corporate dynamics that are centred around the disconnection problem. It is therefore that an inquiry was done among the first-round interviewees and this has brought forward two interviewees for this second-round interviews:

- Disruptive Design Director at Unilever
- Product Owner Operations at KLM

3.2 Unilever

The second-round interview with regard to the Unilever case is aimed at finding out more about the nature of the disconnection problem between the DDS' output (consisting of product-service ideas) and Unilever's stage-gate funnel. From the interviews the following insights are found.

3.2.1 Unilever's barriers for adopting design output

Although a well-developed, thorough product-service idea increases the chance of being adopted within Unilever's stage-gate funnel, it is not at all guaranteed that this actually will be the case. The motives for whether or not being adapted within the Unilever funnel seems to be quite arbitrary, as is stated in the following quote.

> *"…no matter how well prepared you are beforehand, it can go all over the place due to the noise in the system… You can put a lot of effort in the preparation phase, doing that with the right people and having the right information and say: 'that is where we are aiming for'. But you always have some variation during the process and that is why it can end up going in all kinds of directions."*

Nevertheless there appears to be a type of common denominator within the process that negatively affects the yield of the DDS output and this denominator seems to be positioned at the company's VP management level:

> *"…the most important factor is a pulling force. The moment you…in the Unilever case that is a brand manager or a marketing VP* [Vice President]*…if they say: 'I want this', then that yield* [of the output generated by the DDS] *becomes 50% at the minimum. Because then they say: 'come at me, answer me, I am open to it'…"*

More precisely, it is about ownership that has to be created among brand managers or marketing VP's in order for a DDS product-service idea to be adopted by them:

"The only important factor...is that you need a person who says: 'that is mine'. Ownership. At the moment you have a concept, an idea, whatever and a senior person says: 'that is mine', well, that is one of the parameters in this elegant equation that is very dominant. It is not as abstract, not as impersonal as you would think it is, no, no…you need people who are touched by it. So that they say: 'I see opportunities'."

Apparently, the ownership that has to be created at the higher ranks of the company plays an important factor within the Unilever case. At the same time, the extent to which this ownership is taken heavily depends on the kind of vision that is driving such a manager or VP. As has become clear in chapter 3, the prevailing vision that drives Unilever's formal innovation process (the stage-gate funnel's Discover-Design-Deploy process) is one that has a rather short-term stance on product development that is focussed on assessing low-risk, incrementally improved products. On the contrary, the output generated by the DDS can be regarded as more breakthrough type of product-service ideas and as such they tend to resonate not very well with Unilever's short-term mode of reasoning.

3.2.2 Unilever's stimulators for adopting design output

From the interview, it becomes clear that the majority of the DDS product-service ideas are not adopted within Unilever's stage-gate funnel.

"…I think that 8 to 9 [product-service ideas] *are shelved, they are not successful, and the rest moves on* [to the stage-gate funnel]…*"*

However, a handful of ideas is currently moving through the stage-gate funnel. This means that those ideas have landed within Unilever's formal innovation process and thus have been able to be transferred to Unilever's stage-gate process. One of the driving forces for increasing the chances of such a successful adoption is the development of a thorough product-service idea, as becomes clear from the following interview quote.

"…1 or 2 out of 10 they…where we think: 'we have to play this well', that is why that third phase within the DDS is so important, that you not only have to come up with a nice 'paper-ish' idea, but you should also give it arms and legs…that is really necessary when you want to give your idea some momentum within the company…".

Besides, the significance of human-based memory – both within the DDS and Unilever in general – is seen as a prerequisite for enabling product-service ideas moving into the stage-gate funnel:

"…make sure you do not forget anything and keep looking for emerging needs because the lack of memory within a company is bizarre."

Here, it is about having *"…a few persons, they are like nestors who are there for 100 years…"*: people that can anticipate on emerging business needs by linking them to an existing DDS concept, be it a recent concept or one that has been stored for years.

3.2.3 Efforts to increase the yield of design output

Currently, Unilever puts effort in increasing the yield of the DDS output by searching for external routes, outside their stage-gate funnel. Through a collaboration with Wageningen University and specifically with startup companies that are located in and around Wageningen University, Unilever tries to revitalise DDS product-service ideas that are not able to be adopted within their regular stage-gate funnel. Instead of being put on the shelf, these ideas are given a second chance by means of the startup network:

"One month ago we started to do something naughty: we are going outside of Unilever. With high confidentiality, we have selected a few of those [DDS] *concepts where we state: if smaller companies want to implement that kind of things* [DDS product-service ideas] *and if they are capable of doing so, a kind of local experiment can take place with Unilever monitoring those activities and when it appears to be successful then we pick up the developed idea."*

The collaboration with food and nutrition startups centred within and around Wageningen University can be seen to form a kind of future by-pass for the DDS studio and their display of product-service ideas, with the aim of eventually introducing those breakthrough ideas to the marketplace.

However, also inside the Unilever organisation there are also opportunities for increasing the yield of the DDS output. Here, it is about behaviour of senior management that has to be suppressed in favour of behaviour that is inclined to incorporate a certain amount of risk in the senior management's mode of reasoning. Moving away from Unilever's risk-averse behaviour then could help to adopt a higher amount of the DDS product-service ideas within the stage-gate funnel.

"…a…tremendously important factor is…to suppress that risk-averse behaviour and for us this mainly concerns the senior leadership. Like: 'it is o.k. for you to sometimes fail with a part of the portfolio'…if they say: 'well, we are going to take some risk with that little piece' [of Unilever's product portfolio]*, coming up with some really new things, that would be a huge contribution.*

It seems to be that within Unilever's senior management levels this kind of paradigm shift is starting to take place:

"I have to say that the overall zeitgeist is getting more mature now…Our Unilever world is divided into Country Category Business Teams…the one most active is the Benelux team… They are representing a new generation of senior managers who understand that you need a healthy machine but that you also need something additional to get inspired. So every year they allocate money to do crazy things…they allow experimentation with new concepts, you will need that zeitgeist. Because no way this would have happen 5 years ago."

Such a perspective within the innovation process can be beneficial for the DDS, since the breakthrough type output of the DDS process tends to resonate with the above-mentioned view that tends to emerge among some of the managers at senior level.

3.3 KLM

The KLM interview is aimed at finding out more about the disconnection within their innovation process, more specifically it was aimed at finding out more about the moment that the X team's solution is released and the envisioned implementation of X team's solution within KLM's operational process.

3.3.1 Barriers for adopting design output

Although the solutions that are being developed by the X-team can count on support among the business owner as well as the solution's end users, the implementation aspect of this solution is seen as an element that needs improvement. Here, the solution is developed through the way of working (the X way of working) that KLM wants to use within the entire company, however, the initiation for implementing such a solution is done in a rather old-fashioned way:

"…it mainly is about the fact the traditional way is about a solution that is developed by one person and a second person then says: 'look, this is the solution, go and work with it.' And that is also communicated in that way: 'we have a problem, this is the solution…please go do it.'…

From the perspective of the X-team, this "traditional way" of communicating a newly developed solution towards the operational department is not sufficient in order to achieve the desired effect of the developed solution:

"We have noticed that sending an e-mail or a process instruction is not sufficient for initiating change, you want people to display different behaviour and that is not achieved by simply sending an e-mail…"

Within KLM and the X-team, the development of the solution and the implementation of that solution are regarded as two separate 'worlds' and the fact the X way of working is not yet being used within the entire organisation creates a situation whereby various paradigms meet. Here, the one part of the organisation is driven by the X way of working, while other parts – also at the departments responsible for implementations – still operate through a more traditional way of working:

"…if you have a mandate from the company's highest ranks, while this is not the case at the lower levels…having support from people…then it is still going to be difficult, you cannot get things done by shouting: 'the COO and the CEO also want this'…they have to experience it for themselves, so in some ways we are like pioneers, so to say."

From the c-suite level, the X way of working is regarded as the method of change within every KLM department and as a result every single KLM department eventually has to adopt this way of working. KLM and the X-team are in the midst of doing so and it is stated that not every department is adopting this way of working at the same pace:

"It is just a change that we are going through as a company and that takes time. If they are here, then we are already focussing on the next change…that is just the playing field."

Besides the fact that the implementation problem is found in the discrepancy between the different ways of working that are currently present within the KLM organisation, there also seems to be a political aspect that goes hand in hand with this. It is stated that, within the higher ranks of the organisation, there is some kind of resistance for implementing solutions as they are developed by the X-team:

"What we do see is that sometimes, with regard to the political aspect, there is some kind of political interference… we have a kind of 'make it happen' attitude and, well, we proof it, right? We can be a bit radical when it comes to taking such a stance and there are some departments who are not yet there, that is what we are experiencing. There is a certain fear en that fear is particularly present at the higher ranks, because we are doing the co-creation with the floor personnel, so that is not the problem."

