Master thesis : "How to innovate enterprise software more efficiently by becoming an ambidextrous organization ?"

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How to innovate enterprise software more efficiently by becoming an ambidextrous organization?

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Summary

The manufacturing operations management software market for the consumer package goods industry is a growing market because more and more manufacturers are starting or accelerating their digitalization journey to improve their efficiency, flexibility and time to market. Due to this growing market and the fact that initial products in this market are coming to the end of its lifecycle, new products are being developed by incumbents and startups. I was personally involved in developing a new manufacturing operations management product over the past 5 years, where I was faced with numerous challenges, choices and discussions in bringing such a large enterprise software product to market. Reflecting on this experience, if I would have to do it again, I asked myself the question: How could I bring a new large enterprise software product to market more efficiently? This question was the driver for this dissertation.

As part of a large successful organization, one would think such an organization would have the answer to this question. But reality shows that large organizations suffer from the innovator's dilemma due to their quest for more revenue and higher margins coming from their most demanding customers. This focus on the high end of the market is making that large organizations are sustaining organizations. This comes with several consequences. They must deal with many requirements coming from demanding customers. They need to react to individual opportunities which drives the inability to determine common requirements. And they focus on achieving the numbers making them unable to detect disruptive innovations and to act as an ambidextrous organization. The innovator's dilemma serves also as a threat because it opens the door for new entrants which can disrupt coming from the bottom of the market.

To overcome the innovator's dilemma and its consequences, Clayton Christensen proposes the innovator's solution. This solution consists out of a framework to reorganize the resources, processes and values in the organization to become able to disrupt and to become an ambidextrous organization. Current processes being used in large sustaining organizations are typically agile processes, which do not overcome the innovator's dilemma. Research shows that agile processes even stimulate the sustaining nature of the organization, as they put limited focus on customer problems, they do not provide guidance on which markets to target, and they do not provide mechanisms to rank large sets of customer problems to detect what customers desire most. This makes that processes and values currently in the company do not allow the company to disrupt and to act as an ambidextrous organization.

Given the innovator's dilemma and solution and provided the fact that current processes do not provide a solution for a sustaining organization to become an ambidextrous organization, this dissertation focusses on two elements. First, to validate that the current organization is not an ambidextrous organization and is suffering from the innovator's dilemma. Second, to propose an innovation process, which puts more focus on customer problems, the right markets and can rank customer problems, enabling the organization to become an ambidextrous organization.

A survey in the organization benchmarking the business group with the product development group has been executed. As a conclusion it can be stated that the current organization is a sustaining organization focusing mainly on the high-end enterprise market and is suffering from the innovator's dilemma, where the focus is mainly on solutions instead of customer problems. The approach to develop products and to detect customer needs is mainly driven by internal conversations using the inbound process and experience-based priority judgement instead of using frameworks which focus on detecting and ranking customer problems. The organization is not intending to change the innovation approach because there is currently no initiative to develop a new innovation process and there are rigidities to change the innovation approach.

The solution proposed in accordance with the innovator's solution is a process which is integrated in the existing product development process. This process puts focus on the problems of all management layers at the customer by leveraging the problem space of design thinking. The new innovation process does not only put more focus on the customer problems, but it is also providing guidance on the right markets to be addressed to be able to overcome the innovator's dilemma. High end markets need to be addressed to sustain and the bottom of the market needs to be addressed when the objective is to disrupt. To provide customer satisfaction, also proper priorities need to be set on what needs to be developed first. The new innovation process provides a ranking mechanism leveraging the Kano model and the integrated Kano approach which makes that the most important customer needs are addressed first. The integrated Kano approach uses a survey with 4 key questions, which allows to determine the problems which, when they are solved, provide the most customer satisfaction. The new innovation process, which is able to support as well disruptive as sustaining innovation, puts proper focus on customer problems, the right markets, and is able to determine the priorities of problems to provide maximum customer satisfaction. Due to these characteristics, the innovation process is capable to support the organization to act as an ambidextrous organization.

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APA	Advanced Product Adoption
ART	Agile Release Train
BEN	Business Enablement
BPMN	Business Process Modeling Notation
CPG	Consumer Package Goods
CXO	Chief X (executive) officer
DI	Dissatisfaction Index
ERP	Enterprise Resource Planning
ISA	International Standard for Automation
KPI	Key Performance Indicator
MOM	Manufacturing Operations Management
QFD	Quality Function Deployment
SAFE	Scaled Agile Framework for Enterprises
SI	Satisfaction Index

Preface

The master dissertation which lies in front of you “How to innovate enterprise software more efficiently by becoming an ambidextrous organization?” is research on how to set up an organization and which decisions to take to innovate enterprise software.

During the last five years of my career, I have been involved in bringing a new enterprise software product to market. During this period, I saw a lot of challenges faced by different teams and a lot of questions which needed to be answered. These challenges and questions led to numerous discussions on how to organize to face those challenges and on how to answer those questions. The large amount of experience with enterprise software in the company brought many ideas, perspectives, and methods, which led to even more discussions. Typical discussions were about which markets to be targeted, which features were required and what are the priorities of those features. The question which came to my mind was: If I would have to do it over again, how would I do it better? Therefore, the main driver for this dissertation was to find a more structural, objective and more efficient approach to determine and rank product requirements for enterprise software.

Even though in the software world there are already many methodologies in use, the discussions related to product requirements where for me the sign that something is still missing and that answers for this needed to be found elsewhere. During the business modeling course of the MBA program, I found a lot of inspiration on what could be a potential domain where answers could be found. This inspired me to dig deeper in the domain of business modeling which contains theories on innovation. The results of that research are in this dissertation.

I would like to thank Professor Dr. Frédéric Ooms for his support, inspiration, and guidance during my research. Also, I would like to thank everyone who supported me in any way during this challenging period in my life.

Introduction

Justin Trudeau mentioned in 2018 at the world economic forum in Davos: *The pace of change has never been this fast… And yet, it will never be this slow again*. This change is driven by new innovative products and business models which change the way how people stay informed, how they travel and how they buy things. Due to this fast-changing world, companies are constantly looking for new innovations which they want to bring as fast as possible to the market. The pace of innovation and the ability to disrupt are becoming key success factors in global competition. The software business is highly affected by the pace of innovation and therefore innovation processes are even more critical. Companies like Spotify, Uber and Airbnb disrupted whole industries like the music, taxi, and hotel industry respectively, leveraging their software applications, which enabled totally new business models.

The music, taxi and hotel industry are examples of consumer markets which originally relied on extensive distribution networks and large infrastructure requirements. In the case of Spotify, Uber, and Airbnb these distribution networks were replaced with a relatively small product like a software application which allowed to disrupt the industry. Not only in the consumer market but also in the enterprise software market, where efforts to build a new product are much higher, there are examples of disruption of big incumbent players. Odoo for example, which is currently disrupting the Enterprise Resource Planning (ERP) software business is such an enterprise software example. Odoo started as an open-source ERP system initially serving small size customers which evolved to an enterprise ERP system serving enterprise customers which is taking market share from big incumbents like SAP. For all above reasons, software companies are constantly looking for ways to improve their innovation processes.

The purpose of this dissertation is to find an answer to the question: **What is the most efficient way to develop and bring a new large enterprise software product to market?** As there are almost endless ways to innovate, develop and bring large enterprise software products to market, the purpose is to find the most efficient or at least a more efficient way to do this. To answer this question, the challenges of innovating and developing large enterprise software products will be identified, discussed, and researched, to see how they can be done in a more efficient way. The focus of this dissertation will be specifically on manufacturing operations management (MOM) software for the consumer package goods (CPG) industry as an example of a large enterprise software product.

MOM in the Consumer package goods industry

Consumer packaged goods are a type of goods consumed every day by the average consumer. Products in this category are those that need to be replaced frequently, compared to those that are usable for extended periods of time. While the CPG industry is a solid and growing market from a demographic point of view, it is highly competitive due to high market saturation and low switching costs for consumers.

90% of the products we buy in the grocery store can be defined as consumer package goods, and most of global manufacturers categorize their products into well-known brands as the eye catchers for the consumer. Convergence Alimentaire, a blog focused on the food industry, put together this interesting infographic below, showing how a small number of companies have a significant hold on the CPG industry. **The CPG industry has many subsegments like spirits, beers, packaged food, meat, personal care and many more** as shown in the figure below**.**

Figure 1 - Global CPG players and their portfolio (Alimentaire, 2015)

Manufacturing operations management for CPG

What is so specific about MOM software? First, one needs to understand the scope and purpose of MOM as an enterprise software. **The scope of MOM is to support all aspects of manufacturing to optimize all manufacturing processes**. The main manufacturing processes are the reception of raw materials, the primary production of semi-finished bulk products, the secondary filling and packaging of finished products and the outbound distribution of finished products. **The purpose of MOM software is to provide increased efficiency and flexibility**

to manufacturing processes while maintaining a consistent quality of production. MOM software also enables manufacturers to have a shorter time to market by decreasing the time to introduce new products into manufacturing.

To support all manufacturing processes, **MOM software needs to support many tasks performed by many employees in many different roles**. This makes that a MOM software system is a very complex system composed out of many components to manage orders, equipment, materials, and production processes, but also components to execute manufacturing processes like production scheduling, quality execution and production orchestration. This is just the tip of the iceberg and **in general it can be stated that MOM software consists out of many components which take decades to build**.

The CPG industry has many subsegments. **Each of these subsegments has specific requirements for a MOM product**, which makes that the MOM product for CPG needs to come in different flavors. Each component of the MOM for CPG product needs to serve the needs of each subsegment, which makes that the different components are even more complex.

The MOM market for CPG

The MOM for CPG market is shown in the figure below (ARC, 2021). **The MOM for CPG market is a growing market which grows at a compound annual growth rate of 4,27%, which makes it an interesting market.**

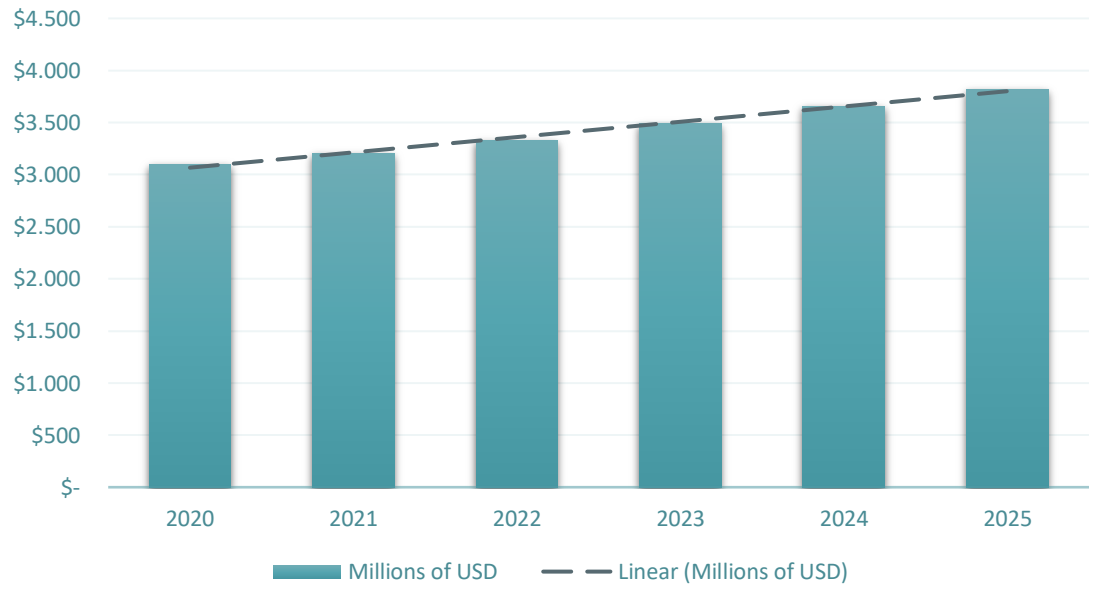

Figure 2 - The MOM for CPG market (ARC, 2021)

The MOM market dynamics

Important to know about the MOM market is the fact that it does not behave itself as a regular consumer market. The main difference is that MOM products cannot be pushed to the market because the market is opportunity driven. **Opportunity driven means that there is only a limited set of opportunities to sell MOM software, because it requires a very high initial budget due to the large costs involved with enterprise software**. Because software is intangible, its value is not always self-evident, and it requires quite some knowledge of the customer to judge which value he can obtain from it. This makes that **the MOM software business is mainly reactive to opportunities on demand of customers which specify their specific needs**. This makes it hard to push new ideas and concepts into the market because customers put upfront their specific requirements which may not be common with the rest of the MOM market. Finally, the MOM market is a relatively new market, aging about 20 years, where during this period a tremendous amount of innovation has taken place in the software world. During this time of innovation, MOM products kept evolving using older concepts and technologies to mature. This makes that the first wave of mature MOM products has come to the end of its lifecycle and a lot of software innovation has not been introduced yet in the MOM world, making that new MOM implementation concepts still need to be discovered. Recently, new MOM products have been developed, but they all face the issue of being incomplete, which make them uncompetitive in the market. **Because the MOM market is an opportunity driven market, it is difficult to test new ideas and concepts in the market.**

MOM startups

Like in all other industries, also in the MOM software business there are startups emerging. Within the MOM business, startups like Ondema, The Grain, Selfbits and Arka are emerging, each focusing on a specific domain, respectively production planning, production optimization, shopfloor visibility and inventory management. All of them are leveraging emerging technologies such as Artificial intelligence, Cloud computing, and big data (StartUs Insights, 2022) to do so. Despite these startups are having competitive advantage within their respective domains leveraging their technologies, they all face the issue that they are not able to cover the whole scope of MOM yet.

Why large organizations fail

To find an answer on the initial question: What is the most efficient way to develop and bring a new enterprise software product to market, literature on innovation and about companies struggling with innovation is reviewed to come to a more focused problem statement.

The innovator's dilemma

When looking into innovation it is hard to ignore the theories of Clayton Christensen. Christensen's theory on disruption states that good management is typically the reason for not investing in disruptive innovations, causing good companies to stumble. (Christensen, 1997) (Christensen, 2021)

Companies innovate their products to make them more profitable by being able to charge higher prices with better margins to their most demanding customers. By doing this, **successful companies tend to ignore the bottom of the market, opening the door for competitors**. As products continue to improve, they will be more expensive and serve higher market segments. Due to that, the low end of the market will be underserved because that market segment cannot afford these expensive products. This allows new entrants to enter the market at the bottom with a much simpler (disruptive) product, which is more affordable and accessible for the low end of the market. When new innovations enter at the bottom of the market, the incumbents are presented a choice. **Do incumbents need to defend the bottom of the market by building simpler products for lower prices and lower margins? Or do they continue to build better products for better customers providing higher margins? This is the innovator's dilemma**. New disruptive innovations initially serve market segments which do not look that interesting from a profit and management point of view at the low end of the market. As a result, due to good management, incumbent companies typically do not invest in innovations to defend the low end of the market and prefer to move up market. This allows the new entrant to capture the low end of the market and to further innovate its product serving more and more customer needs. **Each time the entrant moves into a higher market segment, the incumbents are incentivized to move up market for good management reasons. This continues until the new entrant can serve all the needs of the market, disrupting the incumbents**. Christensen also states that high performing companies have good resource decision processes, causing them to ignore disruptive technologies by not allocating resources to them. This for the reasons of good management as they typically do not produce cash in the short term.

The innovator's solution

To overcome the innovator's dilemma, Christensen proposes a framework (Christensen & Overdorf, 2000). This framework allows managers to think about the capabilities of their company as this is the only habit they typically lack when working in big companies. This is because managers are typically focused on assigning the right individual to the right job in the assumption that if the individual does his job well, the organization will perform well. **The framework states that a company its capabilities come from its resources, processes, and values**. Where in this context, values have a broader meaning than ethical values. They must be considered as the values on which employees base their decisions. For example, a company that sells expensive products to enterprise customers capable of doing large capex investments, will typically ignore viable business ideas for products serving mass markets which have lower prices and margins. The larger the company, the more values and processes will coalesce into culture, and resources become less important as they can be more easily interchanged or replaced. This makes that **in large companies, culture drives the company forward**. The impact of values on culture has already been shown with an example. But what is the impact of processes on culture? Despite process specialists state that processes are flexible for large companies, in the big picture they are not, due to the evolution and values of the company. A large company has typically grown by evolving and sustaining its core activities, called sustaining innovations. This makes that the processes in place are intended to deliver these sustaining innovations efficiently, and are not intended to discover disruptive innovations, which is in line with the innovator's dilemma. **Only by implementing a new set of values and processes, a sustaining organization would be able to change itself to become an ambidextrous organization**.

Types of innovation

Clayton Christensen identified 4 types of innovation (Christensen, 2016). These 4 types of innovation are discussed to see what must be considered from them.

New product innovation

New product innovations are about products which serve a need that has not been served before, for markets that do not exist yet. Because these innovations serve new markets, **they cause growth**. A new product innovation allows a job to be done for the customer which was not possible before. Christensen defines a job to be done as follows: "When people find themselves needing to get a job done, they essentially hire products to do that job for them."

Sustaining innovations

Sustaining innovations are all about making existing products better. They improve products to improve their profit margins and to gain more market share. A sustaining innovation is the most common innovation which is a logical next step after a new product innovation. However, **sustaining innovations do not cause growth** because they are replacing older products with newer products and a customer buying the latest product, does not buy the older product. No new markets are penetrated which would cause growth. Sustaining innovations are however important as they help to keep margins healthy and to grow market share. **Sustaining innovations secure required cash flows to sustain the organization**. A hallmark of the sustaining innovation is that incumbents in the market would respond to a new competitor providing a similar sustaining innovation. For example, Facebook is reacting to other new social media platforms like TikTok by adding similar functionalities to their platform.

