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The exploration of experiential aspects of fiber casting machinery in the sales process

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Abstract

Modularity is an area of research with lots of applications that is slowly being used in services of different companies ranging from product to sales process. The use of service design methodologies is needed to implement the modular concepts in a product or service. This can be quite challenging without proper methodology and knowledge in how to research to achieve the desired result.

This study explores how experiential elements of fiber casting modular technology can be used to improve and demonstrate modular concepts in the case company's sales process. The exploration of experiential elements is important as they can increase the user experience of the product and sales process, which can lead to more sales and a more personalized sales experience. Modular concepts are investigated and followed to understand how to best describe them in the sales process.

This thesis begins by analyzing the modularity concepts, competition in the fiber casting product area and service design methods. Then it proceeds to talk about the state-of-art literature that exists in service modularity followed by the methods used. Interviews with four sales professionals were carried out to better investigate the experiential aspects of the sales process.

As an outcome of this study and interviews, a prototype tool was developed that presents the experiential element of the fiber casting modular technology and presents modular concepts in a simple way. This tool will be used to identify the needs of customers early in the sales process of the case company's modular products.

The findings suggest that experiential aspects such as visual sales material have a positive impact and can be beneficial for the sales process in terms of identifying the needs of the customers much quicker and more effectively. Additionally, they suggest the further use of modularity concepts in the sales process as those were presented in the literature review.

Keywords modularity, service modularity, service design, UX design, configurator tool, sales process, sales material

Contents

Preface

This thesis has been one of the toughest and most rewarding experiences of my life to this point.

There is lots of people that have helped me in the process to make this a reality. Therefore, I would like to start this long list of thanking with my supervisor PhD. Marko Nieminen, whom without I would not have been able to understand this difficult thesis topic and proceed with properly explaining it.

Also, I would like to thank the case company stakeholders for their help and guidance with the topic and for choosing me to work on this project.

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Thank you so much this experience has been one of the greatest experiences of my life!

Helsinki, 21 November 2022
Efthymios Atsaloglou

Abbreviations

B2B	Business to Business
CAGR	Compound Annual Growth Rate
DMF	Dry Molded Fiber
MFP	Molder Fiber Product
RQ	Research Question
SSI	Semi-Structured Interviews
UX	User Experience

1 Introduction

Nowadays, numerous companies, focusing on being more sustainable, are developing technologies to be competitive in the new emerging market. Some companies are focusing on manufacturing fiber-based packaging products. One way to create fiber-packaging products is by implementing the concept of modularity. When building products, modularity refers to the method of decomposing a complex product into separate components (Marion, 2010). Modularity is an important area of research and business applications since it allows for product and service flexibility and customizability, which can lead to faster lead generation, sales, and product development. Currently, however, there are no solutions on the market that approach product modularity from a sales perspective.

This thesis aims to explore various approaches to improving the experience of a fiber casting machine and plant technology for the different stakeholders involved, throughout the sales process of these products. This topic is important as it aims to investigate how experiential elements of modular technology and service design methods can contribute to the sales process.

1.1 Case Company

The case company is an established international company providing products and services for the paper and pulp industries. The case company is presently working on building new modular products that are going to be used in pulp and paper industrial sites and modular characteristics and provides certain degree of flexibility to the case company and its customers. It created a multidisciplinary project to explore three different aspects of modularity: plant, machine, and sales.

The case company aims to research the use of modular products with the goal to address the arising sustainability market needs as well as offer better products and experience for its customers. This thesis explores modularity from a sales and service design perspective while combining aspects and information from the works of the other two theses.

1.2 Goal of Thesis

The goal of this thesis is to investigate methods of enhancing the experience of a fiber-casting machine and plant for different stakeholders involved in the sales process. In practice the aim is to define an improved understanding of the customer journey and the sales process with a corresponding tool to present the technical concepts in the sales process.

Furthermore, several research questions (RQ) are formed, as seen below, to address the topic of the thesis:

RQ1: What is the effect of visual sales material on the customer in the sales process of a newly developed fiber casting machine?

RQ2: Who the stakeholders are, their characteristics, and what do they consider to be valuable?