3.3.2 Stimulators for adopting design output

The X-team and their X way of working are seen to involve all of the business and problem stakeholders from the outset and throughout:

"The big difference mainly lies in the fact that the generated solution or the product comes into being by collaborating with the people that have to work with it, but also with

the input of the customer and the employee et cetera. Usually an employee was involved within the project teams, acting as a point of reference, but it is not shaped by the target group that eventually have to use it. We are not only testing, but we are also building the idea with different people in the live environment and the moment we receive feedback we directly make adjustments and we go on."

The fact that also the project initiator, the business owner, is involved from the very beginning increases the acceptance of the eventual product, since all stakeholders approach the problem with the same ambition in mind:

"In fact, the moment we arrive at a point where we state: 'this is a successful MVP [Minimal Viable Product]*, you can implement it', then the business also wants it because we are working on the same ambitions, on the big problems that they are experiencing, so very often there is a need. We do not think by ourselves: 'we think that this is a good idea, let's do it', no, there is a need and it has been proven so there is no one who then says: 'no, we do not want this.'"*

The thing that seems to work out well for the X team is the fact that all of the problem stakeholders, from the very beginning, are involved in the development of a solution.

"…the solution or the product is created together with the people who have to work with it, but by means of the input of the customer and the employee… We position ourselves at the intersection of those three stakeholders, in everything that we are doing we try to arrive at benefits for the employee, for the customer as well as to arrive at operational benefits."

It is therefore that the solution that is created by the X team tends to be accepted by the people that eventually have to work with it.

"I notice that the business puts a lot of faith and trust in our way of working due to the fact it is being developed by an agent, whereby the frontline staff confirms that they agree with the developed idea."

When this solution eventually has to be implemented within KLM's operational processes, the X team encounters a barrier related to the way the implementation of their solutions are being communicated. In the current situation only the solution to an operational problem is developed by means of the X-way of working but it is proposed that also the implementation of this solution needs to be done through this way of working:

"Of course we see that within our organisation, within the implementation, some things could be done better, but that is not up to us. Sometimes people say that we should X-ify the implementation trajectory, that we have to build that…how to implement and that is something that could gain a lot of profits."

Another aspect that could provide KLM with increasing chances of dealing with the design output more easily is the fact that KLM trainees are being trained in design at the IDE faculty at the Delft University of Technology.

"So each two months, all of the KLM trainees…the management trainees, the IT trainees, the finance trainees… they come to the IDE faculty for a design training. This makes sure that we are going to have people at places within the organisation that are trained in design thinking."

3.4 Comparison of the Unilever and KLM case

The insights that were derived from the second-round interviews – focussing on the disconnection problems that occur within the innovation processes of Unilever and KLM – allow for an examination of similarities and differences between both cases. Although the cases are far from similar when looking at the type of industry or at the way their innovation processes are organised, both cases – up to a certain level – are seen to have a particular overlap in the encountered problems, whereby this overlap could form the starting point for drawing conclusions and formulating recommendations. Below, a further elaboration on those various barriers and stimulators is displayed.

3.4.1 Upper-echelon barrier

As can be derived from both Unilever and the KLM case, a similar type of barrier can be found in the way "*senior management*" (Unilever) or the company's *"higher ranks"* (KLM) are interacting with the output coming from either the DDS or the X team. In both cases, the upper echelons are the ones responsible for enabling the design output to be adopted within Unilever's stage-gate funnel, whereas in the case of KLM they are responsible for deciding on the X team's intermediate design propositions and for the actual implementation of the X team's solutions within KLM's operational processes.

From the perspective of Unilever, a brand manager or marketing VP has to show a sense of ownership in order for a DDS product-service idea to increase chances being adopted within Unilever's stage-gate funnel. However, the parameters for whether or not showing this ownership are rather arbitrarily and are mainly driven by the risk-reducing behaviour (common practice within Unilever's innovation process) and the extensive change rate among brand managers. As such managers want to obtain a success rate as high as possible during the relatively short period of time that they are on the job, they are inclined to show ownership to those projects that they can finish successfully. As a result, those projects are relatively low-risk projects aimed at incremental

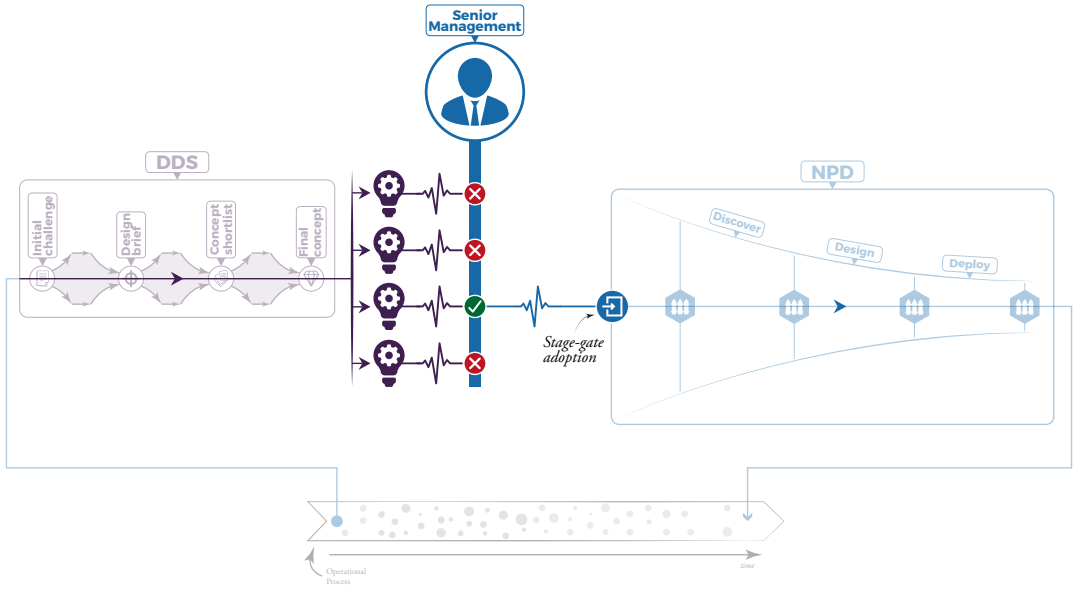

Figure 16 *Assessment of DDS output from a stage-gate funnel perspective*

product innovations. The latter is orthogonal to the type of product-service ideas that are developed by the DDS department, creating a situation whereby such product-service ideas are assessed through the lens of low-risk, incremental innovations (figure 16). It is therefore that the output of the DDS department, coming in the form of a product-service idea, has a relatively low yield.

At KLM one can also speak of an upper-echelon barrier. Although KLM's c-suite regards the X way of working as the method of change for every of its departments, it does not per se mean that everyone at the lower management levels are directly on the same page, especially since various departments have not yet adopted the X way of working. It is therefore that the X team, which is a forerunner in adopting and using the X way of working, encounters a barrier that comes in the form of a political type of opposition (figure 17), present within the higher ranks or upper echelons of KLM's departments. This opposition is caused due to the fact that the X team tends to have a way of working that breaks down KLM's vertical silos, while many other departments are still organised and structured in a rather hierarchical way.

Besides, the various departments changing their way of working at several speeds creates a situation whereby the X team on the one hand develops a solution through the X way of working, whereas the solution is implemented through the old and hierarchical way of working. The latter means sending an instructional e-mail or publishing the document that contains the developed solution on KLM's internal communications platform.

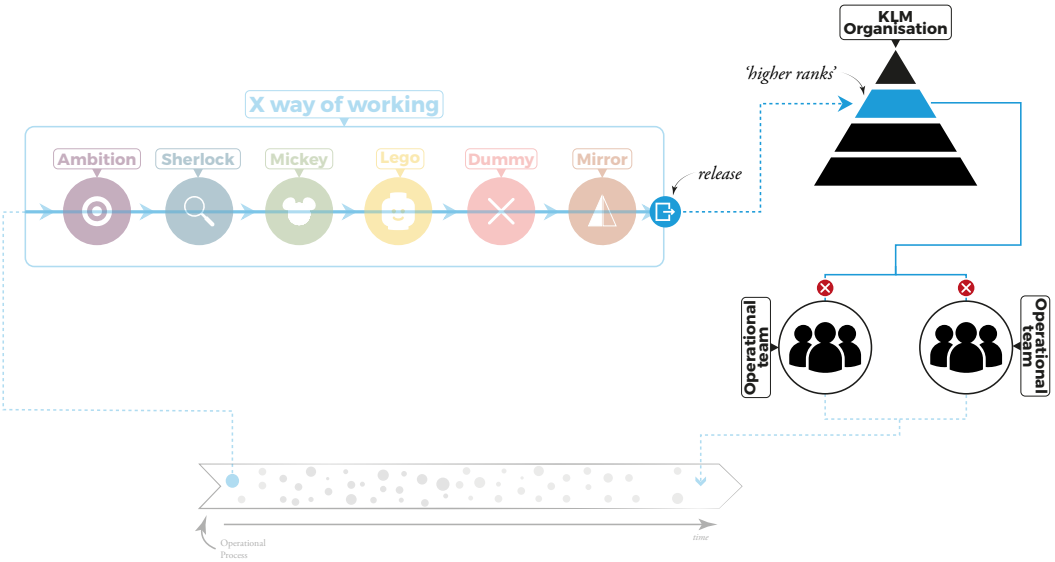

Figure 17 *Political type of opposition prevents the X team's solution from being implemented*