Disruptive growth innovations

Disruptive growth innovations initially provide products for customers located at the bottom of the market and then move up into the market, pushing the incumbents out of the market. One of the reasons why certain products are disruptive is the fact that they are initially simple products that serve the bottom of the market which are typically ignored by incumbents because they focus on the high end of the market as indicated by the innovator's dilemma. From the bottom of the market these innovations can grow and further move up into the market. **Because the incumbents are more interested in the high end of the market, they do not defend the low end of the market, allowing the disrupter to enter higher market segments**. When the disrupter enters a higher market segment, the incumbents will also move into a higher market segment. This continuous until there is no higher market segment anymore and the disruptive innovation has grown in such a way that it serves the needs of all customer segments in the market. Typical hallmarks of disruptive innovations are that they are initially cheap and simple products having lower margins that serve target markets who are currently underserved by the incumbents and in extreme cases compete against non-consumption due to lack of alternative. The bottom of the market is underserved because incumbent products overserve in functionality and these customers are typically not able to afford these complex products. Incumbent products provide functionality which most customers do not actually need or at a pace customers are not able to consume. An example of disruptive innovation is Odoo. Odoo has initially been providing open-source ERP modules for

customers who could not afford a full ERP but is now disrupting the enterprise ERP market coming from the bottom of the market. **Disruptive growth innovations solve customer problems in a simpler and more cost-effective way** causing them to serve the market more appropriately making them the better choice for customers. Therefore, customer problem discovery and ranking are key to disrupt. **Disruptive growth innovations cause growth because they make products more affordable and accessible, and they provide access to products for people who could not access them earlier.**

Efficiency innovations

Efficiency innovations are not about improving the product, but they are about reducing product costs to increase profits. **Efficiency innovations allow to make more products with less effort and their focus is on improving product margins**.

Disruption using multiple innovations

How these types of innovations play their role in the market and help to explain disruption is further elaborated using two figures. The figures below show how the innovations provide a management perspective of their role.

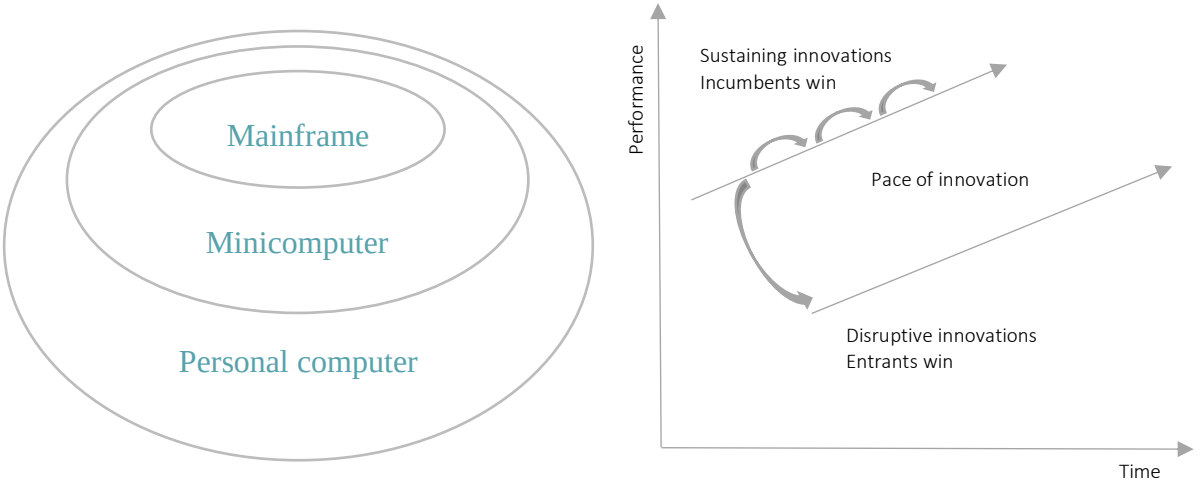

Figure 3 - Christensen's disruption model

The right side of the figure demonstrates disruption, where disruptive innovations are represented by the lower arrow and sustaining innovations are represented by the upper arrow. Disruptive innovations start at the bottom of the market by providing less performance at a lower price than sustaining innovations. **After a disruptive innovation has started at the bottom of the market it starts to sustain by adding more functionalities**, to move into higher market segments. **Over time, the disruptive innovation will be able to serve all market**

needs, but at a lower price than the sustaining innovation, pushing the sustaining innovation out of the market.

The left side of the figure shows how new innovations address different market segments. The concentric circles represent the different market segments. Initially, a new product innovation serves a new need and can typically only be afforded by the **wealthiest customers** in that market, which are represented by the most **inner circle**. The computer market which was created by the invention of the mainframe is used as an example. Mainframes initially sold for 500 000 dollar and provided margins of 60%. Due to the high price of mainframes, only the wealthiest and most knowledgeable customers in the computer market were able to afford it. At a certain point in time, minicomputers were put into the market for people who were not able to afford or use a mainframe, which sold for 250 000 dollar and provided margins of 45%. Minicomputers were less powerful but much smaller than mainframes and therefore more customers were able to put them on their premise. This opened a new market for people who were initially overserved by the mainframe. This is the second circle and thus the second market segment. The minicomputers kept evolving and thus started to behave like a sustaining innovation. The phenomena of the right side of the figure takes place and at a certain point in time the minicomputers were able to serve the needs of the users of mainframes, but for a lower price. This is when the mainframes got disrupted by the minicomputers. The same happened for minicomputers when personal computers entered the market. Personal computers which sold for 2000 dollar having margins of 20 to 40%.

In summary, Christensen's theory states that: Disruptive innovations are initially simple products which serve the bottom of the market. After their introduction, they start sustaining until the existing products in the market get disrupted. This can also be translated as: When new entrants enter an existing market at the top of the market, the incumbents will nearly always win because they fight back to secure their market share. When new entrants enter an existing market at the bottom of the market, they will nearly always win because incumbents typically do not defend the low end of the market.

Extending Christensen's theories – More about why giants fail

As mentioned by the innovator's solution, the answer on how to respond to disruptive change is to be found in the organization its resources, processes, and values. But to change the culture in an organization, a change process is required to drive this change. To indicate what needs to be considered for this change process, Henry Lucas Jr and Jie Mein Goh (Lucas Jr & Goh,

2009) propose an extension to the theory of Clayton Christensen, based on the study of the Kodak case. They propose 2 extensions:

1. The struggle for change
2. The operational culture

One of the most classic examples of why large organizations fail is Kodak. Kodak's photo film technology got totally disrupted by digital camera technology. Due to this, from 1993 till 2006 revenue went down from 25 billion to 10 billion and the number of employees dropped from more than 100.000 to 40.000. In 2019 the company only reported a revenue of 1 billion and had only 5000 employees left. This to indicate that what has taken decades to build has been lost so quickly, which shows the power of disruption.

The first extension is what they call **the struggle for change each company faces when being confronted with disruptive technology**. **The ability to respond to disruptive technology is determined by the firm its dynamic capabilities, core rigidities and management propensities** as shown in the model below.

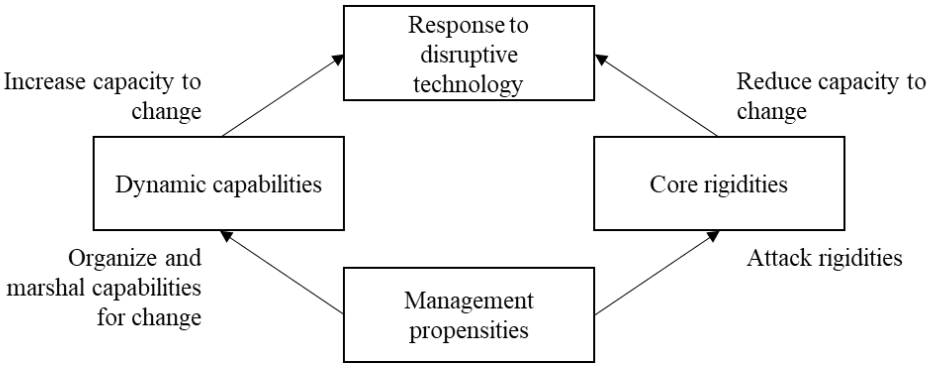

Figure 4 - Framework to respond to disruptive change (Lucas Jr & Goh, 2009)

Dynamic capabilities are defined as the firm's ability to integrate and build external competences to address rapidly changing environments. They are strategies and organizational processes to create value in new markets by using resources for new value creating strategies. They consist out of processes, assets and paths. Where paths are the sequence of events that have led the firm to its current position. **Core rigidities consist out of employee skills, technical systems, managerial systems and norms associated with knowledge, which can become so rigid that the company will not be able to respond to new innovations**. The reason for this rigidity can be the focus of the firm which can be very narrow, outdated technical systems, management systems driven by incentive models which drive the organization in a certain direction, and the competency trap. The competency trap is

that employees convince themselves that current processes and technologies are superior to a new disruptive technology. **Management propensities determine the outcome of the battle between dynamic capabilities and core rigidities.** It is the power of management on how they react to new innovations. They can use their power to build dynamic capabilities to drive change or to leverage current capabilities which will become core rigidities. Because each manager can have its own view and choice, he can have his own impact on the overall outcome whether the organization is going to be rigid or builds new dynamic capabilities. It is said that long-term employees typically create rigidity and newer employees typically try to innovate and take advantage of dynamic capabilities.

A second extension is related to the first extension and the operational culture, where the power of all managers is indicated. Organizational culture which exists as already mentioned out of processes and values, is determined by managers at all levels, senior and mid-management. **The second extension states that not only senior management determines organizational culture but also middle management**, which is typically the largest group. They need to follow into adopting the new culture. If they don't, they create inertia in the organization for the new culture.

The limited answer of Agile

In previous paragraphs the importance of processes in the organization has been indicated. So, which processes are currently being used in the software industry? Agile processes like Scrum are wildly spread in the software industry. Agile processes were a response to rigid processes like waterfall which have limitations in responding to change as they require extensive analysis upfront before development. Agile processes provide more flexibility, but do they provide an answer to the innovator's dilemma and the initial question of this dissertation?

Processes have always been important in the software industry due to the intangible nature of software. For this reason, there is always ongoing research in the academic world on processes for the software industry. Research has shown that **agile processes show limitations in problem understanding and solution definition** (Lindberg, Meinel, & Wagner, 2011). **Agile processes provide efficiency gain in software development, but do not learn what needs to be developed and how to prioritize the work**. This leads to the fact that software companies are getting more efficient in developing the wrong products. Therefore, agile processes provide no answer to the innovator's dilemma and our initial question because they provide no answer on which customer problems (jobs) and markets to focus on. Franziska Dobrigkeit and Danielly

de Paula (Dobrigkeit & De Paula, 2017) indicate that adding design thinking to Scrum helps in defining what needs to be developed. They propose to combine elements of design thinking, Scrum, and lean startup in the innodev process which is shown in the figure below. Even though the innodev process puts more focus on problem understanding, it does not show how to cope with a huge number of requirements like in the enterprise software business and how to prioritize them. It also does not show which markets to focus on to become successful.

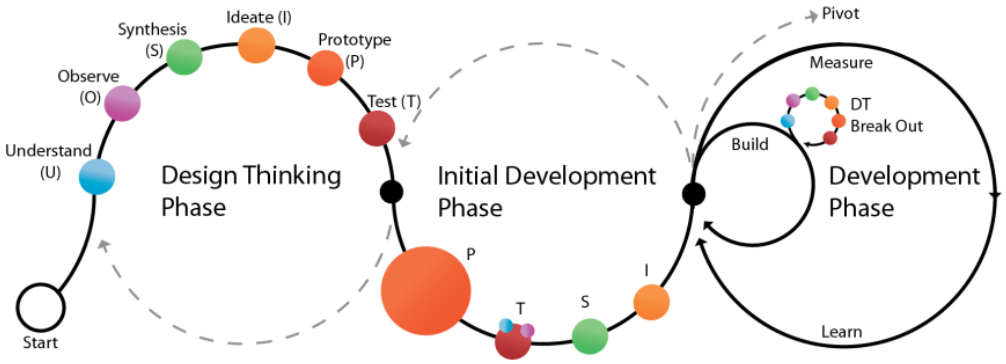

Figure 5 - Innodev process (Dobrigkeit & De Paula, 2017)

Conclusion

Ironically enough, it is good management that causes companies to stumble as it puts focus on fast return on investment and avoiding risk. This attitude means that the answer of companies to the innovator's dilemma is to focus on improving their margins and increasing their revenues which make them focus on the high end of the market and act as sustaining organizations.

The real answer to the innovator's dilemma is to be found in the resources, processes and values organizations use. The current agile processes being used provide efficiency gain but do not provide guidance on which markets to focus, what to develop, which customer problems to solve and how to prioritize those problems. Therefore, they provide no answer to the innovator's dilemma. In general, following conclusions on innovation are taken from the literature:

- The focus is on high margin sustaining instead of low margin disruptive innovations
- There is no focus on defending low-end markets allowing disruption from the bottom
- Management propensities determine core rigidities coming from existing skills
- Organizational inertia is caused by managers not adopting a new culture
- Processes with good decision values to discover customer problems are key to innovate
- There is limited support of existing processes to problem discovery and prioritization

The MOM design challenge

When a company wants to bring a new enterprise software product to live, it will be faced with several challenges. Within this section the challenges faced when bringing a new MOM product to market are elaborated.

Fighting incumbents

When going to market **in an existing market you will always have to fight the incumbents**. However, the means available and required to fight the incumbents differ a lot for every market. In the soft drinks market for example, the products only need to compete on flavor. It does not matter for the new soft drink how many features it has available. This is a completely different reality than in the enterprise software market like the MOM market. In the MOM market, a comprehensive number of product features need to cover a comprehensive list of requirements coming from the market. **In general, it can be stated that MOM products compete based on the number of requirements they can cover with their product features**. For example, a typical MOM opportunity will result in a project where the customer his requirements will be covered partly by the product and partly by doing services. These services provide custom additions to the product for requirements which are not covered by the product. The more requirements are covered by the product, the less services are required. In summary, it can be stated that the product coverage determines the required services and thus the total project price. **New MOM products face the challenge that they have limited product coverage, which requires a high number of services, which make them uncompetitive with the incumbent mature MOM products**.

As a result of what has been mentioned in the previous paragraph, it is clear that the decision on how and when to introduce a new MOM product into the market is extremely important. There are however many ways to approach this introduction. On the one end of the spectrum, one could try to build a full featured new MOM product before releasing it into the market. This is however almost impossible to achieve as it requires a full investment of years of development without having any incoming revenue. On the other end of the spectrum, one could release every feature as soon as it is developed. This is impractical as it requires build and release activities for every feature. In practice, software is being released in release cadences ranging from every three months to once a year. **The question which then arises is: Which functionalities do you put in which release?** The main question of this dissertation.

A comprehensive scope

The international standard for automation (ISA) is used to show the scope of a MOM project. **The ISA 95 standard is the standard for enterprise control systems which provides a theoretical model of the scope of a typical MOM project**. This provides a view on the magnitude of the challenge of deciding on which functionality to put in which release.

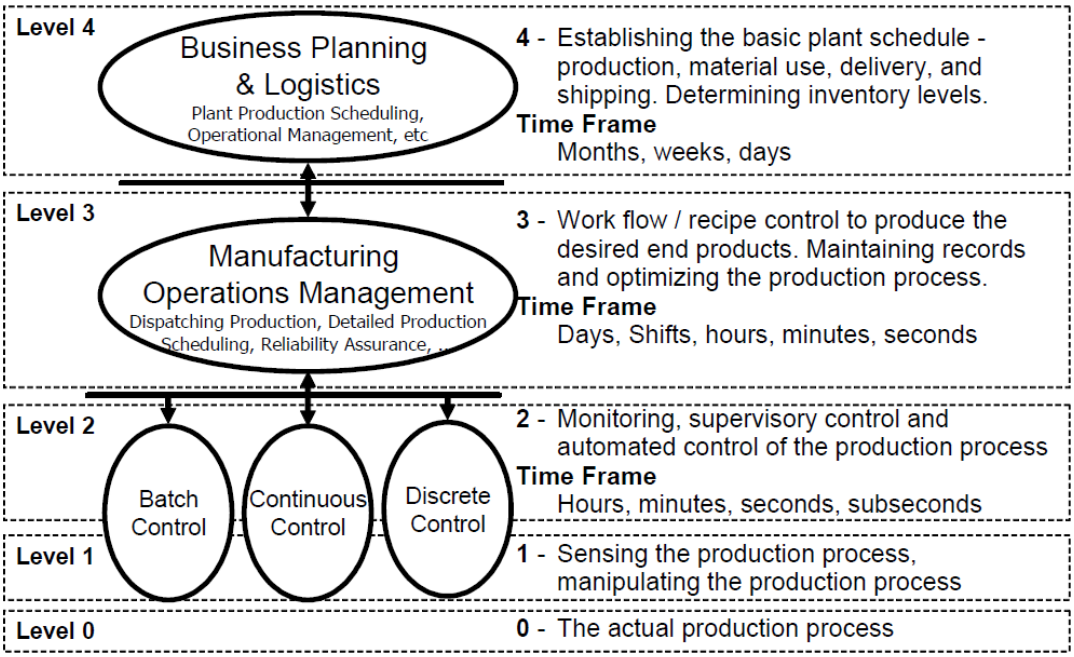

Figure 6 - Multilevel overview of manufacturing activities (The ISA society, 2005)

A first high level view coming from ISA 95 is provided in the figure above. The figure shows the different levels of activities involved in manufacturing. Level 4 is the business level, which contains typical business operations, which are typically supported by ERP. Level 3 is the actual MOM level where all manufacturing operations are managed. Level 2, 1 and 0 are the implementation of the automation and actual production processes on shopfloor level. The purpose of the figure above is to show the boundaries of scope between business, manufacturing operations management and manufacturing execution.