The research questions shown above connect to the topic of product modularity and sales since RQ1 aims to explore the effect of sales material in fiber casting machine and RQ2 investigates the stakeholders who are involved in the sales process of the modular products presented in this study. Also, the RQs connect to the case company by defining the experiential aspects (visual sales material, stakeholder characteristics) of the modular technology. In addition, both RQs connect since they explore the modular concepts of fiber casting technology from different sales viewpoints, the RQ2 with an understanding of the stakeholders and RQ1 with how those stakeholders comprehend those sales materials. Those RQs were chosen to be investigated since the goal of this thesis was to explore how experiential aspects can be used in a modular technology context.

Moreover, this thesis will research and discover answers to the RQs by exploring the modular concepts to better understand them. Also, it will research the state-of-the-art to see the research outcomes, arguments, and constructs of the service modularity area. It will follow service design methodologies to help in the exploration and understanding of the topic as well as the formulation of artifacts relevant to the study and the RQs.

As soon we have reached the aim of the study, we can begin with the evaluation of the sales pitch and its monitoring. However, these items require that we have defined the sales process and information that supports it as well as material to define sales pitch. Those are two areas of sales pitch evaluation and monitoring of customer experience are depicted in the questions below.

What is the effect of a created sales pitch on the customer experience?

What are ways that the sales process can be monitored to improve both the customer and salesperson experience?

Additionally, this study aims to assist the case company to explore new techniques of selling similar innovative products in the future. Later in this thesis there is a discussion on future recommendations to consider as well as the limitations of the study.

1.3 Structure of Thesis

The remainder of this thesis is structured as follows: The following chapter discusses the literature and definitions around modularity, applications of modularity and service design. Chapter 3 presents the methodology used to explore and understand the concepts. Whereas, Chapter 4 shows the results produced as an outcome of the study, how these results were produced, as well as responses to the research questions. Chapter 5 discusses the results, their limitations, and possible improvements for the future that the case company would need to take into consideration. Finally, Chapter 6 presents a summary of the work of this thesis.

2 Literature Review

2.1 Modularity

This section includes background information on modularity, the modularity concepts, the market the case company utilizes and its competition in that market as well as its benefits and challenges.

2.1.1 Definition

Many researchers define modularity in their own way. This occurs due to the various ways the concept of modularity can be defined in the different fields. Each field utilizes it in its own way to achieve the best possible result (product, service, design, software, architectural structure, etc.).

According to Wang and Zhang (2018), modularity, with respect to designing a product, is defined as a system with components that can be changed to reduce complexity. Sanchez and Mahoney (1996) share a similar understanding of the concept, defining it as a flexible structure with multiple levels of components that can be reconfigured in different ways to create new products.

Gentile (2013) defines a modular architecture as a system that is composed of multiple components having specific properties; components having compatible and consistent behavior; components having similar size and complexity; components being interchangeable.

Modularity can also be detected in software engineering with Sullivan, Griswold, Cai and Hallen defining modularity, with respect to designing software, as a system with multiple modules and the capability of constantly searching for superior alternatives and deciding whether to keep or replace the currently selected module.

Finally, modularity is found even in modern digital services, such as Amazon Web Services (AWS) with Stoffer, Widjaja and Zacharias (2018) defining service modularity as the capability of a system (service), which is comprised of different, independently created modules, to perform a specific operation. In that case, the service (AWS) which analyzes large data is split into various service modules, namely frameworks (Amazon Elasticsearch Service, etc.) and databases (Amazon DynamoDB, etc.).

In the context of this thesis, sales modularity is defined as the capability to explain and sell a whole product, or parts that constitute it, to a customer as part of an offered service.

2.1.2 Benefits

There are numerous reasons why modularity is important for the fiber-casting machine project. Pine (1993) states that creating modular components that can be reconfigured into various products and services, minimizes costs and allows for maximum personal product customization.

Wu, Song, and Whang (2021), modularity provides a method to accurately organize a system and therefore provide flexibility, variety, structure, and clarity when personalizing the product. The same authors also mention that it provides a way to easily create multiple repetitive components, which aim to add customers' specifications during the product creation process.