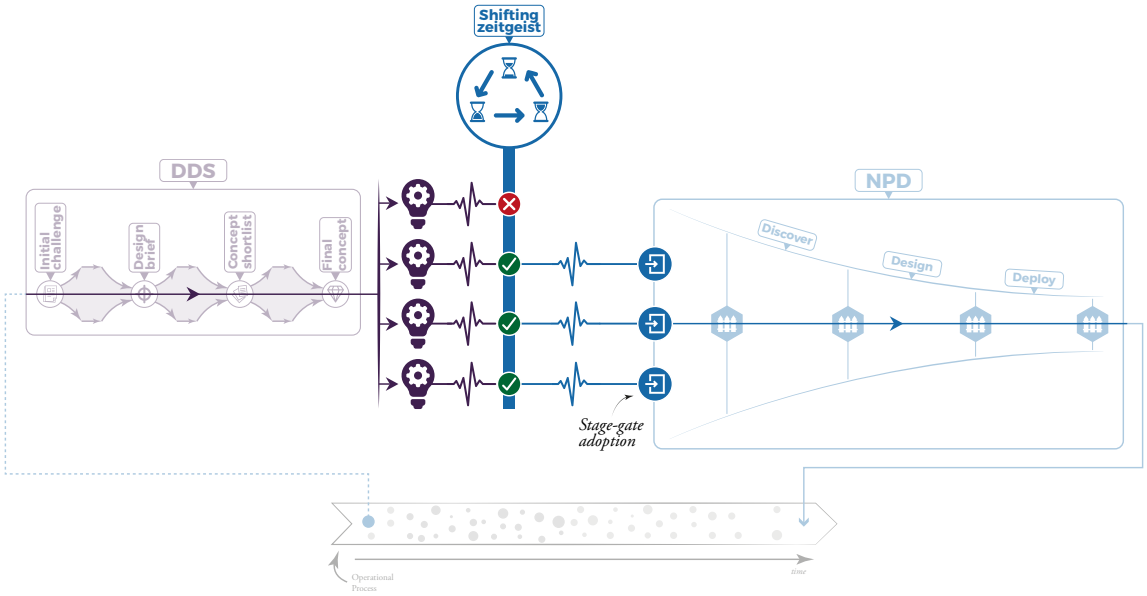

Figure 18 *A changing zeitgeist within Unilever's senior management could increase the yield of DDS output*

3.4.2 Changing zeitgeist

Even though the above-mentioned findings describe a so-called 'upper-echelon barrier', it is also found that there are signs of a shift going on in these same echelons. Within Unilever it becomes clear that within their CCBTs (Country Category Business Teams) a new generation of senior managers emerges. As is highlighted, these senior managers are inclined to move away from the risk-averse attitude that currently prevails within Unilever's stage-gate funnel, and are allocating resources for additional, inspiring and even "crazy" projects. The proliferation of such a mindset throughout the Unilever organisation could be beneficial for the DDS product-service ideas to be adopted within Unilever's stage-gate funnel (figure 18), as these ideas, compared to the company's core product portfolio, can also be regarded as "inspiring" or "crazy" projects.

A similar development is set in motion by KLM. On behalf of the 'Design Doing at Royal Dutch Airlines' collaboration between KLM and the IDE faculty of the Delft University of Technology, all of the trainees (i.e. management, financial and IT trainees) are following design workshops. By doing so, KLM wants to ensure that among all ranks of the company future managers carry with them a design thinking attitude. Although this is not going to have direct impact in the here and now, KLM trainees that carry with them a design thinking attitude could potentially be beneficial for KLM's X team. This is due to the fact the X team's actions and output have a higher chance to be assessed in a way that matches the design characteristics of the output developed by the X team. However, since the "Design Doing" collaboration program is initiated only 1.5 year ago, proof has yet to be provided whether this design training provides the result as envisioned above.

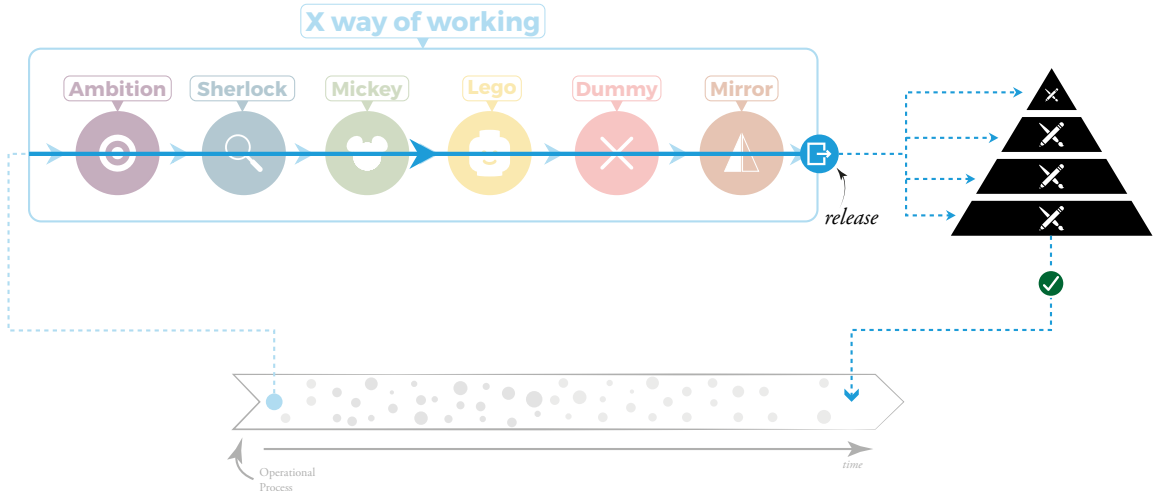

Figure 19 *Designerly trained KLM trainees could benefit the implementation of the X team's solutions*

3.4.3 Increasing the yield of design output

Both cases present possibilities that could contribute to increasing the yield of the output coming from Unilever's DDS and KLM's X team. The former case makes clear that Unilever is opting for an external route: the company strives for collaboration with external partners in order to increase the adoption rate of the DDS product-service ideas. Here, Unilever is increasingly collaborating with Wageningen University, thereby making use of the university's ecosystem which houses several startups and startup incubators. This ecosystem enables startup companies to 'pick up' and further develop DDS product-service ideas that are not able to enter or be adopted by Unilever's own stage-gate funnel. When such a startup then develops a product-service idea into a full-fledged product, Unilever gets the possibility to acquire that product or the entire startup and to let it enter their regular innovation process with the aim of introducing the product into the company's operational process. By setting up this external detour (figure 20), Unilever tries to increase the yield of the DDS output by means of by-passing Unilever's stage-gate funnel.

From the KLM case it is found that – from the X team's point of view – one has a certain opinion about increasing the yield of solutions developed through the X way of working. Here, it is suggested that, in order to increase the chances of righteously implementing the developed solution, the current implementation method should be 'X-ified'. The latter means that, besides the X way of working that is already being used by the X team, a similar way of working should be used during the implementation trajectory (as can be seen in figure 21). At the moment, implementation is done by sending an e-mail but this method is not regarded as a sufficient for the developed solution.