Within the MOM level (level 3), the ISA 95 standard provides an overview of all activities involved in manufacturing operations management. This is shown in the figure below. The heavy dark grey dashed line shows the boundary between business and manufacturing operations or between level 4 and level 3. The figure shows that **4 main domains are involved in MOM: production operations management, maintenance operations management, quality operations management and inventory operations management.**

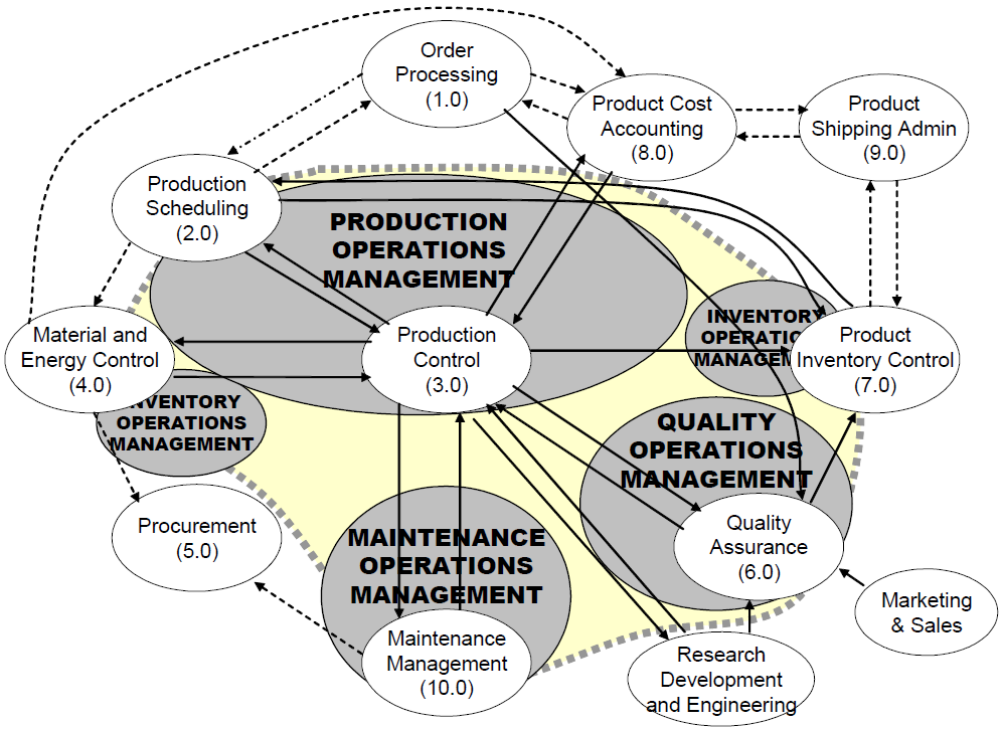

Figure 7 - Manufacturing operations management model (The ISA society, 2005)

In this dissertation it is however not the objective to elaborate all the activities involved in manufacturing operations management, but **it is however important to see that the scope of a manufacturing operations management system is tremendous and that this is part of the challenge to design a MOM product**. In the elaboration above, the different subsegments of the CPG industry were not even considered, which for each domain have a specific implementation, which makes the scope and possible implementations of a MOM product even more complex.

An opportunity driven market

As already mentioned earlier, the MOM market is reactive to opportunities, which can come from any of the subsegments in the CPG industry. Due to this, it is very hard to focus on a specific subsegment, because it is difficult to predict in which subsegment the next opportunity or most opportunities will be. This brings again **the challenge to decide on which functionalities for which subsegment you will focus on in which release.** There are again multiple ways to cope with this challenge. One could take the risk to focus on a certain subsegment and hope that an opportunity comes soon, with the risk that no opportunity comes. One could also choose to focus on generic functionalities which are common for most subsegments, with the risk that for a certain opportunity the subsegment specific functionality

is missing and the number of services becomes too high. Again, this shows that the choice of functionalities to be developed is crucial to be successful.

The industry standard

One could say that after several opportunities have passed, the probability of an opportunity in a certain subsegment can be estimated. This is true. But even though production processes are standardized within a subsegment, they are implemented according to the preferences of each company. For example, filling of bottles in the spirits industry is done in the same way nearly everywhere using the same process. However, each bottling facility has its own specific way to implement the process. For example, in how it implements its quality process across the filling lines. This leads to the fact that if one would focus on **implementing all product functionality based on the first opportunity in a certain subsegment, it is not certain that all product functionalities can be reused in the next opportunity**. Another time it comes down to the choice of which functionality to productize and how to determine this choice.

Innovation versus technological upgrade

Another approach to build a new MOM product could be to rebuild and technologically upgrade the existing MOM product. This approach might seem obvious, but it comes with several issues. All functionalities including all issues of the old product will be copied to the new product, making old issues to remain in the new product. If there would be no issues in the old product, the rebuild of the new product would still take years in a new technology, bringing back the same challenge to the table. Which functionality is going to be put first in the product? Even stronger, the approach of **rebuilding the existing product would come with a huge disadvantage of not using innovations which have been introduced in the software domain lately**. For example, business process modeling notation (BPMN), an intuitive modeling language, could be leveraged as modeling language in the new MOM product. However, rebuilding the old product would not allow you to use this innovation. One could think to adopt BPMN only, but this would affect the whole design of the product bringing it back to building a completely new product. **As a conclusion, one could state that rebuilding the old product does not solve the challenge of choosing which functionality to be put in which release of the product**.

Issues coping the challenge

To cope with the challenges mentioned above, organizations need to figure out how to cope with the challenge of defining a product roadmap. Within this section some issues and phenomena will be addressed which arise in the daily life of the organization while coping with the challenge of defining a product roadmap. They are issues which indicate that there is room for improvement on how to bring a new MOM product to market. All the issues and phenomena mentioned below are personal perspectives coming from personal experiences. They are not proven theories, but rather indicators on which domains improvements can be done in the enterprise software world like MOM.

Pretense of knowledge

Most large organizations in the enterprise software business have become what they are based on their successes. Typically, those organizations have mastered and dominated a certain domain by providing good products to the market which were a result of their understanding of market needs. **Due to this success, people in the organization get the impression that they have full knowledge of the market and fully understand the customer needs**. However, as the world evolves continuously, new customer needs emerge over time and continuous monitoring of those needs is required.

Looking more closely into the topic, it is not only about finding new customer needs but also about reviewing **customer needs which are currently being served, verifying how well they are served with the current products**. To quote Peter Drucker, “The customer rarely buys what the business thinks it sells him”. One might state that due to its success the company knows what it sells the customer, but one might also turn this around. One could also say that the product that was being offered at the time was the best because there was no better alternative. This means that there is still a better way to serve the customer needs and to solve the customer his problems. However, in most large companies, due to the fact being already successful, **the company assumes it already knows the customer problems sufficiently**. Especially in the MOM business where the product needs to serve many customer problems, this is an issue. **Because the problems are assumed to be known, there is no further research on these problems and the focus is fully on the solution**. This leads to the fact that certain low hanging fruits will never be detected or finding a new paradigm is impossible.

The power of opinion

Because people in the organization assume, they fully know and understand the customer his problems, they consider themselves as an expert. These experts focus on the solution, as already mentioned, and **each expert has his own opinion on how the ideal solution should look like. This leads to more focus on the solution in trying to find consensus on the ideal solution**. The experts try to persuade each other on what in their opinion is the best solution to bring to market. As the focus is purely on the solution and not on the problem, this is merely an opinion and not a validated learning out of a customer problem.

Different perspectives

A product, especially a MOM product, is not the result of a single person but of a group of experts. These experts typically focus on designing the product based on their experience. In the MOM world, people involved in designing the product, typically have a project background. They have built up their expertise and experience during MOM projects they have executed at customers in the past. This leads to the fact that **each expert has its own perspective on how the ideal product should look like, based on his experience**. This leads again to the fact that, based on their perspectives, consensus needs to be found on the ideal product, which strengthens the focus on the solution instead of the customer problem.

The status quo

In previous paragraphs some issues and phenomena have been indicated. One might think if the issues are known, one might be able to solve them. But because innovation is a group activity, one needs to change the behavior of the whole group to solve the issues. Attempts to change group behavior typically come with the introduction of new ideas and concepts. But despite their good intentions, it is very hard to change group behavior. **Habits and the status quo are very hard to change, as it requires a whole organization and its processes to change**. To change the processes of an organization, there needs to be willingness to adopt the new processes. Within an organization where the business is driven by intellectual property, like the enterprise software business, people are very intelligent and thus critical. To convince people to change their way of working in line with new processes, often academic theories are used. But despite the fact these theories might bring comprehensive learnings, **theories are often seen as impractical in real life and people often fall back to ways of working by which they were successful in the past**. For these reasons, it is very hard to change the status quo.

Achieving the numbers

One of the driving factors of a company from a financial perspective is to sustain revenue, profit and growth. To achieve the overall numbers of the company, individual leaders of the company get individual financial targets. Therefore, individual leaders need to make conscious decisions. On the one hand side they need to make decisions to be able to achieve the numbers in the short term, but on the other hand side they need to make decisions to sustain long term growth. **Short term objectives typically have a larger weight in the decisions of leaders then long-term objectives**. This makes that product roadmap decisions typically are more determined by short term then long-term objectives.

Seizing opportunities

A catalyst to achieve the numbers are opportunities which come along the way. **As individual leaders need to achieve the numbers, it is very tempting to try to seize any opportunity**. But seizing opportunities comes with the liability to fulfill the demands of those opportunities, which might be contradictive to the common market needs. This makes a structural way forward more difficult.

Levers for success

In this section, important elements which can be levered to come to a solution for the issue under investigation are discussed.

Business model and value proposition design canvas

In 2010 Alexander Osterwalder designed the value proposition (VPC) and the business model canvas (BMC) (Osterwalder & Pigneur, 2010). These two canvasses are used to define a value proposition for a certain customer problem and to define a business model around that value proposition. The two canvasses serve different levels of perspective on the value proposition. **The value proposition canvas focuses on the challenges of a customer segment and the product that can help the customer with those challenges**. On the right-hand side of the VPC, the canvas is zooming in on which jobs this customer segment needs to get done. Related to these jobs there are certain gains a customer wants to achieve by performing these jobs and several pains he faces while executing these jobs. On the left-hand side, the VPC focusses on the product which helps the customer with his jobs and helps to define which pains are relieved and which gains are provided by the product. **The business model canvas puts the customer segment and value proposition of the VPC in a wider perspective to focus on the other 7 elements of the business model around the value proposition**.

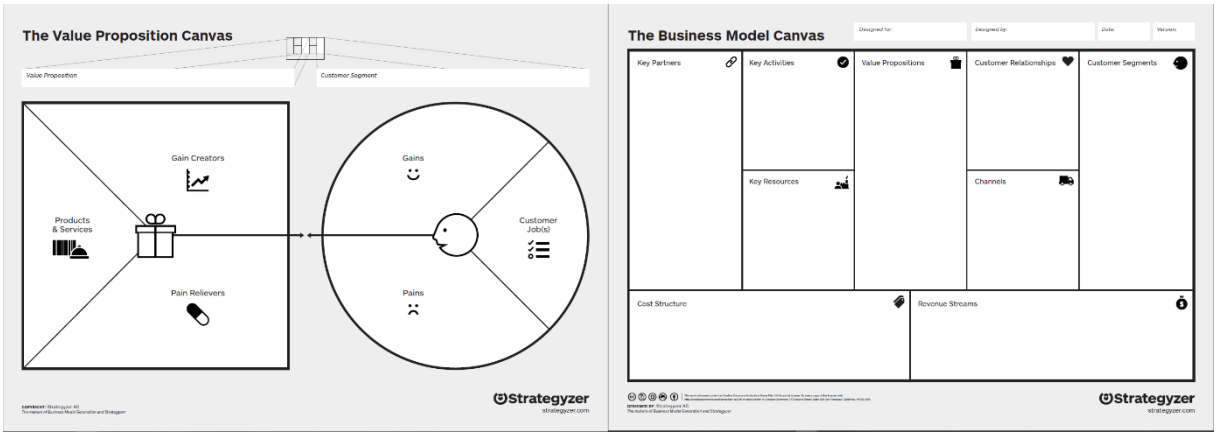

Figure 8 - Value proposition and business model canvas (Strategyzer, 2022)

An important remark about the VPC and BMC is that it is not a tool which delivers you a value proposition or business model, but a language which helps you to discuss all the elements related to a value proposition and business model. The VPC has strong analogies with the job to be done concept proposed by Clayton Christensen. The VPC provides however no objective

or quantitative way to determine the priorities of the jobs to be done for the customer segment. Like the value proposition canvas there is also the empathy map. It is a similar concept like the value proposition canvas, but which puts more focus on the experiences of the customer.

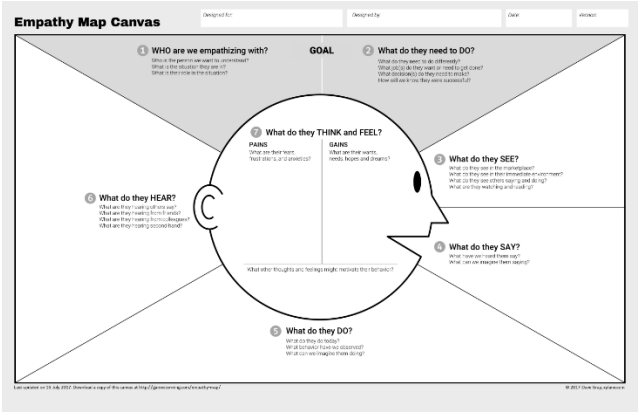

Figure 9 - Empathy map (Lewrick, Link, & Leifer, 2020)

Design thinking

Design thinking is an innovation approach which provides a process, shown in the figure below, to investigate problems and ideate solutions based on divergent and convergent thinking. The focus of the process is on customer empathy to cocreate solutions with the customer for problems the customer is facing. Divergent and convergent thinking is performed in the problem and solution space of the process. It has the purpose to first diverge and generate many perspectives on the problem and the potential solution, from which to converge and select the best point of view on the problem and the best solution.

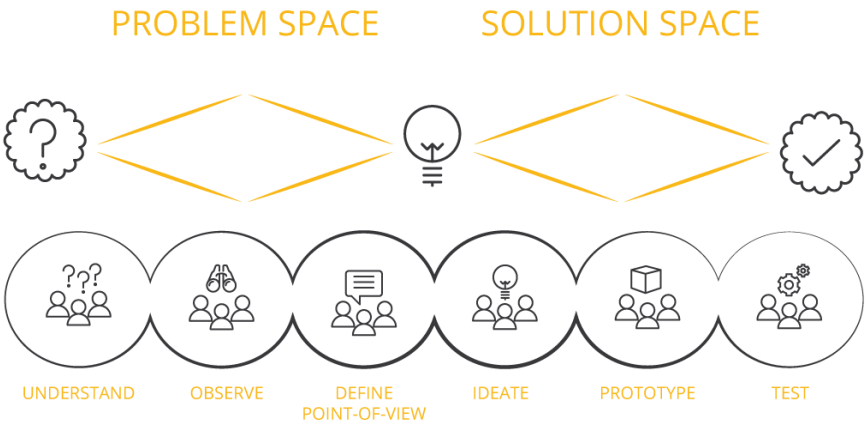

Figure 10 - Design thinking process (Lewrick, Link, & Leifer, 2020)

Each phase of the design thinking process is supported by several tools which can be leveraged during that phase. A complete set of tools can be found in the quickfinder matrix shown in the figure below coming out of the design thinking toolbox book (Lewrick, Link, & Leifer, 2020).

Tools Quickfinder Matrix	Page	Understand	Observe	Point of view	Ideate	Prototype	Test	Reflect	Examples of tools applied over a typical design cycle of 1 day up to 14 weeks				Your favorite tools for various workshops/projects				
									1 day	2–3 days	4–7 days	14 weeks	days	days	days	days	days
Problem statement	49	◐	◐	◐					✓	✓	✓	✓					
Design principles	53	◐	◐	◐	◐	◐	◐	◐			✓	✓					
Interview for empathy	57	◐	◐				◐		✓	✓	✓	✓					
Explorative interview	63	◐	◐				◐			✓	✓	✓					
Ask 5x why	67	◐	◐				◐			✓	✓	✓					
5 WH questions	71	◐	◐				◐			✓	✓	✓					
Jobs to be done	75	◐	◐		◐		◐			✓	✓	✓					
Extreme users/lead users	79	◐	◐				◐				✓	✓					
Stakeholder map	83	◐	◐				◐				✓	✓					
Emotional response cards	87	◐	◐				◐					✓					
Empathy map	93	◐	◐	◐			◐		✓	✓	✓	✓					
Persona/user profile	97	◐	◐	◐			◐			✓	✓	✓					
Customer journey	103	◐	◐	◐		◐	◐				✓	✓					
AEIOU	107	◐	◐		◐						✓	✓					
Analysis question builder	111	◐	◐									✓					
Peers observing peers	115	◐	◐									✓					
Trend analysis	119	◐	◐		◐							✓					
"How might we…" question	125			◐	◐				✓	✓	✓	✓					
Storytelling	129			◐		◐	◐			✓	✓	✓					
Context mapping	133	◐		◐	◐			◐		✓	✓	✓					
Define success	137	◐	◐	◐	◐	◐	◐	◐			✓	✓					
Vision cone	141	◐	◐	◐				◐				✓					
Critical items diagram	145			◐		◐	◐	◐			✓	✓					
Brainstorming	151				◐	◐	◐	◐	✓	✓	✓	✓					
2x2 matrix	155	◐	◐	◐	◐	◐	◐	◐	✓	✓	✓	✓					
Dot voting	159				◐	◐	◐	◐		✓	✓	✓					
Brainwriting/6-3-5 method	163				◐	◐				✓	✓	✓					
Special brainstorming	167				◐	◐					✓	✓					
Analogies & benchmarking as an inspiration	171		◐		◐	◐					✓	✓					
NABC	177		◐	◐	◐	◐	◐				✓	✓					
Blue ocean tool & buyer utility map	181				◐	◐	◐					✓					
Exploration map	187					●	◐				✓	✓					
Prototype to test	199					●	◐		✓	✓	✓	✓					
Service blueprint	203					●	◐				✓	✓					
MVP – minimum viable product	207					●	◐					✓					
Testing sheet	213						●			✓	✓	✓					
Feedback capture grid	217	◐	◐	◐	◐	◐	●	◐	✓	✓	✓	✓					
Powerful questions for experience testing	221	◐	◐				●			✓	✓	✓					
Solution interview	225	◐	◐				●				✓	✓					
Structured usability testing	229	◐	◐				●					✓					
A/B testing	233						●					✓					
I like / I wish / I wonder	239	◐	◐	◐	◐	◐	◐	◐	✓	✓	✓	✓					
Retrospective sailboat	243						◐	◐		✓	✓	✓					
Create a pitch	247			◐			◐	◐		✓	✓	✓					
Lean canvas	251			◐				◐			✓	✓					
Lessons learned	255							◐				✓					
Road map for implementation	259							◐				✓					
Problem to growth & scale innovation funnel	263							◐				✓					

Figure 11 - Design thinking quickfinder matrix (Lewrick, Link, & Leifer, 2020)

Job stories

It has been mentioned that in the MOM world there are many requirements which need to be covered by the software product. As seen with the job to be done concept and the VPC, **the focus needs to be on the customer problem to come to a good solution**. Because a MOM product needs to cover the jobs of many people, and many people are involved to create a product for all these jobs, proper indication of the jobs to be done is needed. As well Christensen's theory as the VPC do not indicate how to write down the job to be done. Job stories provide help here.