Furthermore, Kuderer (2006) states that modularity can support organizations in six particular areas, namely: product development and design, variance, production, quality, and after-sales.

In product development and design, it can reduce development costs and resource requirements by creating shorter development times while reducing module redesign, which can be extremely time consuming. What is more, as a result, it allows for the company's modular products to launch faster on the market compared to the competition, while at the same time being flexible to changes to a product or customer requirement level.

Regarding variance, it allows the organization to create a large variety of product designs since the different modules can be replaced or added to the already existing product. This gives customers the freedom to create products that ultimately meet their needs.

When dealing with production, modularity allows for lower production costs as product complexity decreases and manufacturing becomes less demanding. Additionally, it provides for the possibility of having parallel events when assembling and manufacturing the products.

Besides, modularity could result in a solution of higher quality as the end-product is composed of multiple modules, which can be tested and developed independently, therefore creating fewer final product defects and returns, while providing higher customer satisfaction.

What is more, the same author points out that modularity can also be utilized after the sale of the product to the customer has been finalized. This is achieved as the organization can easily update, replace, or perform maintenance on each existing module separately, when required, according to each module's life cycle. This provides the company with flexibility as well as more ways to sell future developments to the same product, as they do not have to focus on one product.

Finally, Offermars (2004) points out that the life cycle of a modular product can be extended, since its modules can be reused, replaced, or repaired. Modularity allows products to easily adapt to up-to-date technologies since the changes that need to be made can be progressive and only accomplished simultaneously on one or two modules.

2.1.3 Challenges

While modularity appears to be a promising methodology for different markets, one might question why all products and processes are not modular. The reason mainly lies in the several challenges that stakeholders involved in the product creation process need to take into consideration when wishing to create a modular product.

Kexin (2004) suggests that for designers it is difficult to design modular systems since they need firstly to have a very thorough understanding of the overall process then to create design specifications that would enable the modules involving the product to work as one. The challenging part though is that those specifications, which need to be identified in advance, are independent of the modules. A further challenge is that the designers and engineers working on one product variant need to ensure that any new ideas or concepts also apply to the older variant and its modules.

Lau, Yam, and Tang (2011) point out several disadvantages of modularity on product innovation. The first of them being that when building an innovative product, the various development teams in charge of the different modules overly concentrate on each module separately, thus, resulting in less coordination, leading to a reduction in the important knowledge-sharing aspect amongst them.

Another possible drawback of modularity is that while creating products with modules selected by users is highly innovative, it can be rather expensive as users tend to become overwhelmed with the number of available modules. Additionally, non-expert users may face difficulty when selecting modules for a modular product due to its complexity and their lack of knowledge, and will therefore decide to either choose the options familiar to them, the default options, or do nothing.

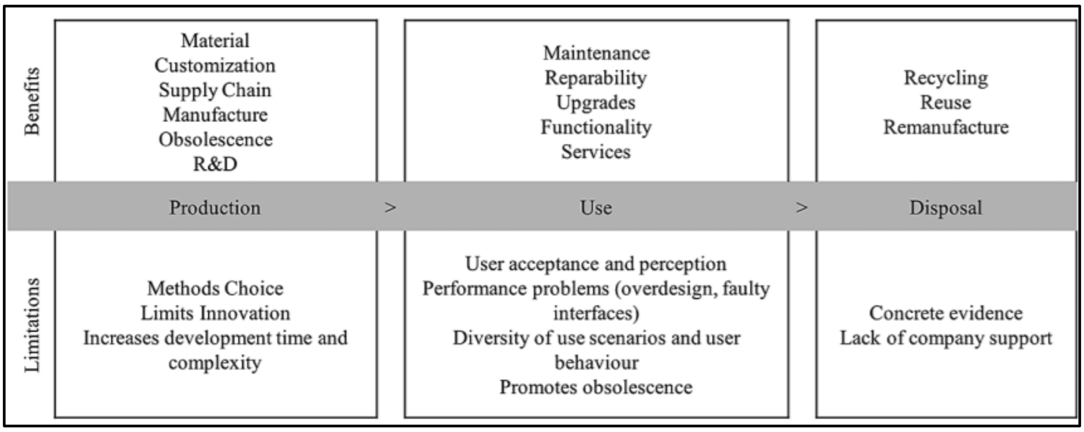

Figure 1: Benefits and Limitations of Modularity in different phases of a product (Sonego et al. 2018)

Sonego, Echeveste, and Debarba (2018) mention that while modularity has many benefits, they argue that it can have limitations in the production, use, and disposal processes of a product. Their research focuses on how modularity can affect sustainable design.