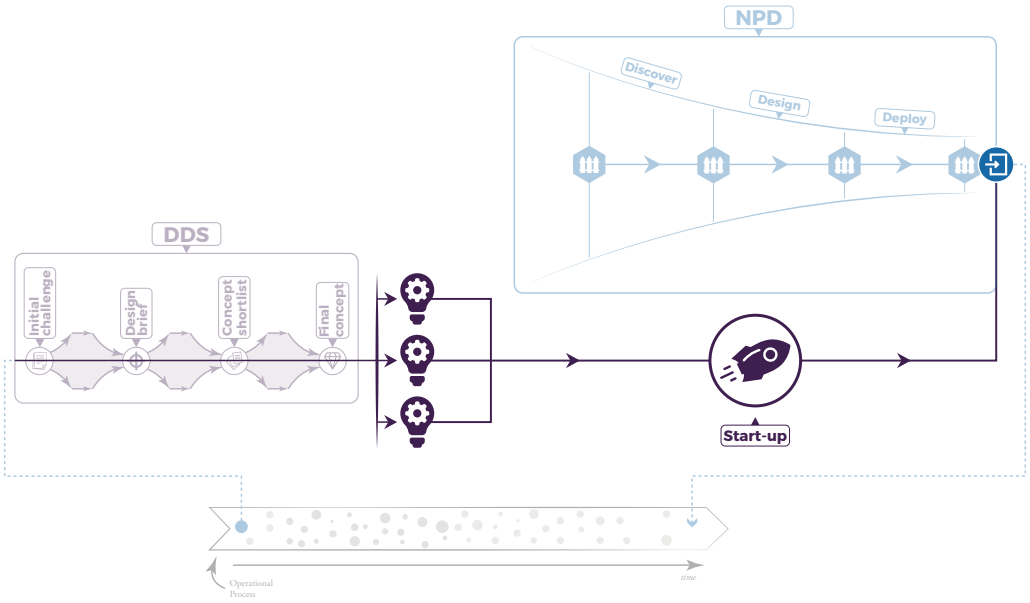

Figure 20 *Unilever's collaboration with startups is envisioned to increase the yield of DDS projects*

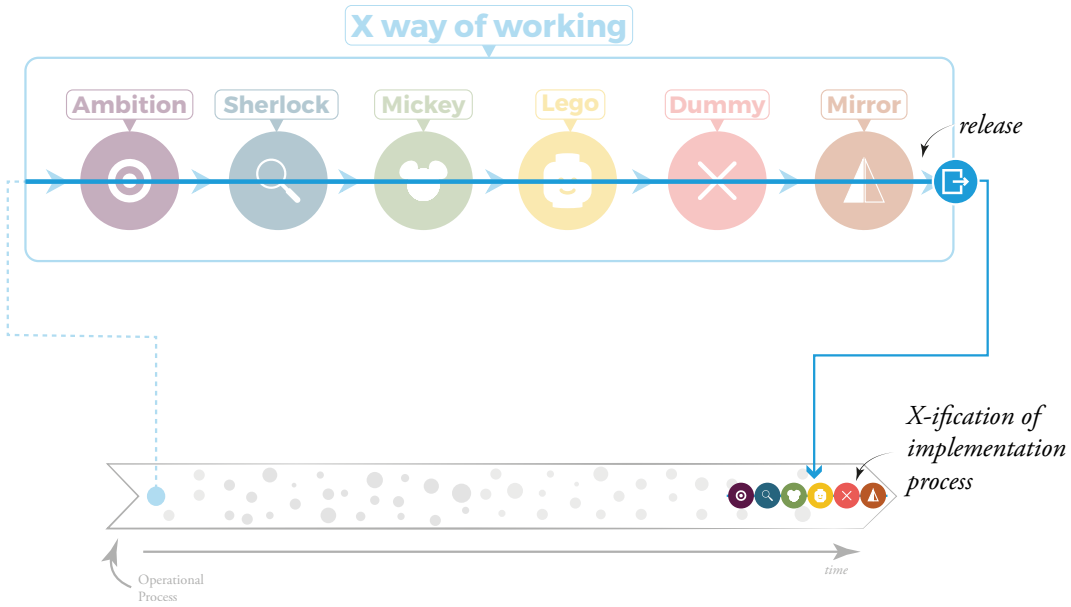

Figure 21 *X-ification of the implementation trajectory is envisioned to increase the yield of X team solutions*

Although in both cases it becomes clear that there are ways to improve the yield of the output that is generated by either the DDS or the X team, there are differences in the degree those improvements are being actually implemented. Unilever is currently building its new innovation centre in Wageningen after announcing this move in 2016 (Unilever, 2016). Simultaneously with building the innovation centre, the DDS department has initiated the acquisition process that will bring together the DDS product-service ideas on the one hand and suitable startups that can further develop these ideas on the other hand. In doing so Unilever and, more specifically, the DDS department are translating their words into deeds.

Contrary to the Unilever case, the yield-increasing proposition as was derived from the interview with the X team member is not put into practice yet. It merely is an envisioned suggestion which, from the perspective of the X team, could benefit the implementation trajectory that comes after the solution developed by the X team. In that sense, one could regard the proposed X-ification of the implementation process as a way to adjust this process so that that it would increase the chance that the X team's solution eventually will be operationalised.

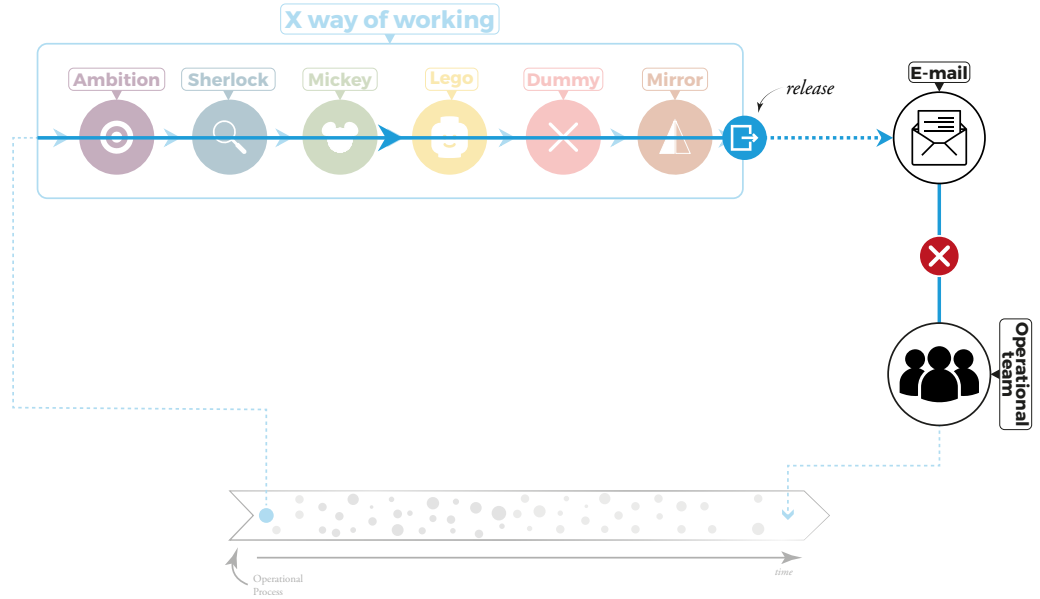

Figure 22 *KLM's old way of implementing solution does not resonate with the X team's solutions*

4 Discussing design within innovation processes

The empirical research in chapter 2 and 3 has shown that companies are able to embed design within their existing innovation processes. From the companies' operational processes the 'initial brief' can be composed and introduced to either the DDS or the X team, the design action can take place and an outcome of this action can be developed into a solution to the problem as initially presented. However, it is at the moment this newly developed solution has to move into the part of the innovation process that is already put in place that the design output fails to be adopted. As a result, the design output does not end up at the marketplace in the form of products, services or operational procedures as an innovation cycle cannot be fully completed. This is a problematical situation because, as becomes clear from the above-mentioned cases, companies use design within existing innovation processes in order to introduce new products or services to the marketplace.

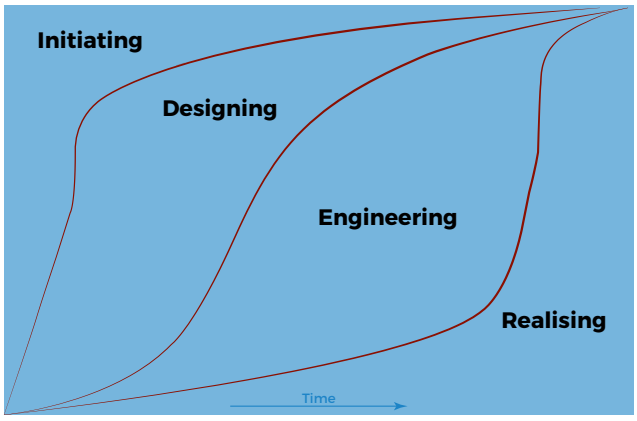

Figure 23 *The IDER model (Smulders, 2014)*

With the latter observation in mind, one could wonder whether there is a way to theoretically interpret the output of design and the obstruction this output encounters within the innovation process. Such a perspective is provided by the IDER model as is described by Smulders (2014). Here, design is regarded as being inherently embedded in an innovation process being preceded by an initiation phase and succeeded by an engineering and a realisation phase, hence the model's name: I-D-E-R. The four elements of this model can be seen to represent a sequential set of activities, each element representing a part of the innovation process, whereas all four elements combined make up for one complete innovation cycle.

Initiation

The IDER model's Initiation phase resembles the 'initial brief' that forms the start of the Unilever and KLM innovation process. In the initiation phase, the front end of the innovation process is addressed meaning that this phase is concerned with scoping future product or service opportunities, market research and ethnographic research (Smulders, 2014; Smulders, 2015).