User stories have become widespread in the software industry to document requirements for the product to be built. However, the initial idea was to have a problem focus, **user stories are typically formulated with a solution in mind**, proposing how to solve the problem, describing the required features (Lucassen, et al., 2018). To cope with this, Alan Klement (Klement, 2013) introduced another paradigm to document problems called the job story, which uses following template: When <situation>, I want (to) <motivation>, so that (I can) <expected outcome>. **The**

job story expresses the motivation for a certain outcome in case of a given event, which expresses the problem or job to be done. The job story is strongly inspired by the job to be done theory. An important feature of the job story is that it focuses on the why of the problem instead of the how of the solution, which gives a stronger indicator for the need of the customer.

Problem prioritization

To decide which functionality to deliver first, one needs to be able to set priorities. This section shows two examples of how priorities of customer challenges can be determined.

Integrated job story method

To come to proper use of job stories, the paper of Lucassen comes with **a method on how to come to a prioritized list of job stories** (Lucassen, et al., 2018). The method is called the integrated job story method which consists out of following five phases.

- An interview phase to explore the goals and the challenges which come with those goals.
- An analysis phase to analyze the interviews to come to job stories.
- A survey phase to validate the job stories coming out of the analysis phase.
- A prioritization phase to determine which jobs provide the biggest opportunity
- A project definition phase.

During the prioritization phase information is being used which is gathered during the survey phase. During the survey phase the respondents need to put for each job story their valuation of importance and current satisfaction based on a Likert scale. Using these values, an opportunity score is calculated with opportunity score = importance + max (importance - satisfaction ; 0). **Based on the opportunity score, job stories can be categorized in three categories: underserved, served right and overserved**. Job stories for example with high importance and low satisfaction are currently underserved and good opportunities. To do this in a visual way, an opportunity graph can be drawn to identify good opportunity job stories.

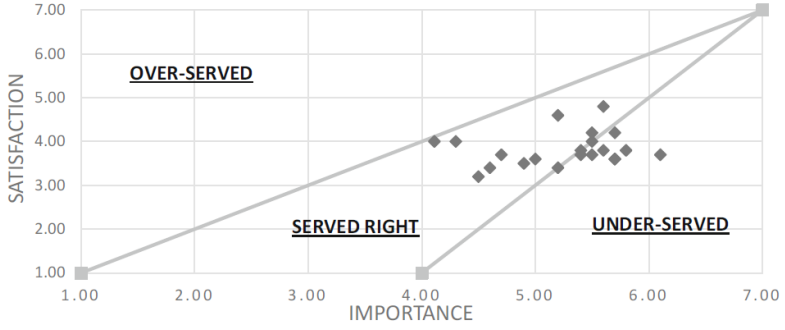

Figure 12 - Opportunity graph (Lucassen, et al., 2018)

Kano model in Quality function deployment

One of the issues in measuring customer satisfaction is that it is not linear. An increase in performance of a product would not always lead to a proportional and linear increase in customer satisfaction. To cope with that, **Kano developed a two-dimensional model based on the amount of fulfillment of a product feature and the satisfaction this fulfillment provides** (Chaudha, Jain, Singh, & Mishra, 2011). Using this model, several types of product requirements, each with a different meaning for the product, can be distinguished. These types of requirements are:

- Must be: Provide extreme dissatisfaction when not fulfilled, but low satisfaction when fulfilled
- One-dimensional: Provide incremental increased satisfaction when more fulfilled
- Attractive: Provide high satisfaction when fulfilled but low dissatisfaction when not fulfilled
- Indifferent: They provide no difference in satisfaction whether they are fulfilled or not
- Questionable: Illogical response based on misunderstanding of the requirement
- Reverse: Customers expect the opposite of the requirement

Each of those requirements has a different impact on satisfaction as shown in the Kano model in figure the figure below.

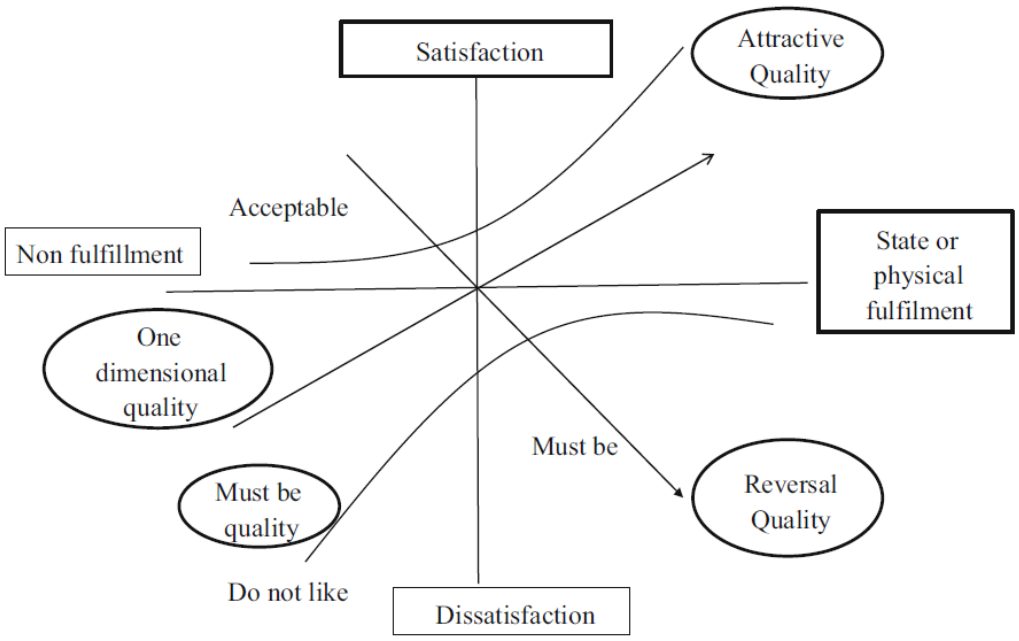

Figure 13 - Kano model (Shwetank, Rohit, & Rashmi, 2020)

To demonstrate that the Kano model improves product requirement prioritization, the **Kano model has been integrated and used in quality function deployment (QFD)** (Chaudha, Jain, Singh, & Mishra, 2011). QFD is a method to determine customer requirements based on a multitude of perspectives like importance, competitive analysis, strategy, and requirement correlation. By integrating the Kano model in QFD it has been demonstrated that **the attractiveness of a product requirement is more properly considered causing that more attractive product requirements get a higher priority**.

Problem statement

Leveraging the knowledge obtained in previous chapters, a refined problem statement and research questions are formulated here.

Prior research has shown that it is more important for a company to focus on how to organize itself instead of technology to become an innovative company. By organizing itself it is meant that companies need to know how to leverage its resources in processes using values that facilitate innovation and disruption. By implementing the optimal culture, employees can take decisions that facilitate innovation and disruption.

To introduce a new MOM product into the market, the theory of disruption learns that a company its best chances to be successful and potentially to disrupt, are to start from the bottom of the market and to focus on solving customer problems more efficiently using a simple product. A large organization is typically a sustaining organization focusing on the high end of the market leveraging processes which have insufficient attention to problem discovery and ranking. Therefore, a subset of the large organization needs to be reorganized using different processes and values to include focus on the bottom of the market and to put more focus on problem discovery and ranking. This to allow the company to be able to disrupt, to become an ambidextrous organization, and to overcome the innovator's dilemma.

This dissertation is focused on how to organize an organization, which is currently a sustaining organization, **to be able to become an ambidextrous organization,** specifically in the enterprise software business like the MOM business for CPG. **The purpose of this study is twofold: First, to validate the current organization is not an ambidextrous organization and is suffering from the innovator's dilemma. Secondly to propose an innovation process, enabling the organization to become an ambidextrous organization.** This process needs to put more focus on the customer, his problems, the right CPG markets and needs to be able to rank the large amount of customer problems to be addressed by an enterprise MOM product.

Research design

A research approach is set up using 2 stages. A first stage to validate that the current organization is a sustaining organization which is not properly organized to act as an ambidextrous organization. A second stage proposing an innovation process based on the levers for success, to help the organization drive its change to become an ambidextrous organization.

Stage 1 - Validation of the current organization state

A survey is executed in the organization to validate that the current state of the organization does not allow the organization to act as an ambidextrous organization. The audience, validation objective and survey design are elaborated here.

Audience

The survey is presented to two key groups in the organization. The first group is **the product development group** which consists out of **multiple development teams, called startups,** which each develop a different product. The second group is **the business group**, which supports projects at customers which use the products delivered by the startups. The business group is also involved in determining product requirements based on its interactions with customers during projects. The business group consists out of two parts. The first part, called business enablement (BEN), performs business development activities at customers during opportunities. The second part, called Advanced Product Adoption (APA), provides product support to project teams at customer projects. **The business group will serve as benchmark for the product development group (startups)**.

Validation objective

To verify if the company is suffering from the innovator's dilemma and is not organized to act as an ambidextrous organization, the following research questions need to be answered:

- RQ 1: What is the current market focus of the organization?
- RQ 2: How is the organization currently detecting customer needs?
- RQ 3: How is the organization currently prioritizing customer needs?
- RQ 4: Are there rigidities present in the organization to adopt a new innovation process?

To answer the research questions mentioned above, following hypotheses are verified:

- H1: There is limited contact with customers by product development teams
- H2: The development focus is mainly on the enterprise customer market.
- H3: There is currently limited focus on customer problems
- H4: There is currently no framework to determine customer problems
- H5: There is currently no quantitative framework to rank customer problems
- H6: There is currently no initiative to develop a new innovation process
- H7: There are rigidities in the organization to adopt a new innovation process

To validate these hypotheses, benchmarks and measurements are performed in relation with the hypotheses. The dependent variable of each hypothesis is shown below preceded by the indicator of its related hypothesis, after which the measured independent variables are listed. **In the variables and questions related to hypotheses 4, 5 and 6, the term product requirements instead of customer problems is used** because it is more accepted terminology in the organization in the context of product definition frameworks which need to be discovered.

- H1 - Amount of customer contact: This is validated by a benchmark between the business and product development group. Following variables are measured:
    - Number of customers contacted per quarter
    - Number of hours of customer contact per quarter
- H2 - Market type: Following variables are measured to determine the focus market:
    - Amount of people having contact with of enterprise size customers
    - Amount of people having contact with of medium size customers
    - Amount of people having contact with small size customers
    - Amount of people having contact with no customers
- H3 - Problem focus: This is validated via a benchmark between the business and product development group. To perform this benchmark the rank per discussed topic is measured. The available topics to be ranked are indicated in the survey design.
- H4 - Problem framework: The validation of the missing problem discovery framework is done by measuring:
    - The number of people determining product requirements
    - The number of people using a framework to discover product requirements
    - The number of discovery frameworks used
- H5 - Ranking framework: The validation of the missing problem ranking framework is done by measuring:
    - The number of people ranking product requirements
    - The number of people using a framework to rank product requirements
    - The number of ranking frameworks used
- H6 - framework initiative: The validation of the missing initiative to develop a problem discovery and ranking framework is done by measuring:
    - The number of people developing a framework
    - The number of times a certain framework initiative is indicated
- H7 - Rigidities: The exitance of three rigidities is measured via:

- The average agreement to leverage practical versus academic knowledge
- The average agreement not to improve the current innovation process
- The average agreement to leverage only internal knowledge

Survey design

The questions of the survey and their relationship with the hypotheses are discussed here. Each question is preceded by the indicator of the related hypothesis to indicate the relationship with the hypothesis. The first two questions are asked to be able to perform the benchmarks.

Question 1: **Where are you located in the organization?** Verifies if the responder is in the product development or business group.

Question 2: What is your role? Verifies the role of the responder within its group. Options are: Startup owner, Product owner, Solution architect, Developer, Product specialist, Business developer and Lean Agile leader

H1 - Question 3: How many customers do you talk to per quarter on average?

H1 - Question 4: How many hours per quarter on average do you spend having direct customer contact?

H2 - Question 5: Which type of customers do you talk to? Multiple answers possible. Options are: Enterprise customers, Medium size customers, Small size customers and None

H3 - Question 6: Rank which topics you discuss most with customers? Top = discussed most; Bottom = discussed least. The topics to rank are:

1. Reasons of customer challenges - Root causes of his problems
2. Customer challenges - Problems he is facing
3. Possible solutions - Potential / future product features
4. Available solutions - Current product features
5. What the customer needs - Requirements he provides
6. What the customer wants - Desires he expresses

The ranking of topics provided here is the ranking expected to receive indicating that the teams provide sufficient focus to customer problems. The difference between requirements mentioned in point 5 and problems is that requirements in this context are solutions the customer thinks he needs to solve his problems from his perspective and not the actual problems. Desires are here more visionary ideas the customer expresses and are typically also solution oriented.

H4 - Question 7: Do you determine the product requirements of the product roadmap?

H4 - Question 8: Do you have a framework to determine the product requirements of the product roadmap?

H4 - Question 9: If previous question is yes, briefly describe your framework?

H5 - Question 10: Do you prioritize product requirements of the product roadmap?

H5 - Question 11: Do you have a quantitative framework to prioritize product requirements of the product roadmap?

H5 - Question 12: If previous question is yes, briefly describe your framework

H6 - Question 13: Are you currently developing a framework to determine and prioritize product requirements?

H6 - Question 14: If previous question is yes, briefly describe this framework?

H7 - Question 15: Provide your agreement with following statements related to the current roadmap definition process? Agreement needs to be provided based on a 5-point Likert-scale from strongly disagree, disagree, neutral, agree to strongly agree. Following statements need to be rated:

1. The current roadmap definition process is good
2. Practical experience is most helpful to improve innovation
3. We are best suited to know how to innovate
4. The current roadmap definition process needs to be improved
5. Academic theories are most helpful to improve innovation
6. External knowledge on innovation should be obtained

The rating verifies 3 core rigidities by measuring a positive and negative statement for each of the rigidities. Statement 1 and 4 verify the rigidity versus improvement of the existing process. Statement 2 and 5 verify the rigidity against academic theories, which is the most important as the proposed innovation process will use academic theories. Statement 3 and 6 verify the rigidity of obtaining external knowledge.

Stage 2 - Process design

An improved innovation process is proposed leveraging the levers for success, the information learned from the existing situation in the survey, and the academic theories discussed in the section “Why large organizations fail”.

To do this, the focus is on following research questions:

- RQ1: How to implement an innovation process for MOM software that puts more focus on customer problems, and which supports disruptive and sustaining innovations?
- RQ2: What are the markets where the MOM innovation process needs to be applied?
- RQ3: Who needs to be involved in the innovation process?
- RQ4: How can a large set of customer problems be prioritized?

Current organization - problem validation

In this section the results and conclusions of the survey are discussed.

Respondents

The survey was sent to two groups which are related to determining product requirements, the product development group and the business group. The product development group is called startups below. The distribution of the respondents is shown in the figure below.

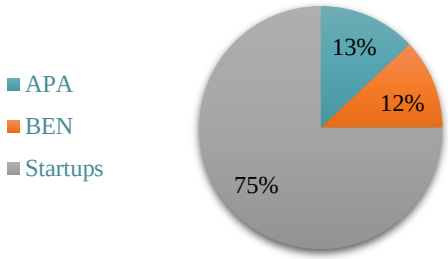

Figure 14 - Respondent group distribution

The survey was sent to 393 people where 355 were part of the startups and 38 part of the business group. Out of 92 respondents, 69 respondents are part of the startups which represents 75%, 12 people are part of APA and 11 people are part of BEN which together represent 25%. This distribution of respondents is approximately proportional to their group populations. The distribution of the roles of respondents is shown in the figure below. The primary role of respondents is developer with 46% of the respondents. The product owner and startup owner are currently the main roles involved in determining product requirements in the startups. However, the developers and solution architects are also important stakeholders in determining product requirements as they need to understand the problems they need to solve.

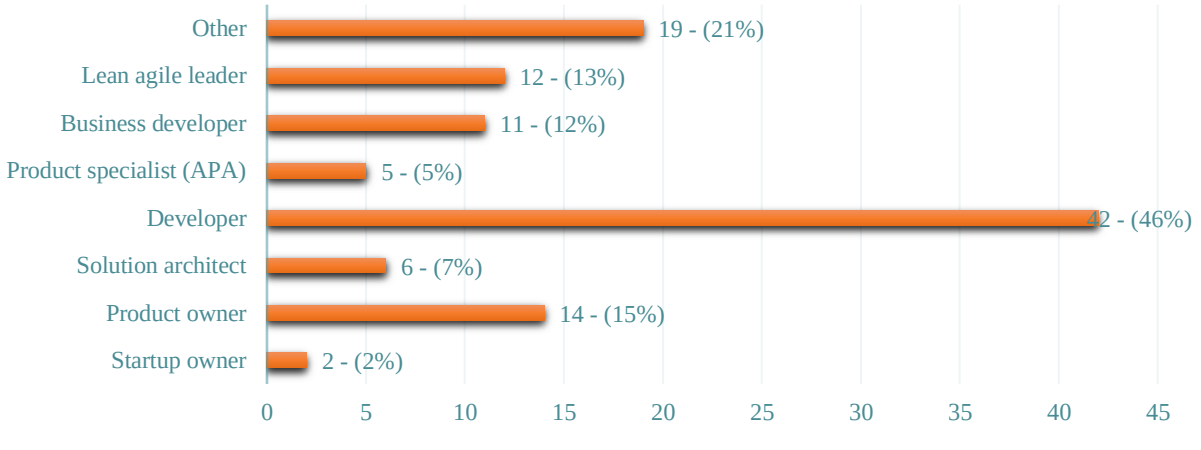

Figure 15 - Respondent role distribution

H1 - Customer contact

To verify the amount of customer contact of the startups, they are benchmarked with the business group. The survey provides following data for each role per group of the number of customers they have seen and the number of hours being in contact with customers per quarter. In general, the startups have less contact with customers then the business group. The startups have on average contact with 10 customers per quarter where the business group has contact with 23 customers on average. This reflects to 17 hours of customer contact per quarter on average for startups versus 40 hours for the business group. In conclusion, **Startups have 57% less contact with customers then the business group resulting in 58% less time spent with customers on average.** What also stands out is that in the startups almost all time spent with customers is performed by the product and startup owner. This means that developers of development teams who need to understand and research customer problems have limited contact with customers. For example, a solution architect in the startups, spends 85% less time with customers then the one from the business group. This is an indicator that limited amount of time is spent by developers performing research on customer problems at customers.

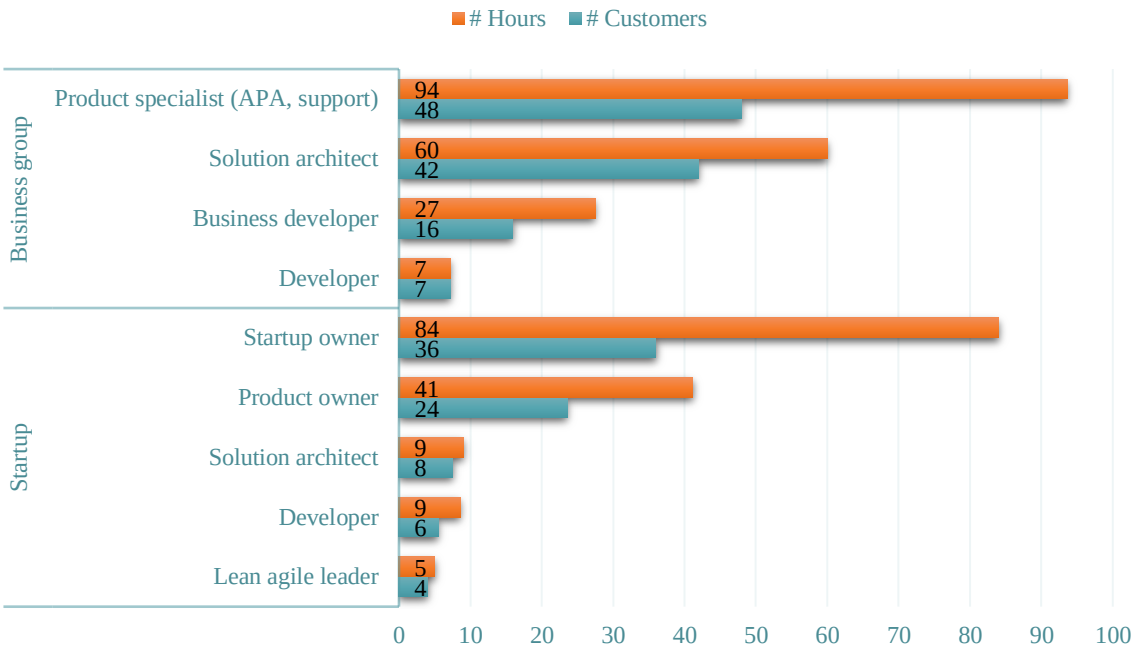

Figure 16 - Customer contact benchmark

In conclusion, hypothesis 1 is validated for two reasons. First, startups have significantly less customer contact then the business group. Second, the required roles like solution architects and developers in startups have limited focus on problem discovery at customers due to limited customer contact.

H2 - Market type

The survey provides following results per group regarding the customer type they see.

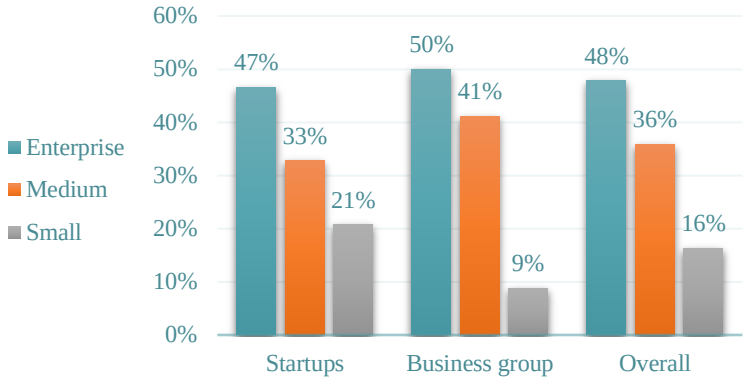

Figure 17 - Contacted market type

The figure shows that as well in the startups, the business group as overall, the enterprise customers represent approximately 50% of the customers. For medium size customers this is about 35%, and small size customers only 15%. **Hypothesis 2 about the focus on the enterprise market is validated because half of the customers are enterprise customers.**

H3 - Problem focus

To validate the lack of focus on the problem, 6 topics which are potentially discussed with customers needed to be ranked. Per respondent, the topic ranked first got 6 points, the second 5, till the last which received 1. After all rankings were received the average score per topic per group was calculated and this determined the final rank of the topic per group. Following average scores are obtained via the survey.

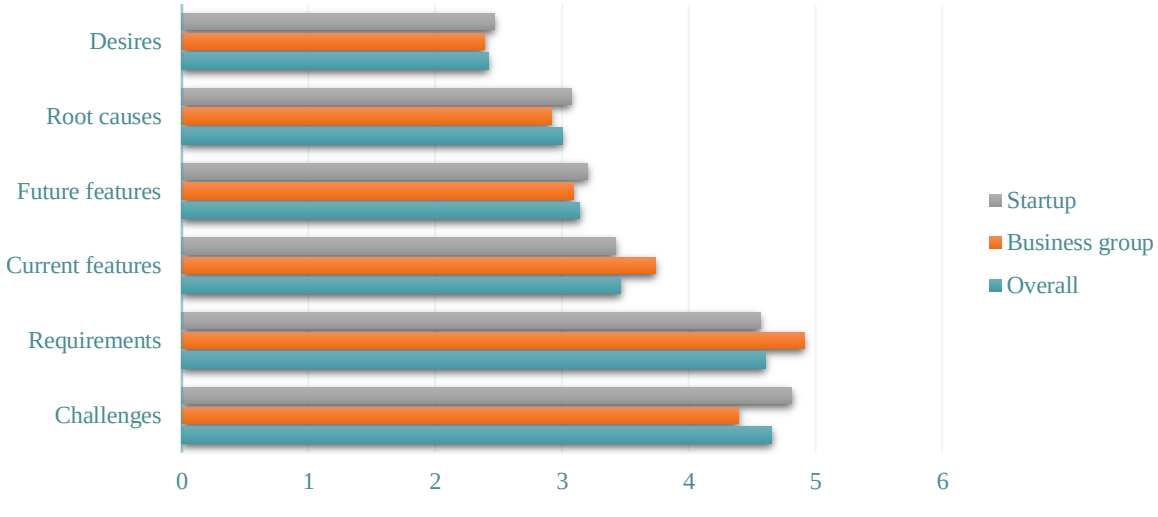

Figure 18 - Average topic scores per group

These scores provide the following ranking per topic per group.

Rank	Overall	Business group	Startups	Expected
1	Challenges	Requirements	Challenges	Root causes
2	Requirements	Challenges	Requirements	Challenges
3	Current features	Current Features	Current Features	Future features
4	Future features	Future features	Future features	Current features
5	Root causes	Root causes	Root causes	Requirements
6	Desires	Desires	Desires	Desires

Table 1 - Topic ranking per group

The ranking of the topics learns that there are no big differences between the startups and the business group. The only difference is that the primary topic of the business group is requirements which is challenges for the startups. The rest of the topics have similar rankings for both groups. Looking at the average scores for challenges and requirements, it shows that they are very close to each other for the business group, the startups and overall. There is only a significant decrease in the score as from topic three, the current features. Therefore, it can be stated that **requirements and challenges are discussed equally at customers and both are the primary topic**. Due to that, it can also be stated that **there is no difference in the ranking of discussed topics with customers between the startups and the business group.**

As already mentioned in the survey design, requirements are solutions the customer thinks he needs for his problems from his perspective. Because this topic is ranked first together with the challenges, there is a lot of focus on trying to understand what the customer thinks he needs. The customer is seen as the best suitable to know his needs and therefor seen as the best source for potential solutions. However, customer problems are not further investigated in this way. **The focus on requirements provides a signal on lack of focus on customer problems**.

Important to note is that in all groups, **the root causes topic is only ranked as the fifth topic discussed with customers, contrary to expected and despite the high ranking of challenges**. This learns that challenges are not further investigated at customers. The challenges are merely accepted and are not further investigated to find out what causes these challenges and which problems really need to be solved. The same was seen with requirements which are merely accepted. **This strongly signals lack of investigation on root causes and customer problems.**

However, the current and future features are approximately on their expected ranking after the challenges, **current features are ranked higher than future features contrary to expected**. Looking at the scores, one can see that current features are significantly more discussed than

future features. Discussing future features is a signal that solutions for problems are investigated. Because current features are more discussed than future features, the focus is on how to apply the current product, rather than on investigating how the product can be improved to solve additional customer problems. **This strengthens the signal on lack of investigation on root causes and lack of focus on customer problems**.

Finally, given all the signals discussed above about the lack of investigation on root causes, combined with the fact that challenges and requirements are equally discussed, following conclusions can be made. First, **there is insufficient conversation and thus investigation on root causes of problems with customers**. **Second**, however challenges and requirements are most discussed with customers, due to the lack of investigation on root causes, **challenges and requirements are merely accepted and not investigated**.

All above leads to the conclusion that the hypothesis of lack of focus on customer problems is validated.

H4 - Problem framework

To validate no framework is being used to determine customer problems, people where asked if they determine product requirements, if they use a framework to do that, and if so, which framework. Again, the term product requirements is used instead of customer problems as this is more accepted by the audience of the survey. The survey provides following information.

Group	Determine	#	% of group	Framework	#	%	% of group
Startups	**Yes**	18	26%	**Yes**	8	44%	12%
				No	10	56%	14%
	No	51	74%	**Yes**	7	14%	10%
				No	44	86%	64%
Business group	**Yes**	8	35%	**Yes**	5	63%	22%
				No	3	38%	13%
	No	15	65%	**Yes**	3	20%	13%
				No	12	80%	52%
Overall	**Yes**	26	28%	**Yes**	13	50%	14%
				No	13	50%	14%
	No	66	72%	**Yes**	10	15%	11%
				No	56	85%	61%

Table 2 - Indicated requirement discovery framework

The table above teaches us how many people determine requirements, who uses a framework and the percentage of their group they represent. Looking at the startups group, one can see that 18 (26%) people determine requirements where 8 people use a framework to do this and 10 do

not. This represents 44% and 56% of the people determining requirements respectively. These 8 and 10 people represent respectively 12% and 14% of the startup respondents. In analogy the results of the other groups can be read. Looking at the overall picture, it shows that 28% (26) of the respondents are involved in determining requirements of which 50% (13) of them uses a framework, which represents only 14% of all respondents. One would expect that more people are involved in investigating problems as those teams need to understand them to be able to solve them. **Limited amount of people is involved in determining requirements and there is limited usage of frameworks**.

Strangely enough 7 people (10%) in the startups group who indicate not to determine product requirements indicate they use a framework. This can be interpreted that they are involved or consulted in the process of determining product requirements but are not driving the framework. For this reason, the indicated framework of everybody is verified and shown in the table below.

Group	Framework	Amount	% of frameworks	% of group
Startups	INBOUND	7	58%	10%
	POLARION	4	33%	6%
	WSJF	1	8%	1%
Business group	INBOUND	5	50%	22%
	POLARION	3	30%	13%
	WSJF	1	10%	4%
	OTHER	1	10%	4%
Overall	INBOUND	12	55%	13%
	POLARION	7	32%	8%
	WSJF	2	9%	2%
	OTHER	1	5%	1%

Table 3 - Overall indicated requirement discovery frameworks

The frameworks reported by respondents were clustered in groups to provide a good overview. The result of this clustering is shown in the table above where the framework and the number of respondents indicating to use that framework are listed. Looking at the frameworks, inbound refers to the inbound process which is conducted biyearly. The inbound process consists out of conversations with industry experts and sales to come to a set of product requirements, but it is not a problem discovery framework like design thinking. It is during the inbound process that other people in the group are involved to provide input and therefore they indicate they use a framework. The inbound process is the most used framework, overall used by 55% of the people indicating to use a framework, which represents 13% of all respondents. The same applies to Polarion, which is an application lifecycle management tool and not a framework to discover problems, which is used by 32% of the people indicating to use a framework, representing 8%

of all respondents. Also, weighted shortest job first (WSJF), which is used by 9% representing 2% of all respondents, is not a problem discovery framework but a ranking framework coming out of the SAFE framework. **Limited number of people are involved in determining requirements using frameworks and the frameworks being indicated are no customer problem discovery frameworks**.

Looking at the used frameworks per role for people who specifically indicated they determine product requirements using a framework, provides the information shown in the table below.

Group	Role	Framework	Amount	% of framework	% of group
Startups	**Lean agile leader**	POLARION	1	14%	1%
	Product owner	INBOUND	4	57%	6%
		POLARION	2	29%	3%
Business group	**Business developer**	POLARION	2	40%	9%
		INBOUND	1	20%	4%
		WSJF	1	20%	4%
	Developer	INBOUND	1	20%	4%

Table 4 - Indicated requirement discovery frameworks per role

It stands out that in startups 86% of the people determining product requirements using a framework are product owners which represent 9% of the group, and that in the business group 80% are business developers which represent 17% of the group. Product owners mainly leverage the inbound process and business developers Polarion. **This shows that a limited number of roles is involved in determining requirements using a framework and that the framework they leverage is not a problem discovery framework**. This makes that most roles who should be involved in investigating problems as they need to solve them, like developers and architects, are not involved.

In conclusion, the hypothesis that no problem discovery framework is being used is validated, as only a limited number of people and roles use a framework, and the frameworks being used are no problem discovery frameworks.

H5 - Ranking framework

To validate that no framework is being used to rank customer problems, people where asked if they rank product requirements, if they use a framework to do that, and if so, which framework. Again, the term product requirements is used instead of customer problems as this is more generally accepted by the audience of the survey. The survey provides following information.

The table below teaches us how many people rank requirements, who uses a framework, and the percentage of their group they represent. Looking at the startups group, one can see that 24 people rank requirements where 12 of them use a framework to do this and 12 do not. This represents 50% of the people who rank requirements in both cases. These people represent in both cases 17% of the startup respondents. In analogy the results of the other groups can be read. Looking at the overall picture, it shows that 38% (35) of the people rank product requirements of which 46% (16) uses a framework, which represent 17% of all respondents. **Even though a reasonable amount of people ranks requirements (38%) there is limited framework usage (17%)**.

Group	Rank	#	% of group	Framework	#	%	% of group
Startups	**Yes**	24	35%	**Yes**	12	50%	17%
				No	12	50%	17%
	No	45	65%	**Yes**	3	7%	4%
				No	42	93%	61%
Business group	**Yes**	11	48%	**Yes**	4	36%	17%
				No	7	64%	30%
	No	12	52%	**Yes**	0	0%	0%
				No	12	100%	52%
Overall	**Yes**	35	38%	**Yes**	16	46%	17%
				No	19	54%	21%
	No	57	62%	**Yes**	3	5%	3%
				No	54	95%	59%

Table 5 - Indicated requirement ranking framework

Again, people indicating not to rank product requirements indicate they use a framework. This can again be seen that these people are consulted during the process of ranking requirements. The list of indicated ranking frameworks of everybody is shown below.

Group	Framework	Amount	% of frameworks	% of group
Startups	POLARION	6	46%	9%
	JUDGEMENT	5	38%	7%
	WSJF	2	15%	3%
Business group	JUDGEMENT	3	75%	13%
	WSJF	1	25%	4%
Overall	JUDGEMENT	8	47%	9%
	POLARION	6	35%	7%
	WSJF	3	18%	3%

Table 6 - Overall indicated ranking frameworks

Again, the frameworks indicated by respondents were clustered to provide an overview. As well Polarion as weighted shortest job first (WSJF) are already seen and discussed earlier. The

judgement framework represents personal judgement of the ranking person as such. Based on information coming from industry experts, sales and other stakeholders, the person evaluating the rankings makes a judgement on what needs to be prioritized first. Overall, the judgement framework is used by 47% of the people who indicate to use a framework, which represents 9% of all respondents. Polarion is indicated by 35% of the people indicating a framework, representing 7% of all respondents. Finally, 18% of the people indicating a framework uses WSJF, which represents 3% of all respondents. Both Polarion and personal judgement are not actual customer problem ranking frameworks. **The only actual problem ranking framework which is indicated is the WSJF framework, which is only used by 3% of the respondents**. **This provides a signal that there is limited adoption of ranking frameworks**.

Looking at the used frameworks per role for people who specifically indicated to rank product requirements using a framework, provides the information shown in the table below.

Group	Role	Framework	Amount	% of framework	% of group
Startups	**Developer**	POLARION	2	20%	3%
	Lean agile leader	JUDGEMENT	2	20%	3%
	Product owner	JUDGEMENT	2	20%	3%
		POLARION	1	10%	1%
		WSJF	1	10%	1%
	Solution architect	POLARION	1	10%	1%
	Startup owner	WSJF	1	10%	1%
Business group	**Business developer**	JUDGEMENT	2	67%	9%
		WSJF	1	33%	4%

Table 7 - Indicated requirement ranking frameworks per role

It can be noted that overall, there is no role which stands out in ranking product requirements using a framework. In general, each framework has a low adoption rate per role not going above 9% per group. This provides a signal that there is no specific role who drives the ranking of requirements. The only actual ranking framework, WSJF, is only used three times, each time by a different role. **This signals that people using a ranking framework like WSJF are mainly using it on an individual basis**.

Looking at the combination of both sets of information, the information about the used frameworks to discover product requirements and the information about the used frameworks to rank requirements, provides the information below. The table shows the used ranking framework for each requirement discovery framework being used by people who specifically indicated they use a requirement discovery framework.

The table below shows that most ranking frameworks are used with the inbound process and that the judgement framework is most used with the inbound process. It also shows that the WSJF framework is only used once with the inbound process and in all other cases is combined with WSJF by individual people. This further validates that WSJF is not used structurally but only in individual cases.