Design

It is the outcome of the Initiation phase that eventually informs the Design phase. Here, a new, conceptual stance on the future product or service is developed, based on the market research and opportunity scoping that is executed during the Initiation phase. From the perspective of the IDER model, the design element is driven by design activity, eventually resulting in the recombination of elements in order to identify a new conceptual perspective that can act as a starting point for future innovation (Smulders, 2015). What comes out of this phase can be regarded as the output of design activity that then has to move through the subsequent E (Engineering) and R (Realisation) phases of an innovation process in order to fully complete an innovation cycle.

Engineering

The output of the Design phase feeds into the Engineering phase of the IDER model. The engineering phase is put into place to make sure that the newly created output that comes out of the Design phase is prepared to be implemented in the Realisation phase. In other words, as stated by Smulders (2015), the engineering phase focusses on "…making sure that the envisioned conceptual (D) ideas become robust enough to be realised."

Realisation

The last element of the IDER model is concerned with all of the preparations that are necessary to introduce the product or service to the marketplace. According to Smulders (2014, 2015) this phase is about making sure that the innovation is brought to a finalised performative state, meaning that activities such as purchasing, production and sales are

examined prior to be launched to the marketplace, while it also includes the use of the newly developed product or service. The realisation element 'R' simultaneously stands for the end of the innovation cycle.

Although the above-mentioned elements of the IDER model can be generically applied to an innovation process, Smulders (2014) states that every innovation cycle – whether linked to a specific industry, company or product/service – is different and therefore the IDER elements have a different contribution to each innovation cycle. Since the cases within this project also differ from each other, the IDER model will be separately projected onto the Unilever and the KLM case. By doing so the emerging disconnection problem within the Unilever and KLM innovation processes and, for each case, the manifestation of this disconnection in relation to the IDER elements can be further explained.

4.1 Unilever & IDER

The projection of the IDER model on Unilever's innovation process is shown in figure 24. As has already been mentioned in the chapter 2, the initiation of an innovation cycle finds its origins in Unilever's operational process and the fact that Unilever is a marketing-driven company results in a situation whereby an operational marketing process underlies the company's innovation process. From this operational marketing process business needs or emerging opportunities are perceived and are deemed suitable to be developed into a new product or service, therefore the 'I' or Initiation element of the IDER model is positioned in Unilever's operational marketing process. The initiated call for a new product or service proposal is translated into an initial brief which, in its turn, is handed over to the next part of the innovation process and therewith also to the 'D' or Design element of the IDER model.

The position of the DDS department within Unilever's innovation process resonates Design ('D') element of the IDER model due to the fact that it employs a design process in order to create a new conceptual stance on the initial brief that comes from the Initiation phase. The DDS design process allows for a deviation from the initial brief since the design team formulates a design brief – based on their own design, user and market research – that contains the team's interpretation of the initial assignment. This design brief serves as an overture for the development of an eventual product-service idea that can be seen as the outcome of the DDS design process. It is at this very moment that this outcome feeds into Unilever's stage-gate funnel, the latter resonating with the 'E' or Engineering element of the IDER model. As mentioned earlier, the Engineering ('E') element makes sure that the output generated by the Design element is made robust enough so that it can be realised and introduced to the marketplace. This also becomes clear from the Unilever case interviews, whereby it is stated that '…the only meaning of that funnel is that it enables mass production, so in fact it [the product-service idea] is being streamlined…'

From the perspective of the Unilever case the transition between the DDS department (D element) and the stage-gate funnel (E element) marks the entrance of the design output to the company's formal innovation process. The stage-gate way funnel ensures that a proposed product or service idea resonates with the vision of a particular Unilever brand, that this idea gets turned into an actual

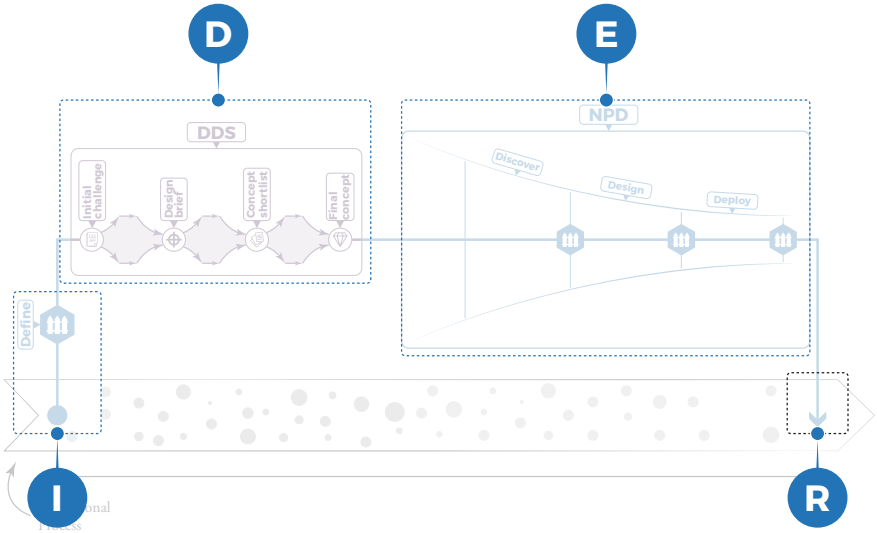

Figure 24 *The IDER model projected onto Unilever's design-embedded innovation project*

product meeting the ambition of such a brand and that this new product eventually is launched on time, at the right place and with the maximum impact. The observations in chapters 2 and 3 have made clear that the disconnection problem occurs during the transition of the DDS department's design output and Unilever's stage-gate funnel. From the perspective of the IDER model's this can be perceived as a situation whereby the Engineering element is not capable of 'streamlining' the output that is generated by the Design element. This means that this output also cannot move into the Realisation ('R') element, thus it is not possible to achieve the completion of a full innovation (I-D-E-R) cycle.

4.2 KLM & IDER

KLM's innovation process, including the X-team and their X way of working, can also be examined from the perspective of the IDER model, as is shown in figure 25. Similar to the Unilever case, a KLM innovation cycle finds its initiation in the company's ongoing operational process and is driven by the company's operational procedures. A call for an innovation cycle is then initiated based on an encountered problem within these procedures. KLM's case interview shows that it is often an operational manager that brings forward such an emerging problem, stemming from the operational process. It is therefore that the 'I' or Initiation element of the IDER model can seen to be positioned in KLM's operational process. The call or initiation of a new innovation cycle then moves towards the 'D' or Design element of the IDER model due to the fact the X-team has to generate a solution to the presented operational problem. The X-team's process seems to match with the Design element due to the fact that the X way of working allows for the creation of a new stance on a problem that is initially presented to them. Even though the initiator of the operational problem longs for an answer to the problem as presented, the X way of working thrives on the freedom to re-explore and broaden the problem space of the initial problem, therefore arriving at the 'problem behind the problem'. The re-interpretation of the initial problem paves the way to generate different solutions whereby, through prototyping and validation of these prototypes, eventually a working solution is presented. The latter can be seen as the output of the Design ('D') element, which can also be found in Unilever's innovation process (the output of the DDS team) and in a similar fashion the output that is generated by KLM's X-team has to feed into the subsequent 'E' or Engineering element.

Contrary to Unilever's innovation process, the KLM process is centred around the development of services and therefore no such a stage-gate type of funnel is put in place that can serve as a stand alone Engineering element within the IDER innovation cycle. Instead, the Engineering element is embedded in the X way of working, as the Lego, Dummy and Mirror process steps are seen as a means to make sure the designed solution is validated through prototyping, testing and developing a final solution based on the test results. When the developed solution is ready to be introduced into KLM's operational process a 'release' document is published with the aim of handing over that solution to the ones responsible for implementing change within the operational departments. Transferring the release document to the operational process then represents