Group	Requirement framework	Ranking framework	Amount	% of requirement	% of group
Startups	**INBOUND**	JUDGEMENT	4	67%	40%
		POLARION	1	17%	10%
		WSJF	1	17%	10%
	POLARION	POLARION	2	67%	20%
		JUDGEMENT	1	33%	10%
	WSJF	WSJF	1	100%	10%
Business group	**INBOUND**	JUDGEMENT	2	100%	67%
	WSJF	WSJF	1	100%	33%

Table 8 - Ranking frameworks per requirement framework

In conclusion, the hypothesis that no ranking framework is used to rank customer problems is validated, since very limited amount of people and roles use a proper ranking framework like WSJF. Even stronger, WSJF has limitations in ranking requirements, which are discussed later, and WSJF is only used on an individual basis.

H6 - Framework initiative

People were asked if they are developing a framework. This provided following results:

Framework	Amount
REQUIREMENT INTERVIEWS	1
IMPROVE JUDGEMENT	2
IMPROVE USAGE WSJF	4

Table 9 - Development frameworks

Because there is only a single initiative to start using interviews for determining product requirements, it can be concluded that **there are no structural initiatives to develop a customer problem discovery or ranking framework**. The other things mentioned are only initiatives to improve frameworks already being used.

H7 - Rigidities

Agreement with following statements was asked to verify the rigidity against change of the current innovation process, the use of academic theories and the use of external knowledge. The results of the responses can be found in the figure below.

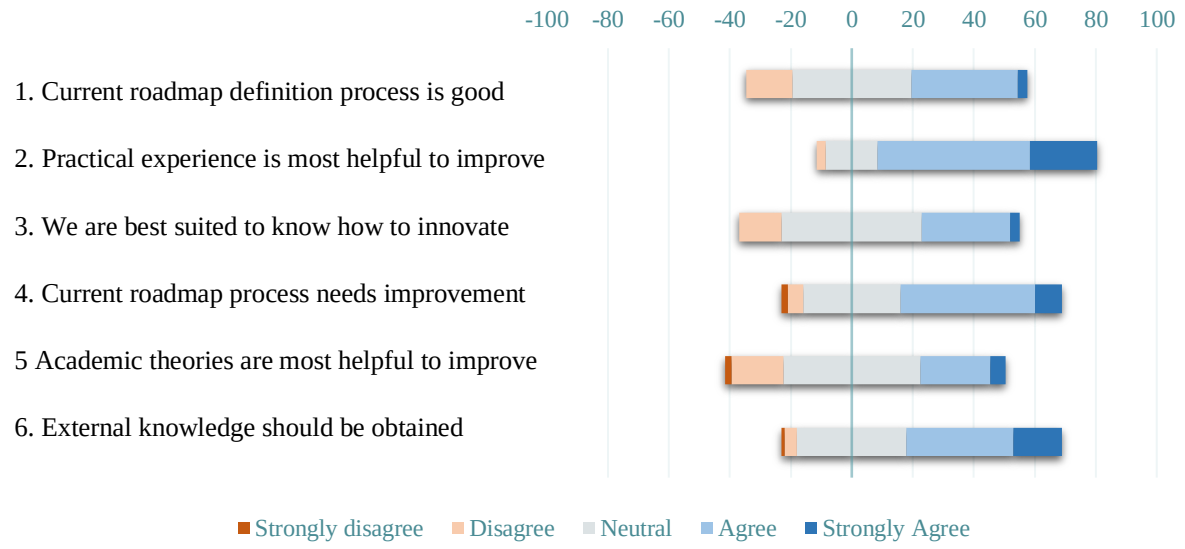

Figure 19 - Rigidity survey results

The rigidities are verified in pairs, with a positive and negative statement about each potential rigidity. In the ideal situation, if there is no rigidity against a certain topic, there is full agreement with the positive statement and full disagreement with the negative statement.

The first rigidity which is verified is the rigidity against change of the current innovation process. Statement 4 is the positive statement, meaning the innovation process needs to be changed, and statement 1 is the negative statement. Looking at statement 1 and 4 you can see a mixed picture. On the one hand side there is agreement to keep the current process as is. On the other side, there is even more agreement to change the current process. However, there is also some strong disagreement to change the current process. One can conclude that given this information, there is some rigidity to change the current innovation process.

The second rigidity is the rigidity against academic theories. Statement 2 is the negative statement and statement 5 the positive statement. Looking at statement 2 and 5 about the usage of academic theories to improve the innovation process, one can see a strong agreement in favor of practical experience and rather a mixed picture of using academic theories with some agreement and disagreement. Also, there is some strong disagreement with the positive

statement number 5. This leads to conclude that there is strong rigidity to obtain knowledge from academic theories to improve innovation.

Finally, the rigidity against external knowledge is verified. Statement 6 is the positive statement and statement 3 the negative one. Looking at statement 3 and 6, one can see that there is agreement to leverage internal knowledge, but there is even more agreement to obtain external knowledge. However, obtaining external knowledge has also some strong disagreement. One can conclude that there is small rigidity to obtain external knowledge.

In conclusion one can see that there is overall some rigidity against the elements which are going to be leveraged to improve the innovation process. **The hypothesis that there are rigidities to adopt a new innovation process is validated, due to the rigidities against the elements which are going to be used to build and adopt that new innovation process**.

Conclusion

As a conclusion it can be stated that the current organization is a sustaining organization that is focusing primarily on the high-end enterprise market and which is suffering from the innovator's dilemma. The focus of the organization is on developing products by accepting customer problems instead of discovering customer problems and investigating root causes. The approach to detect and rank customer needs is mainly driven by internal conversations using the inbound process and experience-based priority judgement instead of using frameworks to discover and rank customer problems. The organization is not intending to change the innovation approach as there is currently no initiative to develop a new innovation process and there are rigidities to change the innovation approach.

Process design prerequisites

In this section the prerequisites to design the innovation process based on previously discussed theories and the currently used software development framework are discussed. This is done to set the boundaries on what needs to be improved and how to hook the new innovation process in the existing process.

Usage

Before starting the design of the innovation process, a view on the context to which it will be applied is required. The most important precondition is that **the innovation process is not intended to recover an existing sustaining innovation which is having issues**. The innovation process is intended to search and learn about potential products, not to overcome or fix issues of earlier dogmas. This prerequisite is to avoid having to consider all the details of specific issues of existing products for the scope of this dissertation. However, it is not the purpose to only support teams which start from scratch. The process also needs to be useable with existing products to determine a new independent component which can be brought to market as an individual product.

Organizational setup

Important to consider is the organizational setup because **it is not possible to organize an organization to disrupt and to sustain at the same time when all working together**. This comes due to the different culture, which is the combination of processes and values, which is required to sustain or to disrupt. For this reason, **for each type of innovation an independent team or organization needs to be set up which can use its own process and values**.

Current framework

To bring a large product like an enterprise software product to market, a lot of activities need to be performed. These activities range from ideation, product development, release activities till product support. All these activities are typically encapsulated in processes. An enterprise software product typically consists out of a portfolio of products which can be seen all together as one big enterprise software product. **The current framework being used to bring a portfolio of products to market is the Scaled Agile Framework for enterprises (SAFE)**. The SAFE framework is a combination of portfolio management and development processes to align the whole portfolio. In the figure below an overview of the SAFE framework is shown.

What stands out in the SAFE framework is the huge portion of the framework which is about agile product development processes and the limited amount of attention to customer problem discovery. As seen in the paragraph about the limited answer of agile, these agile development methods provide limited capabilities in defining the customer problems and what to develop, which causes companies to develop the wrong products more efficiently.

To fit the innovation process into the current development framework one needs to see where product requirements are determined. **There are 2 places in the SAFE framework where product requirements are determined and ranked, in the portfolio and in the program backlog.** These backlogs are encircled in the figure below. The portfolio backlog is filled with business epics and the program backlog with product features. To fit the innovation process into the existing process while not disturbing current operations to much, the innovation process will be put before the program and portfolio backlog. By having these two backlogs determined by the innovation process, the rest of the SAFE process is driven by the innovation process without being heavily affected. **The objective of the innovation process is to determine and rank epics in the portfolio backlog and product features in the program backlog.**

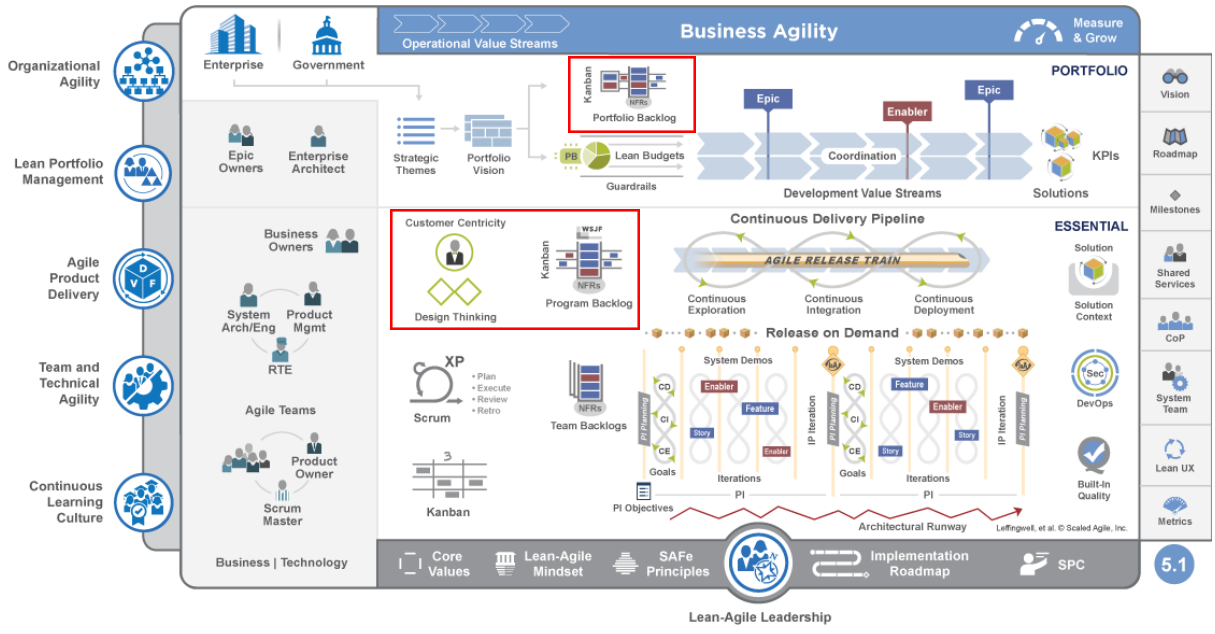

Figure 20 - The SAFE development framework (Scaled Agile, 2022)

Limitations of SAFE

In this section the limitations of the SAFE framework in the light of previously discussed theories are highlighted. This serves as a starting point where to adapt the framework by applying previous theories to improve the framework.

Portfolio backlog - Epics

The portfolio backlog is filled with high level business and enabler epics. An epic is defined in SAFE as: “A container for a significant solution development initiative that captures the more substantial investments that occur within a portfolio.” Even though SAFE recommends applying the lean startup build-measure-learn cycle to define epics, **the focus of epics is mainly on solutions instead of high-level customer problems**. As an example of the focus of epics on the solution instead of the problem, one can look at the epic hypothesis statement of SAFE. The epic hypothesis statement has following elevator pitch template: For <customers> who <do something> the <solution> is a <something - the how> that provides <value> unlike <competitor> our solution <does something better>. Further proof of the focus on the solution can be found in the portfolio Kanban system, which determines new epics. It shows that epics are based on internal information instead of customer information. It also shows that the focus is on finding solutions based on analysis of internal information instead of customer problems discovered during customer interviews. Because the focus of the epic is on the solution based on internal information, the value of the epic is not properly demonstrated. It is just an idea based on an internal vision. **The value of a solution is determined by the problem it solves for the customer. Therefore, epics need to be more focused on the problem based on customer information instead of the solution based on internal analysis.**

Design thinking starting from epics

As already mentioned before, there is limited attention to customer problem discovery in the SAFE framework. **The only attention to customer problem discovery is during the design thinking phase which follows when moving epics into implementation**. The design thinking phase determines the problems the epic is composed of in the problem space part, and then solves them in the solution space part, turning them into product features. **Because the epics are focused on the solution, the design thinking phase may try to discover and solve problems related to epics which are not worthwhile solving.** This is potentially causing it to produce product features for the program backlog which are not valuable for the customer.

SAFE framework - Target markets

What specifically stands out when looking at the SAFE framework is that there is no guidance in defining the target market for epics and features. **Defining the target market is important for disruption and needs to be done before filling the backlogs.** Because in the CPG-industry there are multiple subsegments, it needs to be addressed which subsegments need to be targeted.

Therefore, two dimensions need to be considered in defining the CPG-industry target market: the subsegment and the side of the market, top or bottom. **It needs to be determined for each epic and feature which target market is relevant for it in terms of subsegment and market side.**

Weighted Shortest Job First - Prioritization

The program and portfolio backlog priorities are determined in SAFE using the weighted shortest job first (WSJF) method. This method determines the priority based on the ratio of cost of delay divided by the job duration. The cost of delay is determined by the sum of the terms business value, time criticality and opportunity enablement. The job duration is the amount of work required to bring an epic or feature to life. The formulas are shown below. **The SAFE framework does not provide a way how to objectively determine the value of the terms business value, time criticality and opportunity enablement which determine the cost of delay, which make the priority arbitrary.** More objective measurement of customer satisfaction provided by epics and features will improve the ranking of features and epics.

$$Weighted\ shortest\ job\ first = \frac{Cost\ of\ Delay}{Job\ Duration}$$

$$Cost\ of\ Delay = Business\ value + Time\ criticality + Opportunity\ enablement$$

Innovation process design

To fit the innovation process into the SAFE framework, the process needs to be divided in three parts. Two parts to discover customer problems, which make up the problem domain of the innovation process, with one part being put before the portfolio backlog and one part before the program backlog. And a third part to develop products based on those problems making up the solution domain of the process. There are however important links between those parts. Therefore, the common components and principles of the innovation process are discussed first.

The innovation process building blocks

In this section the building blocks and overall principles of the innovation process are discussed. These building blocks will later be used in the actual innovation process.

Different layers of problems

It is important to consider the many layers of people involved at the customer when dealing with an enterprise software product. Each layer has a different role in the organization, a different purpose, and is faced with different problems. **The layers of people and their problems are modeled as a pyramid to have a hierarchical model of problems of an organization which can be leveraged by the innovation process**. The model is shown in the figure below. The problems of each layer, shown at the right of the figure, are each named after a different synonym of the word problems, like obstacles for example, to easily distinguish them per layer. One can see on the left side of the figure, that the problem of each management layer is linked to a business process modeling element coming from business process modeling notation (BPMN), which defines the scope and location of the problems at that layer.

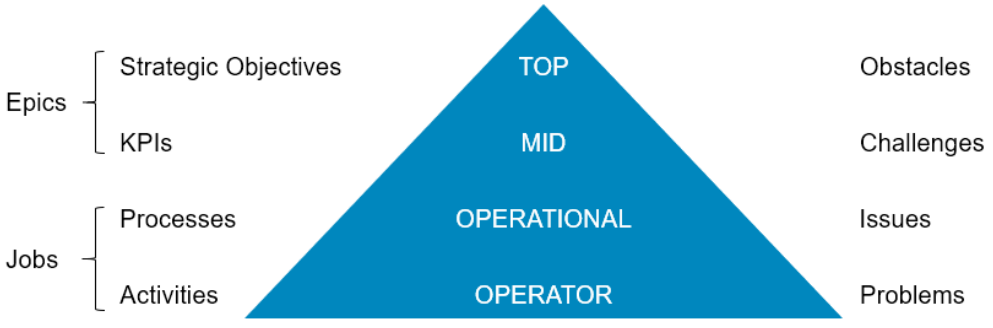

Figure 21 - Problem pyramid model

The problem pyramid model shows 4 roles at 4 layers in the organization. These roles are:

- Top management: CXO level involved in determining the strategic objectives

- Mid-management: Management involved in tactical nonoperational themes using KPI's. For example: plant, division or business unit managers.
- Operational management: All managers involved in operational manufacturing processes. For example: production, planning or supervisory managers
- Operators: All people involved in executing operational activities related to production.

Each of these roles has problems at their own layer and from their own size as shown on the right in the figure above. The problems of top management, called obstacles, are the largest kind of problems. These obstacles break down into several smaller problems for mid-management, called challenges. These challenges further break down into issues for operational management and problems for operators. In this way, **small operator problems are linked to large top management obstacles**. The breakdown of problems makes the pyramid go wider to the bottom, where many operator problems at the bottom are linked to a certain top management obstacle via mid-management challenges and operational management issues.

The business process element which is related to the problem at that layer is indicated on the left side of the figure. For example, top management obstacles are related to the strategic objectives they want to achieve, like financial objectives or objectives for carbon footprint reduction. To achieve those objectives, mid-management needs to take actions which come with challenges. The outcome of these actions is monitored through KPI's to check if they help to achieve the objectives. To perform all operations which allow to achieve the objectives and KPI's, operational management needs to execute processes which come with issues. These processes are performed by operators which execute activities in those processes and who face problems during execution of activities. This explains the relationship between the problem of a certain layer and how it can be investigated. **The problem of a certain management layer is defined by the impact that management layer can achieve and how that layer can achieve it**. At top management one needs to look at their strategic objectives and the related obstacles. At mid-management level, one needs to investigate the KPI's they use and their related challenges. For operational management one needs to look at the issues of the processes they execute. And for operators look at the problems of the activities they execute. Finally, each management problem is mapped towards SAFE. **The top and mid-management problems related to strategic objectives and KPI's are mapped to epics in the portfolio backlog as they are high level. The issues and problems faced in processes and activities are called jobs. These jobs drive the creation of product features, using design thinking in SAFE, which come into the program backlog**. **Because there is no backlog available in SAFE for**

jobs, the job backlog is introduced. The job backlog is put before the program backlog and design thinking in the SAFE framework.

Why are problems related to activities and processes mapped to jobs and not product features? Product features are solutions which are a result of the design thinking phase in SAFE. **To be able to find the product features related to top and mid-management problems (epics), the first step is to identify the operational management issues and operator problems (jobs) related to those top and mid-management problems**. This is because the top and mid-management problems are composed out of operational management issues and operator problems as shown in the problem pyramid model. The jobs express the issues of operational management and problems of operators related to those top management obstacles and mid-management challenges. **This intermediate step to document jobs makes sure that product features are developed which solve operator and operational management problems (jobs) related to top and mid-management problems (epics)**.