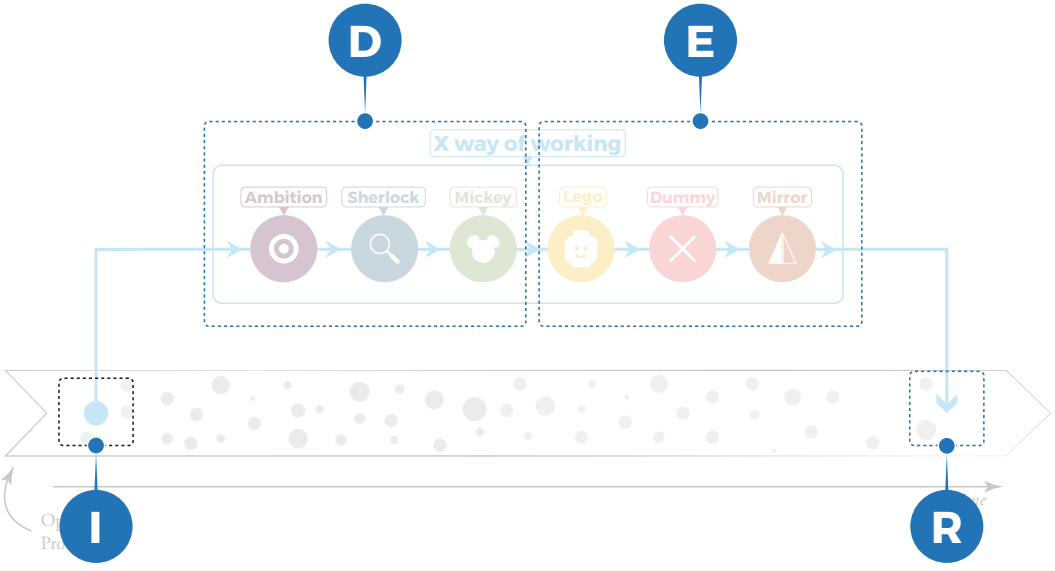

Figure 25 *The IDER model projected onto KLM's design-embedded innovation project*

the transition between the ‘E’ (Engineering) element and the ‘R’ (Realisation) element. Here, the Realisation part of the innovation process is concerned with bringing the innovation to a finalised and performative state, which is exactly the step that has to be taken within KLM’s operational department to implement the innovation. It is exactly at this point that a disconection emerges: the solution as developed by the X-team finds difficulties in being implemented within KLM’s operational process (figure X).

Concluding remarks

The introduction of the IDER model provides a perspective that regards design as being inherently embedded in an innovation process. By doing so, it can help to make clear what the introduction of design and the subsequent output of such an element brings about relative to the full spectrum of an innovation process. As has become clear from this research project, design is embedded in the Unilever innovation process (DDS department) as well as the KLM innovation process (X-team), thereby being able to produce a design output based on a non-design initiation of an innovation process.

However, it can also be seen that the output generated by the Design element runs into a barrier, whereby there is a disconnection between the Design element on the one hand and the E (in the Unilever case) or R (in the KLM case) element on the other hand. In the case of Unilever, the output of the Design element (DDS product-service ideas) is obstructed by the upper-echelon barrier that is located within the Engineering element (Unilever’s stage-gate funnel).

In the case of KLM, the output of the Design element (X way of working) can successfully move through the Engineering element and is ready for being implemented in the Realisation phase. However, it is the transition area between the Engineering element and the Realisation element where an upper-echelon barrier can be found similar to the one that is present within Unilever. The latter means that the proposed solution fails to be accelerated and implemented within KLM’s ongoing operational process.

5 Conclusion

By analysing the empirical research results, one is able to answer the research and sub-research questions that are posited in chapter 1. Before doing so, this project's research goal as well as the research and sub-research questions will be briefly resumed whereafter the sub-research questions are answered and which subsequently enable this project's main research question to be answered.

This research project started off by describing the increasing attention design is receiving from companies that want to change the way they innovate in order to arrive at outcomes other than their current innovation processes are producing. Besides the formation of inter-company alliances, merger & acquisition activities, servitization of a product portfolio or the co-operation with startups, design is seen as a way to overcome creative destruction, helping companies to maintain their competitiveness in the marketplace. In this context, business scholars and design (management) scholars have described the added value of design and design thinking to businesses, organisations, (innovation) processes, products and services. However, the added value of design and design thinking is emphasised by mainly describing anecdotal cases of businesses and organisations (innovation) processes that are successfully making use of design and design thinking.
A common denominator here is the fact that design (thinking) is approached with the premise of being fully operationalised within businesses, organisations and (innovation) processes. However, before being successfully integrated and operationalised, design first has to be introduced within the ranks of businesses and organisations. Since design and management scholars regard design and design thinking as a way to help companies to fuel their innovation processes, a legitimate action is then to research what the implications are when companies or organisations are embedding design within such innovation processes. Hence, the following research question was formulated.

What are the implications of embedding design within innovation processes?

In order for this research question to be answered two sub-research questions were composed aiming at two specific aspects of this project's research question. These two questions were examined during the empirical research that took place.

- **How do companies organise their innovation processes?**
- **How is design positioned within these innovation processes?**

Below, the sub-research questions will be answered first whereafter this project's research question will be answered.

5.1 How do companies organise their innovation processes?

The empirical research has brought forward three different cases and therefore three different innovation processes can be presented, namely those of Unilever, KLM and Ford.
The first partition that can be made here is about the different industries each of the companies are acting in: Unilever operates in the fast moving consumer goods (fmcg) industry, Ford operates in the automotive industry and KLM is operating in the aviation industry. Here, a further distinction can be made since KLM's business is merely concerned with the offering of services, whereas both Unilever and Ford can be seen as providers of products.

The innovation processes of Ford and Unilever are both constructed in a way that strongly resembles Cooper's stage-gate system (Cooper, 1990; Cooper, 1994) which, in a systematical way, is aimed at covering the entire process from product idea towards product launch. Cooper (1994) describes such stage-gate systems as means to break product innovation into several stages, whereby each stage can be seen to contain "a set of prescribed, cross-functional and parallel activities". The stages can be entered through a gate: a check point that is used for controlling the overall process and which serves as a Go/Kill/Hold/Recycle point.

Unilever makes use of the stage-gate model through a funnel type of process comprising the Discover-Design-Deploy process steps that help to gradually shape an idea into a product that can be introduced to the market. Since Unilever, in general, is a marketing-

led company its innovation process is also driven by a marketing perspective and therefore the company's R&D departments mainly develop initial product ideas and proposals that are brought forward by Unilever's marketing department. Throughout the overall innovation process, the marketing department acts as the grinding stone for products-in-development, assessing whether those products are in line with the visions and ambitions of the Unilever brands.
Ford also has made the stage-gate model central to its innovation process and it has done so by using two consecutive stage-gate processes, namely the Global Technology Development System (GTDS) and the Global Product Development System (GPDS). Here, the GTDS develops new technologies which subsequently can be integrated into Ford's automobiles that are developed through the GPDS.

Contrary to the stage-gate type of systems that are being used by Unilever and Ford, KLM's innovation process is not centred around one specific model, process or system. This is the result of KLM being a service-oriented company operating in the aviation industry and therefore there is no such focus on a stage-gate innovation process that has to ensure a product's producibility and (supply chain) operationalisation in the marketplace. Instead, KLM's innovation process is seen to have quite a loosely structured organisation that is concerned with managing day-to-day operations such as flight attendants, ground handling or gate agents. As a result, there are many departments, each having their own area either concerned with customer or operational procedures. Within such a structure, the development of new services or (operational) procedures are instigated by a certain problem that is derived from KLM's ongoing operational processes, whereby the solution to this problem subsequently is created by one of the KLM departments, e.g. the KLM digital department. A department, specifically aimed at implementing such solutions, is subsequently assigned to implement such solutions.

5.2 How is design embedded within innovation processes?

The three cases that emerged from the empirical research are each having their own innovation processes and within each of these processes design, in some way, is seen to be embedded. A first conclusion that can be drawn here is the fact that design is seen to be embedded within the front end of the innovation process. It can be regarded as the deployment of design in the Fuzzy Front End (FFE) of the innovation process, which means that it is situated between the moment of opportunity identification on the one hand and the moment it is decided to devote considerable effort to the development process on the other hand. Within this part of the innovation process, design is concerned with discovering the broadness of an initial problem, to explore and identify opportunities based on this initial problem and to subsequently develop a new stance on the problem in the form of a (new) solution or concept.

When the FFE position of design is projected onto the three cases, several differences are perceived. First, design's FFE position within a product-oriented or a service-oriented innovation process tends to differ, whereby this difference is perceived between Unilever's and Ford's innovation process (product-oriented) and KLM's innovation process (service-oriented). The FFE role of design within the product-oriented innovation processes enables a concept or solution to be developed, which then is handed over to Unilever's (funnel) or Ford's (GTDS and GPDS) stage-gate processes. In the case of KLM, design is also embedded in the first part of its (service-oriented) innovation process, where it has a function similar to the product-oriented innovation processes of Unilever and Ford. However, KLM's innovation process has no structure – following after the solution that is generated through the employing design – such as Unilever's or Ford's stage-gate process. Instead, the designed concept gets tested and validated through a lean startup way of working which is just the second part of the same process in which design is employed.

Not only is design seen to have a specific, FFE-oriented, role within the innovation process, it can also be concluded that in terms of the organisational structure design is organised in a specific way. Here, it is about the fact that within each of the three cases design is positioned within an externalised type of department: Unilever's Disruptive Innovation department, Ford's Innovation Management and Mobility Team and KLM's X team as being part of the X-gate department. Besides, Unilever and KLM also have a specific process (the Disruptive Design Studio process at Unilever and the X way of working at KLM) that is put in place in order to support the design effort.