Important to note is that the problem pyramid model can be flipped towards a solution pyramid. In the solution pyramid, problems are matched to features, issues are linked to components, challenges matched to modules and obstacles linked to solutions. The solution pyramid model provides guidance in composing a granular product out of the many product features.

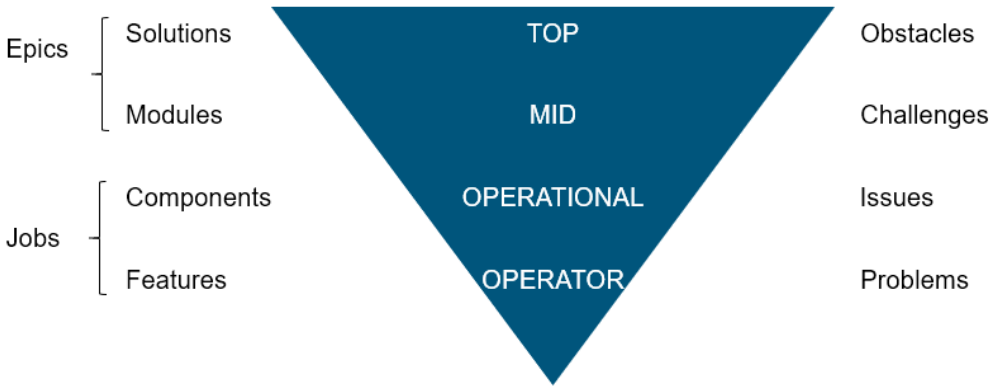

Figure 22 - Solution pyramid model

To show how the problem and solution pyramid models provide guidance on the different layers of problems and solutions, an example is shown below. The figure shows a theoretical example how an obstacle is broken down into challenges, issues and operator problems and then builds up towards a complete solution for that obstacle. The arrows represent the relationships between the different elements. Each operator problem is solved by a specific feature. A component solves an operational management issue and is composed out of multiple features which solve operator problems related to that operational management issue. A module solves a mid-

management challenge and is composed out of multiple components which solve operational management issues related to that mid-management challenge. Finally, the solution which solves an obstacle, is composed out of modules solving mid-management challenges related to that obstacle. This solution can then be combined with other solutions serving other obstacles and shipped as a product.

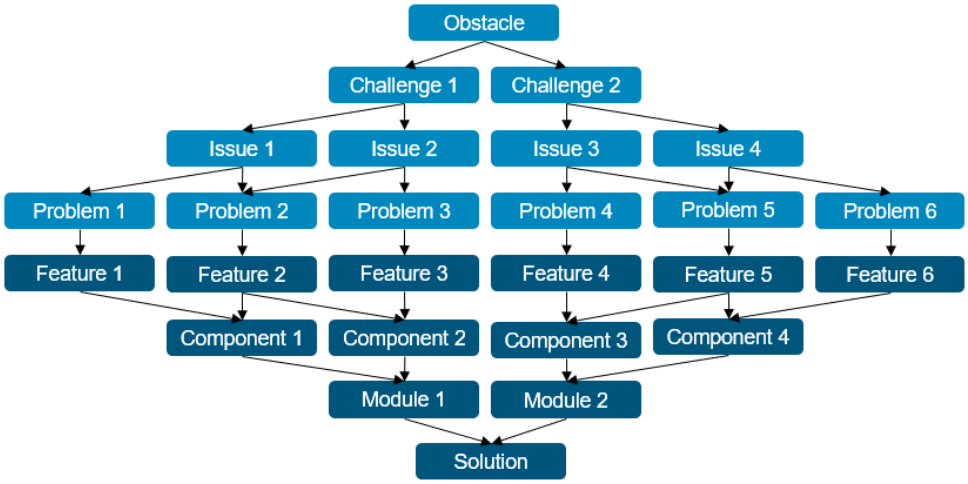

Figure 23 - Problem & solution pyramid example

Assign and link priorities

Because there are relations between the problems of the different management layers, their priorities are also related. Problems are grouped by their common higher layer problem. The common higher layer problem priority determines the priority of the lower layer group. The figure below shows the relationships between problem layers, their groups and their priorities.

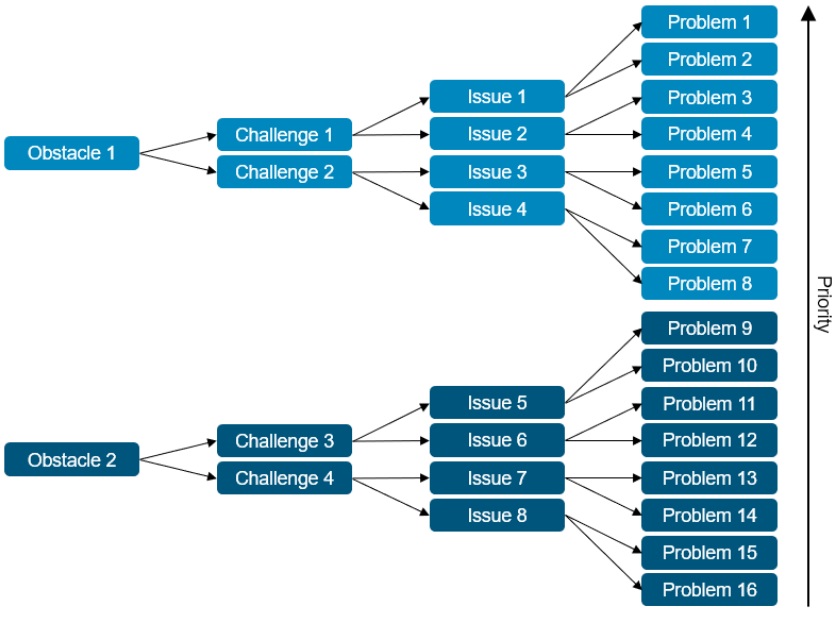

Figure 24 - Obstacle, challenge, issue, and problem priority relations

For example, obstacle 1 is the highest priority problem of top management. Related to obstacle 1 are challenge 1 and 2 ordered by their respective priorities. Because challenge 1 and 2 are related to a higher priority obstacle then challenge 3 and 4, they automatically have a higher priority. Related to challenge 1 are issue 1 and 2. Related to challenge 2 are issue 3 and 4. In both cases ordered by their respective priority. Because issue 1 and 2 are related to a higher priority challenge then issue 3 and 4, they automatically have a higher priority. The same mechanism is again applied for the problems of operators.

Determine problems

To determine the problems in the different management layers, one can leverage a common technique. **The problems of each management layer can be determined by performing the problem space part of the design thinking process leveraging its tools.** For example, by performing interviews with actors on that layer using the value proposition design or empathy map to document the pains people experience and gains they want to achieve related to their jobs to be done. **To detect where to look for the problems that each management layer faces**, **the problem pyramid model can be leveraged**. Design thinking is proposed as it has a specific focus to problems in the problem space part like no other process or framework has.

Fitting the innovation process into SAFE

To see how the innovation process will fit into the SAFE framework, a high-level view on the flow of information is provided based on the figure below. **SAFE starts from strategic themes the company sets for itself which determine the focus of the company**. The strategic themes also determine the priorities of the target markets to be addressed. **Epics related to top and mid-management problems are discovered for a specific target market using the epic discovery part of the innovation process**. The epic discovery part is put before the portfolio backlog into the SAFE framework where epics are prioritized for a specific target market before being put into the portfolio backlog.

Epics are picked up from the portfolio backlog by development teams who have full autonomy, and which are called agile release trains (ART's) (See figure 20). **ART's pick epics which fit their objective and target market**. Each ART can work individually or collaborate with other ART's on an epic. The ART's decompose the epics into product features for products of their ART. To break down the epics into product features, first the issues and problems of operational management and operators related to those epics need to be discovered. These issues and problems are called jobs. **The discovery of jobs related to epics happens during the job**

discovery part of the innovation process. The discovered jobs are stored into the job backlog, which is introduced into the SAFE framework, where the jobs are prioritized for their target market and objective before being put into the job backlog. The job discovery part, including the job backlog, is put before the program backlog and design thinking in the SAFE framework. **The epic and job discovery part constitute the problem domain of the innovation process and are using the problem space part of the design thinking process**.

To come to solutions, product features are build starting from jobs related to operator problems in the job backlog. These features are combined to build components for jobs related to operational management issues in the job backlog. These components are further combined to modules based on epics related to mid management challenges in the portfolio backlog. These modules are finally combined into solutions based on epics related to top management obstacles in the portfolio backlog. All required features to bring the solution to live are being put in the program backlog. **The development and combination of product features, components, modules and solutions is part of the solution domain which is based on the job and portfolio backlog and uses the solution space of the design thinking process**.

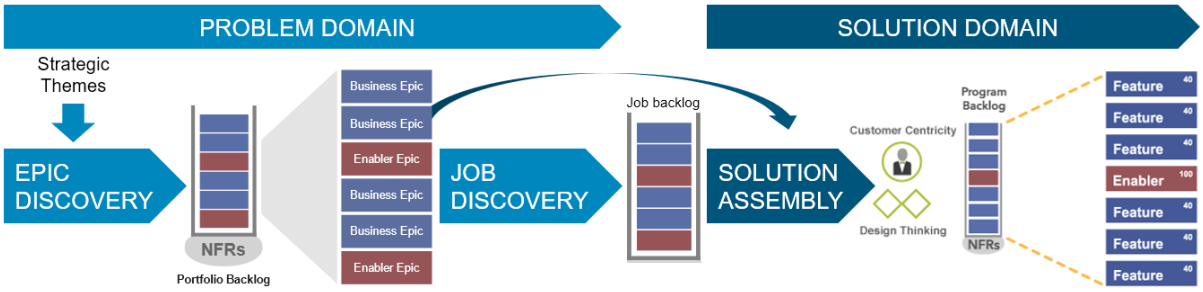

Figure 25 - Innovation process overview

The innovation objective

In the previous paragraph it was stated that ART's have full autonomy. Therefore, **each ART needs set itself an innovation objective, to disrupt or to sustain**. Earlier in this document it was stated that a single group of people cannot disrupt and sustain at the same time. Therefore, by bringing the innovation objective to ART level, each ART can make its own choice, allowing **different parts of the organization to have an independent innovation objective, which allows the organization to disrupt and sustain at the same time**.

Link objective to market type

The theories of Clayton Christensen have clearly shown that it is important to consider the target market related to the innovation objective, to sustain or to disrupt. Because sustainability

and disruption happen in different markets, this needs to be considered for epics, ART's and jobs. Therefore, **if an epic, ART or job is focused on disruption, it needs to focus on the bottom of the market. If they focus on sustainability, they need to focus on the high end of the market.**

Involved people

The strategic themes are the directions and guidelines the company uses to determine its course and how it will approach the market. They provide guidance on which customer needs and target markets the company wants to focus on. Due to its strategic nature, **the strategic themes need to be determined by the management panel**, which is a group of top managers who jointly manage the whole organization. To come to strategic directions, **the management panel leverages information coming from business owners**. A business owner owns a subset of the target markets of the company. For example, a specific target industry.

In the SAFE framework epics are defined by the epic owner. The epic owner drives the go to market of a subset of the markets of the company and has close affinity with the target market. **Business owners are best suitable to perform the role of epic owner due to their affinity with the market**. For this reason, the business owners will drive the epic discovery part of the innovation process. Because the epics need to be handled by some of the ART's in the job discovery part, it is recommended to involve the related ART's already in the discovery of epics where relevant. The epic owner acts as a gateway to the market for the ART's where ART's provide their expertise for a specific domain. **The epic owner can involve the ART owners for their specific domain and target market when relevant to help discover epics related to their domain**. Because the ART's have their own autonomy, there needs to be an agreement on the innovation objective, to disrupt or to sustain, and the target market between the business owner and ART when jointly investigating epics. **The job discovery part of the process is driven by the ART's like in the SAFE framework**. **However, the epic and thus business owner needs to be involved as gatekeeper to the market**.

The innovation process

In this section all elements previously discussed come together to assemble the innovation process. First, an overview of the problem domain of the innovation process is provided. After that the solution domain of the innovation process is elaborated.

The innovation process - problem domain

The problem domain of the innovation process consists out of the epic and job discovery part. **The epic discovery part of the innovation process, executed by business owners, consists out of two subprocesses which need to be executed sequentially**. The first to determine CXO epics related to top management obstacles and the second to determine management epics related to mid-management challenges. All epics are discovered using the problem space part of design thinking and end up in the portfolio backlog.

The job discovery part of the innovation process is the handover from business owners to the ART's. **The job discovery part of the innovation process is driven by the ART's where the business owner is only consulted**. The job discovery part zooms in into the operator problems and operational management issues to discover the root causes of obstacles and challenges to come to the building blocks of the product. **The job discovery part of the innovation process consists out of two subprocesses which need to be executed sequentially**. The first to discover operational jobs related to operational management issues and the second to discover operator jobs related to operator problems. All jobs discovered in these subprocesses using the problem space part of design thinking get into the job backlog. The problem domain is shown in the figure below and contains following steps and activities.

1. Define the innovation objective, target market and potential customers to drive the process
2. Discover CXO epics using design thinking at the defined potential customers
3. Determine ART's who can provide a potential solution for the CXO epics and who have the same target market and innovation objective as defined initially in the process
4. Assign the strategic theme, target market, innovation objective, ART's and customers (called elements) to relevant CXO epics and then determine the priorities of the CXO epics
5. Select top priority CXO epics, and identify related management epics using design thinking at the assigned potential customers of the selected CXO epics under investigation
6. Assign a CXO epic to relevant management epics, which inherit the elements from the CXO epic, and then determine the priorities of the management epics
7. Select top priority management epics, and identify operational jobs using design thinking at the inherited customers of the selected management epics under investigation
8. Assign a management epic to relevant operational jobs, which inherit the elements from the management epic, and then determine the priorities of the operational jobs

9. Select top priority operational jobs, and identify operator jobs using design thinking at the inherited customers of the selected operational jobs under investigation
10. Assign an operational job to relevant operator jobs, which inherit the elements from the operational job, and then determine the priorities of the operator jobs

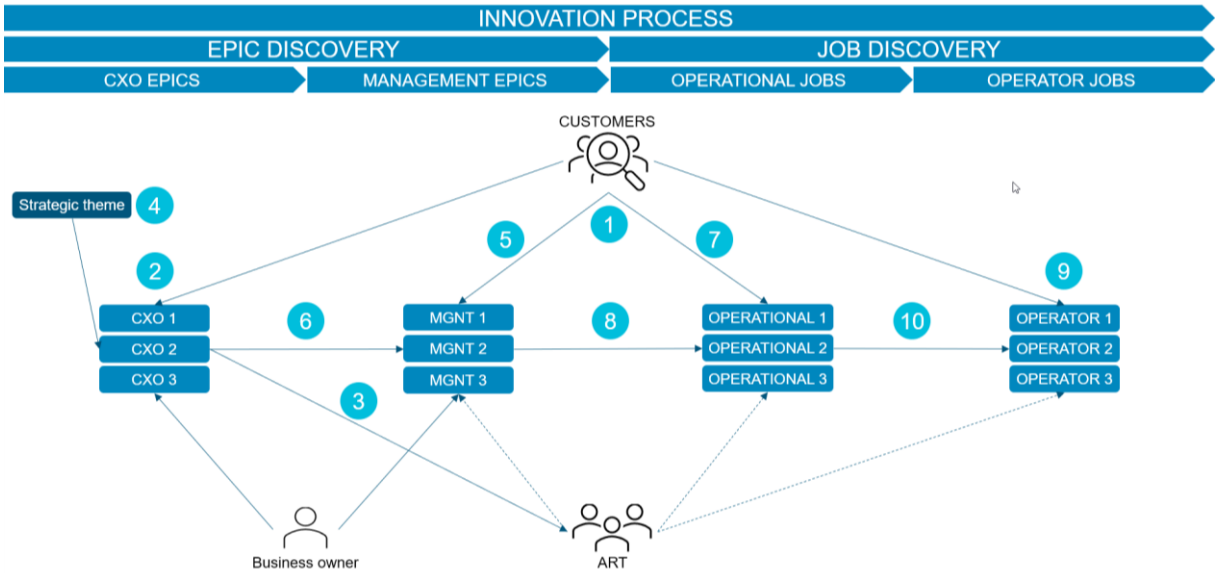

Figure 26 - Innovation process problem domain

There are 4 important things to consider in the innovation process problem domain.

First, the target market and potential customers need to be defined in accordance with the chosen innovation objective. The low-end market for disruption and high-end market to sustain.

Second, the assignment of the higher layer problem to the discovered problem is done after design thinking. For example, a CXO epic is assigned to a management epic after design thinking. This is because only at that moment it can be determined which discovered management epics are related to one of the CXO epics under investigation. This is also because many unrelated things will be discovered. Only discovered items with an assigned strategic theme, epic or job end up in the portfolio or job backlog and move forward in the process.

Third, the target market, innovation objective and potential customers are assigned to the CXO epics. These elements are inherited by all management epics, operational jobs and operator jobs related to the CXO epics. This inheritance makes sure that the next step in the innovation process continues to work using the correct target market, innovation objective and customers.

Fourth, ART's who can provide solutions for CXO epics are assigned to CXO epics. The assigned ART's are also inherited by all management epics, operational jobs and operator jobs

related to the CXO epics. The inheritance makes sure that ART's are able to identify epics and jobs they need to work on. The ART's execute the job discovery part for the epics and jobs they are assigned to.

Assembling solutions - solution domain

The innovation process problem domain is focused on detecting the problems to be solved in the different management layers of an organization. However, the real value comes from the solutions for these management problems. This is the focus of the solution domain of the innovation process, where solutions are assembled to a product from the bottom up. The assembly is performed by ART's which use epics and jobs assigned to them in the portfolio and job backlog which focus on the same target market and innovation objective as the ART. The solution domain consists out of 2 phases. One phase to design features and components based on the job backlog and a second phase to design modules and solutions based on epics in the portfolio backlog. The solution domain is shown in the figure below.

In phase one of the solution domain, the design of a product starts from the job backlog where the highest priority operator jobs related to the highest priority operational jobs are selected and enter the design thinking solution space. Information coming from the problem space of design thinking at operator level related to the selected operator jobs can be leveraged to design features. This will provide features related to a component because they solve operator jobs related to an operational job. **The relations between problems also provide the relations between solution elements which provides guidance on how the product needs to be assembled as explained in the solution pyramid model.** The features to be developed are put in the program backlog with the same priority of the related operator jobs.

In parallel with the design of features for operator jobs in phase 1, the solution space of design thinking is started at the operational level by selecting the highest priority operational jobs in the job backlog. During execution of the solution space at this level, two tasks need to be performed to design components. The features related to the selected operational jobs need to be combined, and component specific features need to be designed, which are all being put in the program backlog. Information related to the selected operational jobs to design the component specific features can be found in the problem space of design thinking at operational level. This will provide components related to a module because they solve operational jobs related to a management epic. The mechanism of combining related features and designing component specific features is used at all management layers. In general, **a higher-level**

solution element is determined by the combination of its related lower-level solution elements and its solution specific elements, which are designed using the data of the problem found in the problem space of design thinking at that management layer.

The features and components designed and developed in phase 1 can be leveraged in phase 2. **Phase 2 kicks off when sufficient features and components are developed to start the design of modules and solutions**. Automatically the highest priority management and CXO epics are selected out of the portfolio backlog because features and components supporting those epics are already provided. The same mechanism as explained in the design of components is used. Components related to modules need to be combined, and module specific features need to be designed. Information related to the selected management epics to design the module specific features can be found in the problem space of design thinking at mid-management level. This will provide modules related to a solution because they solve management epics related to a CXO epic. The module specific features also end up in the program backlog with the priority of the management epics. For the highest priority CXO epics, the same mechanism of combining modules related to solutions is applied. Also, solution specific features need to be designed leveraging the data related to the CXO epics out of the design thinking problem space of the CXO management layer

The end-to-end flow of the innovation process is shown in the figure below. First the problems of all management layers and their relations are determined using the problem space of design thinking. Followed by the assembly off solutions using the problems and their relations, leveraging the solution space of design thinking.

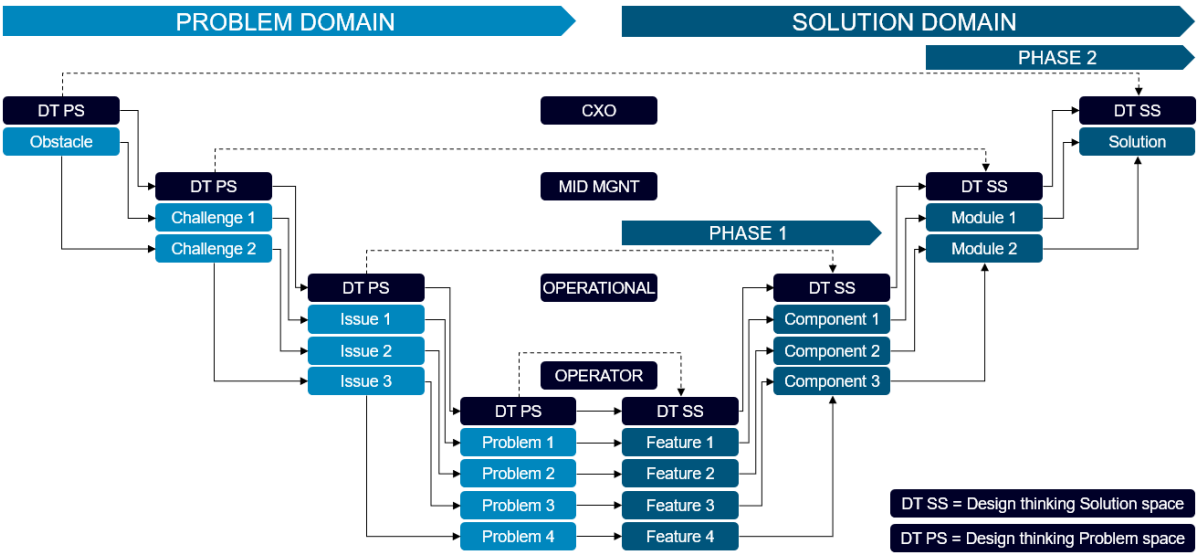

Figure 27 - End-to-end innovation process

Determining priorities – The integrated Kano approach

In the innovation process it has been mentioned at several places that priorities need to be determined. However, till now it has not been stated how to do this. This is done here. To determine the priorities of problems at the different management levels, a common technique is used. **Priorities in the innovation process are determined leveraging the kano model and the integrated Kano approach as explained in the article "integration of Kano in quality function deployment"** (Chaudha, Jain, Singh, & Mishra, 2011). Important is that in the original approach of Kano, the focus is on potential solutions. Here the focus is on problems. Because a problem is the reverse of a solution, the same approach can be leveraged. The integrated Kano approach allows to determine the priority based on the customer his self-stated importance, the company its strategic themes, the customer his current satisfaction and leveraging the discovered Kano category of the problem. The integrated Kano approach consists out of following steps which are further elaborated below:

- Define and execute surveys
- Assign Kano category per problem based on satisfaction and dissatisfaction
- Calculate satisfaction and dissatisfaction indexes
- Identify overall Kano classification
- Determine adjusted improvement ratio and priority

Define and execute surveys

To define and execute surveys to verify the Kano category and priority of problems, a simple format can be leveraged. The details of the used theories are elaborated in the international working seminar on production economics (Sauerwein, Bailom, Matzler, & Hinterhuber, 1996).

The integrated Kano questionnaire needs to contain 4 questions for each problem. **These questions are a functional question, a dysfunctional question, a self-stated importance question and a current satisfaction question**. The survey needs to be answered preferably by more than 50 customers. The Kano survey questions use the following format:

- Functional: How would you feel if problem X will be solved for you?
- Dysfunctional: How would you feel if problem X will not be solved for you?
- Satisfaction: How would you score your current solution for problem X?
- Importance: How important is it for you that problem X will be solved?

The functional and dysfunctional questions need to be answered using a Likert-scale with following options: 1) I like that, 2) it must be, 3) neutral, 4) I can live with, 5) I dislike that. The satisfaction question needs to be answered with following 7-options Likert-scale: 1) totally dissatisfied, 2) very dissatisfied, 3) dissatisfied, 4) neutral, 5) satisfied, 6) very satisfied, 7) totally satisfied. The importance question needs to be answered with following 7-options Likert-scale: 1) totally unimportant, 2) very unimportant, 3) unimportant, 4) neutral, 5) important, 6) very important, 7) extremely important

Assign Kano category

For each response of every customer, **the Kano category of every problem for that customer is determined using the evaluation table of Lee and Newcomb** (Chaudha, Jain, Singh, & Mishra, 2011) which is shown in the table below. The evaluation table uses the answer of the customer on the functional and dysfunctional question of each problem, to assign a Kano category to that problem for that customer. If a customer responds "I like that" for the functional question and "neutral" for the dysfunctional question, the Kano category is attractive.

Customer requirements → / ↓		Dysfunctional (negative) question				
		1. like	2. must be	3. neutral	4. live with	5. dislike
Functional (positive) question	1. like	Q	A	A	A	O
	2. must-be	R	I	I	I	M
	3. neutral	R	I	I	I	M
	4. live with	R	I	I	I	M
	5. dislike	R	R	R	R	Q

Customer requirement is ...

A: Attractive
M: Must-be
R: Reverse
O: One-dimensional
Q: Questionable
I: Indifferent

Figure 28 - Kano evaluation table (Sauerwein, Bailom, Matzler, & Hinterhuber, 1996)

Calculate SI and DI indexes

When all customers have provided their answers, the satisfaction (SI) and dissatisfaction (DI) indexes can be calculated for each problem. To do this, the frequency of each Kano category for each problem is used. **Based on the Kano category frequencies of all customer answers, the SI and DI can be calculated per problem** based on following formulas:

$$\text{Satisfaction Index (SI)} = \frac{(A+O)}{(A+O+M+I)} \quad \text{Dissatisfaction index (DI)} = -\frac{(M+O)}{(A+O+M+I)}$$

Overall Kano classification

Based on the SI and DI indexes, the aggregated Kano category based on all customer answers is determined for each problem. The aggregated Kano category is determined by the SI-DI matrix shown below. The satisfaction and dissatisfaction index for each problem are mapped to the matrix which determines the aggregated Kano category of each problem.

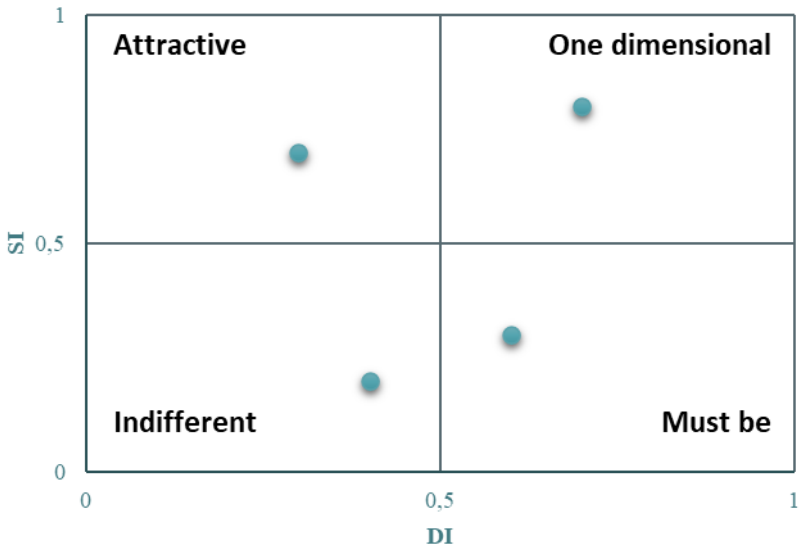

Figure 29 - SI-DI matrix (Chaudha, Jain, Singh, & Mishra, 2011)

Determine adjusted improvement and priority

In this final step everything comes together. The final priority of the problems is based on:

- Self-stated importance (S): The importance of a solution for the problem indicated by the customer during the survey based on Likert-scale
- Current satisfaction (CS): The satisfaction of the current solution for the problem indicated by the customer during the survey based on Likert-scale
- Target satisfaction (TS): Indication of the company to which level it wants to improve the satisfaction of customers for a specific problem based on its strategy
- The aggregated Kano category (C): The Kano category determined by the SI-DI matrix and the SI and DI indexes
- The improvement ratio (IR): The ratio of the target satisfaction (TS) stated by the company and the current customer satisfaction (CS)
- The adjusted improvement ratio (IRA): The adjusted improvement ratio, considering the aggregated Kano category of the problem based on the original improvement ratio.

The adjusted improvement ratio is the original improvement ratio adjusted for the aggregated Kano category of the problem. The adjustment is performed to better distinguish must-be, one dimensional and attractive requirements. The adjusted improvement ratio ($IRadj$) is calculated using following formula:

$$\boldsymbol{IRadj = IR \times (1 + m)^k}$$

where IR is the original improvement ratio, $m = \max(|SI|, |DI|)$ and k = 0, 0.5, 1, and 1.5 for indifferent, must-be, one-dimensional and attractive requirements respectively.

Topic	Self-stated importance (S)	Kano category (C)	Current satisfaction (CS)	Target satisfaction (TS)	Improvement ratio (IR)	SI	DI	m	k	Adjusted improvement (IRA)	Adjusted importance (I)
					TS / CS						S X IRA
Interesting webpage	3,8	A	2	3	1,50	0,54	0,37	0,54	1,5	2,87	10,89
Reading of text	4,11	M	2	3	1,50	0,44	0,69	0,69	0,5	1,95	8,01
Unform page design	3,2	I	4	4	1,00	0,38	0,28	0,38	0	1,00	3,20
Sufficient information	4,25	M	3	4	1,33	0,41	0,71	0,71	0,5	1,74	7,41
Locating information	4,28	O	4	4	1,00	0,53	0,59	0,59	1	1,59	6,81
Good linkage	3,2	A	2	4	2,00	0,65	0,29	0,65	1,5	4,24	13,56
cell phone compatibility	3,7	A	2	4	2,00	0,62	0,21	0,62	1,5	4,12	15,26

Table 10 - Priority determination table

The interesting webpage requirement is used as example to demonstrate how the final priority is determined. To come to the adjusted importance (I) [10,89], the average self-stated importance (S) [3,8], the aggregated Kano category (C) [A] and the average current satisfaction (CS) [2] indicated by the customers in the survey are noted. The next step is to determine the target satisfaction level (TS) [3] by the company. Based on its strategy and strategic themes, the company can choose for which requirements it wants to improve the satisfaction of the customer and by how much, by indicating the target satisfaction level (TS) [3] it wants to achieve. Based on the ratio of the target and current satisfaction level, the improvement ratio (IR) [1,5] is determined. This improvement ratio can then be adjusted to the adjusted improvement ratio (IRA), using the indicated IRadj formula where m is determined using the SI and DI indexes and k determined by the aggregated Kano category (C). **Multiplying the adjusted improvement ratio (IRA) with the self-stated importance (S) provides the adjusted importance (I) [10,89]**. **The higher the value the higher the importance**.

By using the integrated Kano approach, the customer needs can be more specifically determined to maximize customer satisfaction, leveraging the strategic themes, self-stated importance and the Kano category.

Conclusion and discussion

Since the purpose of this dissertation is a twofold and the research has been divided into two parts, also the conclusion and discussion is divided into two parts. One part providing the conclusion and discussion on the research about the current state of the organization. A second part to provide the conclusion and discussion about the research on the new innovation process.

Current organization state

This part of the research aimed to validate the current state of the organization, to verify if the organization is suffering from the innovator's dilemma and is currently not properly organized to act as an ambidextrous organization.

Based on the analysis of the survey responses of employees about the focus and setup of the organization, it can be concluded that the organization is suffering from the innovator's dilemma as it is a sustaining organization focused on the high-end enterprise market. It also shows that the organization is not properly organized to act as an ambidextrous organization because it is mainly focused on solutions and improving current products for better customers instead of investigating customer problems for new and existing customers. This makes that the organization is exploiting its current capabilities but is not able to explore new capabilities and potential business opportunities. The organization is also not able to prioritize problems or new product features properly, leading to difficult decisions and discussions about how to satisfy customers. Despite the fact the organization is currently not properly set up to act as an ambidextrous organization, there is rigidity in the company to change the innovation process, leveraging external and academic knowledge, to become an ambidextrous organization.

The objective of this research was to validate the assumptions which were indicated in the section "Issues coping the challenge". In that section certain symptoms were discussed which provided indicators that there are issues in the organization preventing the company to act as an ambidextrous organization. It was expected that currently the focus is on solutions and the high end of the market, and that there are limited skills to prioritize product requirements. However, all these symptoms still needed to be validated to come to a scientifically proven conclusion. This was formalized by this research by showing the limited attention and skills to discover and rank customer problems in favor of discussion about product requirements. This makes that there are limited new insights in the company on which customer problems to solve and which opportunities to address. Another important aspect which was highlighted by this

research, is that popular agile processes do not provide an answer to the innovator's dilemma and do not help the organization to act as an ambidextrous organization. This due to their lack of focus on what needs to be developed, lack of guidance to the right target markets and lack of focus on the discovery and ranking of customer problems.

This research has validated issues on innovation from an operational perspective by validating that there is insufficient focus on the right markets and lack of focus on discovery and ranking of customer problems. However, there are much more supporting and decision processes involved in innovation then the innovation and product development process. Top management who drives the organization, makes decisions on which items they allocate their budget to and which initiatives in the organization they support. The impact of these top management decision processes and other supporting processes is not covered nor validated within this dissertation. This dissertation has only put focus on validating the operational issues of the current innovation and product development process which hinder innovation.

Even though it was shown that there are rigidities in the organization, it needs to be further investigated what drives these rigidities. The current study does not show how these rigidities can be overcome because it does not show the root causes of these rigidities. It may for example be possible that the lack of knowledge is driving these rigidities, but it may also be possible that psychological factors, like past successes based on currently used practices, are driving rigidities. There needs to be further research on the root causes of these rigidities to help the organization identify the root causes and overcome these rigidities.

Innovation process

Given the conclusion that the organization is suffering from the innovator's dilemma and is not properly organized to act as an ambidextrous organization, it was the purpose to propose an innovation process to organize the organization to be able to act as an ambidextrous organization and to overcome the innovator's dilemma. The idea to propose a process was inspired by the innovator's solution of Clayton Christensen.

Because it is very invasive to introduce a totally new end to end innovation process, the new innovation process has been incubated in the existing SAFE product development process. By integrating the innovation process in the existing SAFE product development process, it provides input to SAFE about what needs to be developed, which makes that SAFE is driven by the innovation process. This allows for easy adoption of the new process, by not being so

invasive, while still having an impact to help the organization to become an ambidextrous organization.

The new innovation process puts more focus on customer problems by focusing on the problems of the different management layers, leveraging the problem space of design thinking. The new innovation process does not only put more focus on customer problems, but it also provides guidance on the right markets to be addressed based on the innovation objective, to disrupt or sustain, to be able to fully overcome the innovator's dilemma. To provide sufficient customer satisfaction, proper priorities need to be set on what needs to be developed first. The new innovation process provides a ranking mechanism based on customer satisfaction leveraging the kano model and the integrated Kano approach, which makes that the most important customer problems are addressed first. The kano approach uses a survey having 4 preformatted questions per problem, to determine the customer satisfaction for each customer problem to be solved.

In analogy with the validation in this dissertation, which only validated the operational issues on innovation rather than the managerial issues, only an operational solution is provided by means of an innovation process. This dissertation only puts focus on how to operationally organize for innovation by providing an operational innovation process. It does not show how to setup other managerial processes related to innovation and it also does not show which decision values need to be used in those processes to support the ambidextrous organization.

Because the disruption theory of Christensen only required to discriminate between the bottom and the top of the market to be able to disrupt or sustain, no further research has been performed on which CPG market subsegments to put focus. However, as also mentioned by Christensen's theories, there needs to be focus on the job to be done and thus the customer problems to verify the need for a solution. In conclusion, any CPG subsegment could potentially be a good market if the customer problem is known and worthwhile solving. The proposed innovation process provides mechanisms to investigate and detect valuable subsegments by identifying problems worthwhile solving. Therefore, the analysis of CPG subsegments having potential is considered as less valuable because initial subsegment focus can be determined based on economic factors.

Despite the new innovation process puts proper emphasis on customer problems and the ranking of them, it still needs to prove itself in practice. Due to the lack of time, it was not possible to benchmark the new innovation process with the traditional process. This needs to be done to show that the new process allows the organization to act as an ambidextrous organization.

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