5.3 What are the implications of embedding design within innovation processes?

Answering both of the sub-research questions enables this project's main research question to be answered as well. By mapping out the innovation processes of three companies and by examining how design is embedded within these processes, one is able to draw conclusions about the implications of embedding design within those innovation processes.

It becomes clear that design, as a human-centred activity or process that can transform an idea into tangible or intangible being new concepts or objects, it is able to generate a new solution for opportunities, demands or problems that stem from a company's operational process, be it a marketing-based operational process (Unilever) or an operations-based operational process (KLM). By embedding design within both product- and service-oriented innovation processes, companies are provided with a perspective other than the one that prevails within their existing innovation process. Such fresh perspectives then can act as a type of inspirational grinding stone for companies and it can inform companies about potentially new product or service outcomes for their innovation processes.
Simultaneously, the embedment of design within an existing innovation process creates a situation whereby the developed design output does not resonate with the prevailing perspective that goes around within companies' current innovation processes. As a result, the design output does not end up being operationalised within a company's ongoing operational process and there are two main reasons that are found responsible for this taking place.

First, the 'upper-echelon barrier' is seen as an obstruction for design output to move through the innovation process, whereas managers or vice-presidents act as the gatekeepers that decide on whether or not further developing the design output. As the design output is assessed by knowledge that is perceived as validated and proven to be true within the current innovation processes, it can be concluded that this output will encounter the same barrier each time it is assessed from this same point of view, from the same knowledge base. This interplay resembles the work of Hatchuel & Weil (2002; 2009) and their C-K theory that focusses on knowledge (K) and concept (C) spaces. The K space is all about acquired and validated knowledge which is proven to be either right or wrong, whereas the C space is concerned with objects or elements that cannot be proven right or wrong yet, therefore marked as 'undecidable'. Here, the design output is regarded as being positioned in the C space and the knowledge that prevails within innovation processes' is subsequently positioned in the K space. As a consequence, a rejection of the generated design output is the logical result.

Second, the innovation processes' structure tends to form a barrier for design output as well. This is due to the fact that the organisational structures of the company cases involved in this research project are merely organised along the lines of exploitative operational processes. As O'reilly & Tushman (2011) and Chen (2017) point out, such processes are aimed at exploiting existing information and capabilities, optimising ongoing operational processes in order to improve organisational performance. However, Chen (2017) also states that firms need both exploitation and exploration in order to survive on the long term, whereby exploration is about exploring new information, businesses or new ways of doing business. With the results of this research project in mind, design – taking care of exploration – is embedded within innovation processes that are merely centred around exploitation. Those innovation processes are not equipped to deal with explorative matters and thus cannot facilitate the design output to be operationalised.

Both of the above-mentioned reasons are seen to be intertwined with each other: it can be regarded as a logical fact that organisations with a merely exploitation-centred processes are inclined to employ people that will reason within the boundaries of the validated knowledge base that is tied to those processes. A main implication of embedding design within such innovation processes is that the design output, in the form of a new idea or concept, will encounter an obstruction which is seen to be a combination of the interplay between the innovation processes' structure and the (upper-echelon) gate keepers. It can then be concluded that, in order for design to help refuelling innovation processes and to create other outcomes than those processes currently do, adaptations need to be made to the innovation process in which design is embedded. This is also proposed by Smulders (2014), who not only states that the innovation process as a whole is covered by an I-D-E-R sequence but also states that each discipline or innovating actor that, in some way, is affected by the innovation process will have to go through its own IDER cycle. This is deemed necessary so that the newly developed content eventually is ready to be used within a company's existing socio-technical system. As a result, the IDER model is about the adaptations, revisions and/or redesigns that have to be made for each of the innovation-related

subject in order to let a complete innovation cycle take place. From this perspective, the knowledge base of Unilever's Engineering (E) element (stage-gate funnel) and of KLM's Realisation (R) element (implementation process) needs to be revised and/or adapted in order for the Design output to be used within the operational processes of both companies. This makes sure that the outcomes of a design process, the output generated by the Design element within an innovation process, is brought into good currency. The latter, as stated by van de Ven (1986), means that it has become an implemented reality and is part of the thought structure of an organisation.

6 Recommendations

This chapter provides several recommendations that are formulated with regard to the conclusions drawn in the previous chapter. Since the outcomes of this research project could be beneficial for multiple parties, the following recommendations are formulated with regard to companies, future research and design schools.

6.1 Companies

Having in mind the results and conclusions that are obtained during this research project, recommendations can be provided to companies that are either in the midst of embedding design within their innovation processes or to companies that are on the verge of doing so.

The outcomes of this research project make clear that simply embedding design within an existing innovation process is not sufficient for companies that want to arrive at outcomes other than ones that their innovation processes are currently producing.
As Sharma & Poole (2009) have pointed out, companies can benefit from design on a project level, an operational level, a strategic level and on a normative level. However, before reaping the benefits of design on all four levels, companies should start to make sure design is actually present among all of these four levels. The outcomes of this research project show that for both Unilever and KLM the use of design can seen to be successful on a project level (enabling physical outcomes of design, such as artefacts, packaging or services, to be generated) as well as on an operational level (having put in place a design process: Unilever's DDS process and the X way of working at KLM). The thing that is recommended here is that companies should also work towards having a plan or a strategy for the use of design within their innovation processes. This means that, besides having design operationalised on a project and a process level, there should be a situation whereby there is a vision aimed at facilitating innovation by design throughout the entire innovation process. As a result, Sharma & Poole (2009) then state that within companies a context should be provided for design to be used at all levels of decision-making. In the wake of this research project's results, design then should be present at a company's management or VP level in order to increase chances for the design output, generated by a design process, to move through the entire innovation process. KLM is seen to make efforts in moving into that direction: besides their decision to make the X way of working central to their innovation processes, they are also sending all of their trainees to the IDE faculty to attend design training. By doing so, KLM lets its future managers and decision makers embed some design into their veins and as such make sure that their mode of reasoning will better resonate with the design output generated by future X-way-of-working projects.

In line with above-mentioned recommendation, companies that are on the verge of innovating their innovation processes by the use of design could benefit from organisational ambidexterity: the ability of companies to make use of both exploitation and exploration (O'reilly & Tushman, 2013). In order to do so, companies need to have the ability to sense opportunities and subsequently capitalise on those opportunities by allocating resources through the adjustment of existing competencies or by developing new ones (O'reilly & Tushman, 2008). As was shown during this research project, one of the reasons the design output got confronted with obstruction was due to the fact that the existing exploitation-type of innovation process was kept in place to develop the exploration-type of design output. In order to avoid this, companies should aim for organisational ambidexterity to enable the development of exploration-type of products and services, while maintaining their exploitation-oriented innovation processes. Based on the empirical research of this project it can be seen that Unilever is aiming for the development of a more exploration-oriented type of process. This is done by collaborating with the Wageningen University's ecosystem, whereby product-service concepts (design output) stemming from the DDS department are further developed by food and nutrition startups. This DDS-startup collaboration can be regarded as an exploration-oriented process, whereby Unilever's exploitation-oriented stage-gate funnel will still be in place. It needs to be mentioned that Unilever decided to initiate this collaboration several years after the first DDS project was executed, therefore lagging behind in their efforts to arrive at organisational ambidexterity.
The way Unilever is partly re-creating its organisational routine – by means of an external route – may not be suitable for every organisation, especially since such an explicitly separated exploitation-exploration

routine could be deemed difficult for service-oriented organisations such as KLM. However, KLM and, more precisely, the X team could benefit from a partly recreated organisational routine, since implementation of the X team's process output by means of sending an e-mail is not regarded as sufficient. As was already brought forward by an X team member, a possible way to recreate the implementation part of the innovation process is by means of co-creation sessions with the eventual users of the X team's solution. By doing so, the X team could contribute to the recreation of KLM's organisational routine by making use of internal resources and capabilities, as is also described by Cohendet & Simon (2016). The latter describe a case study whereby, at some point, the core process of a video game studio is redesigned because the drivers for generating and validating ideas for disruptive games did not match with the company's stage-gate structure that was aimed at efficiently producing incrementally innovative game concepts. For KLM a similar situation can be perceived: the solution as developed by the X team is not perceived as being in line anymore with the efficiency and hierarchically oriented procedure that takes care of implementing the solution. Therefore it is suggested that the implementation procedure ideally should be recreated by means of co-creation sessions that also involve the eventual users (e.g. ground handling, gate agents).

6.2 Future research

The conclusions from this project enable the formulation of multiple starting points for future research regarding the topic of innovation and the role design can play within innovation and innovation processes.

First, the exploratory nature of this research project – in all of its facets – provides room for other research projects to further validate and generalise this project's research outcomes. What kind of results will be found when this research is executed on a larger scale and how do the conclusions, drawn in this report, relate to the results that are found during more elaborate research? In line with this, future research could be aimed at examining the implications of embedding design within various corporate or organisational environments since design can be embedded within product- and service-oriented innovation processes, in commercial as well as in non-commercial organisations and in SME's or large corporations. Such research can provide insights into possible industry-specific implications that comes with the embedment of design within innovation processes, as well as it can provide some generic implications that apply to every company involved in embedding design within their innovation process.

Second, the findings from this research project could form an interesting starting point for empirically testing and validating ways to overcome the barrier that is encountered by design output when progressing through an innovation process. This can be done by setting up experiments that allow for testing within a controlled environment, enabling researchers to assess the effect of e.g. cross-disciplinary teams (Lindberg et al., 2011), the effect of new routine configuration (Cohender & Simon, 2016) or the effect of incorporating intermediate users (Smulders & Dunne, 2017) on enabling design output to be fully operationalised and becoming an implemented reality. Ideally, such research experiments should be executed within existing organisations and organisational structures since this enables researchers to come as close as possible to a real-life simulation due to all of the organisational dynamics that comes with it. Cooperations between universities and companies, such as the ones between the IDE faculty and KLM, Vanderlande and Unilever, can provide such a suitable experimental environment for researchers and academic institutions.

6.3 Design schools

With regard to the process of embedding design within innovation processes, design schools and design students are seen to play a key role in the design output to be generated. By taking our very own IDE faculty as an example, it can be observed that students, by using design tools, design methods and design processes, are able to arrive at tangible design output

The point of recommendation that is posed here is about the way designers apply user-centred approach during their processes and practices. In general, it can be stated that designers are inherently educated to centre their design activities around the end users of the products, services and processes that they are designing. When designing from the perspective of a design school such as the IDE faculty, the initial focus of a design student on such end users seems justified since most of the design projects are instigated either by the IDE faculty itself or by external clients. As such, design students mostly see their design projects and the output of those projects as being 'finished' as the end of the semester approaches and their grade is received from their supervisor. They end up with a product, service or process that is entirely centred around the envisioned end user from the perspective of either the faculty's supervisor or external client. However, within innovation processes such as the ones Unilever or KLM have put in place, a wrap up of

the design process and generating a design output is not equal to its finalisation. As has become clear from this research project, design output has to move past several other actors (e.g. Unilever's supply chain and packaging department and KLM's implementation manager) before being fully operationalised in a company's operational process. Within this context, one could see the design output handed over to many actors – intermediate users – before finally being used by the envisioned end user. Smulders & Dunne (2017) have described this scenario of design moving past various intermediate users, for whom they have proposed an equivalent of the commonly used 'persona'. This equivalent is called 'disciplina', which the authors formulate as "a representative understanding of the receiving actors [the intermediate users] from the other department". Smulders & Dunne (2017) state that designers, although being user-centred, put limited effort in creating such a disciplina, although it is proposed that such a disciplina can provide adequate understanding of intermediate users situated further down the innovation process. This understanding then can help designers or a team of designers to generate an integral design output that can be used properly by the various intermediate users.

When designers involve intermediate users in an early stage of their design process, it could be beneficial for adoption of the design outcome within departments situated further down the innovation processes. For design schools, the challenge is to provide design students with this perspective on intermediate user personas. When looking specifically at the IDE faculty, it can be stated that design students could benefit from the addition of courses or course modules that are specifically aimed at designing for intermediate users. Such courses then could have the most impact within the three master programmes (SPD, DFI, IPD), as those programmes are more involved with projects for external clients, having increased chances to design for intermediate users within the design process.

Eventually, when the output of a design process – besides centred around the end user – is designed with having in mind the intermediate users, one could assume that this has a positive effect on overcoming barriers that prevent the design output to be adopted further down the innovation process.

7 Project reflection

By formulating the recommendations in the previous chapter, the end of this graduation thesis is coming close, which gives me the opportunity to look back at the past months' experiences and to reflect on the way this project has progressed.

First, I would like to reflect upon the research project itself. During one of the meetings I had with my supervisors Frido and Frithjof, we found ourselves in a discussion about the character of my graduation project. Rightfully, Frido stated that my graduation project was a research project being executed within the Industrial Design Engineering faculty and therefore my project could be regarded as a design research project. As such, this research project has touched upon a phenomenon described by Dorst & Cross (2001) in their study on creativity in the design process. The authors propose that during a design process the problem formulation and the ideas that could eventually form a solution are developed and refined simultaneously. This is achieved by iterating between analysing, synthesising and evaluating between two 'design spaces': the problem space and the solution space.

While progressing, I started to realise that my graduation project was also following the path of co-evolution of problem and solution space. The project started by posing my research question with regard to the implications of embedding design within innovation processes, whereby at that point the research question was seen to be grounded in an initial problem space that was confined by the experiences I gained during the years I spent at the IDE faculty. Dorst & Cross describe that, by exploring the problem space, designers are able to conceive a preliminary construct of the solution space in which a possible solution to the initial problem can be found. In the case of my project, the problem space was explored by conducting the first interviews on behalf of the first part of my empirical study and consequently I was able to construct a first set of 'ideas' that helped to construct the first part of my project's potential end result. With the latter I was able to go back to the problem space dimension and to subsequently redefine the initial problem space together with the problem that I formulated at the start of my research project. Such a co-evolution of problem and solution took place multiple times, going back and forth from literature to a second round of interviews and going back to the literature and theory to reshape the insights, thoughts and ideas that emerged throughout the project. Eventually this has lead to the end result as it is written down within this master thesis.

Besides taking into account the characteristics of my

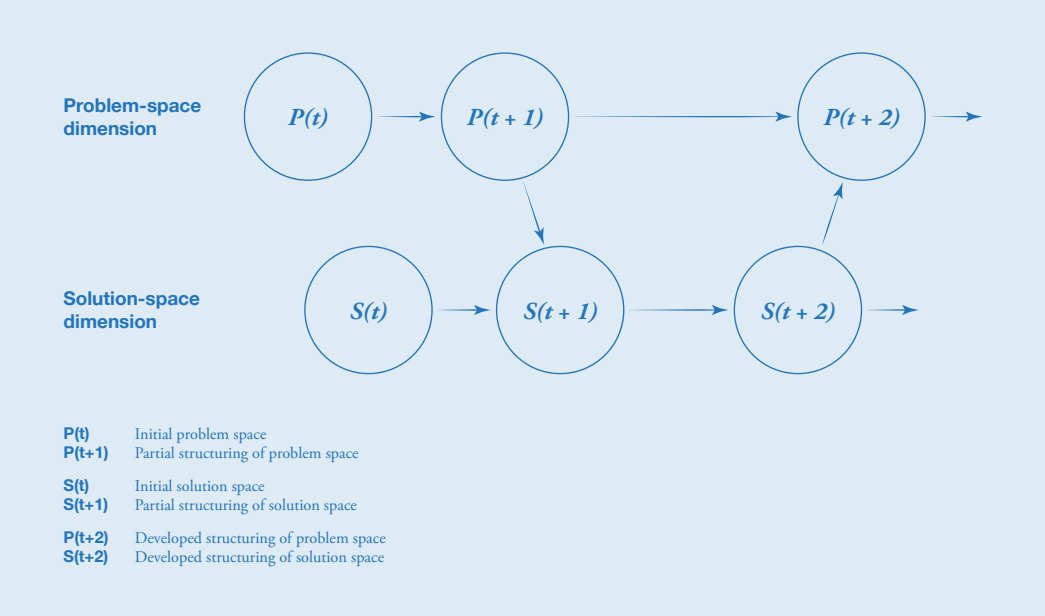

Figure 26 *Co-evolution of problem and solution space (Dorst & Cross, 2001)*

design research project, I would also like to address some reflection to my role as design researcher within this project. Being in the role of such a design researcher asks for a designerly way of thinking and acting, meaning that ideally you are making use of the diverging and converging approach that design students at the IDE faculty have been taught over the past years. In the wake of this project, I must conclude that, from time to time, my approach lacked a certain level of convergence, therefore I missed some focus throughout the project which gave me the feeling of just floating around in the middle of the Pacific Ocean. In hindsight, I must conclude that even though the designerly approach to this research approach has brought me many valuable insights, I could have made it easier for myself by adding more convergence in my way of working. For future projects this is deemed to be a valuable insight, regardless of the context I will be working in.

At last, I would like to state that this project has given me the grateful opportunity to assess the role of design in the context of innovation and innovation processes. From this perspective it has provided me the opportunity to look back at the essence of the education I received during my bachelor and my master studies in the past years, as well as it has helped me to reformulate the position of design and designers for the sake of my future working life.

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