In the production phase, they suggest that the choice of a modularization method is a complex task since there are many available existing and developing methods. Furthermore, understanding how to apply a method and design a modular product is time-consuming and would require expert assistance, which is not always available.

In the use phase, they point out how modularity may face difficulties with user acceptance. They suggest that users perceive modular products or products with upgraded systems as being of inferior performance, less durable, less reliable and obsolete. That raises the question of how modularity can be presented and appreciated by users, even among those who understand its benefits.

Finally, the authors refer to the lack of studies currently available, which document how modularity can be used to achieve a reduction in the disposal phase of the environmental burden. This does not necessarily suggest that modularity is not sustainable, but rather that there is an apparent lack of support in applying such tools due to the complexity involved in understanding and implementing a modularity method. Therefore, stakeholders utilizing modularity methods should also take into consideration that when being used they can have a positive environmental impact.

2.1.4 Market Potential

Modularity can be applied in many different markets. The case company could reap projected benefits if it chooses to operate its fiber-casting machine and plant in the molded fiber product market (MFP), which falls under the packaging market. Smithers (2020) reports that the global packaging market was valued at $917 billion in 2019 and will reach $1.05 trillion by 2024 with a compound annual growth rate (CAGR) of 2.8%. The plastic packaging market as seen below in Figure 2, which is the focus of MFPs was estimated to be worth around $375 million in 2022.

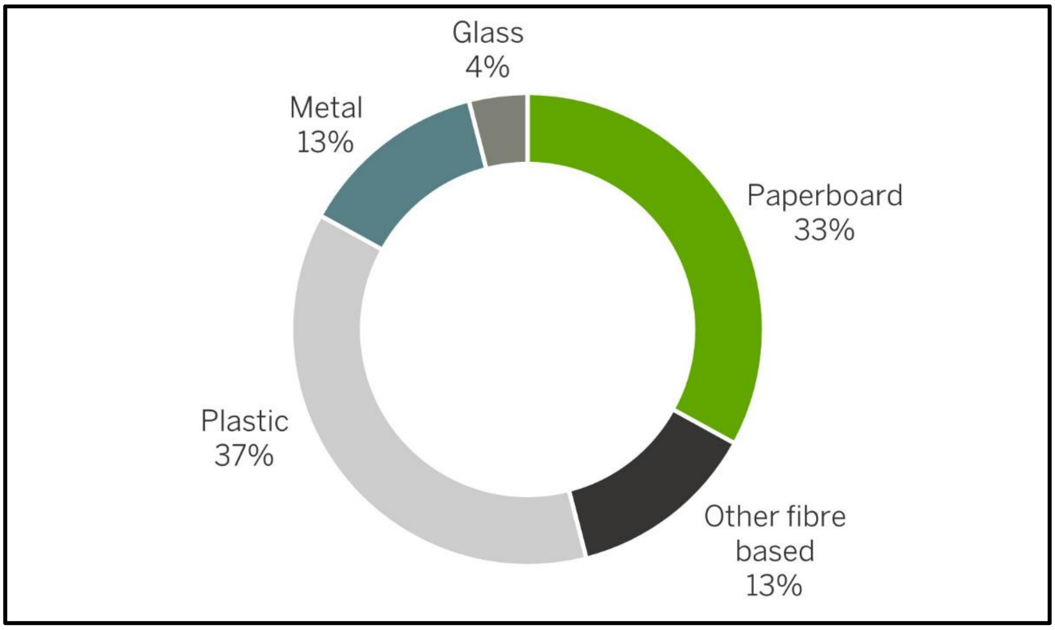

Figure 2: Distribution of Global Packaging Market in 2022 (Metsä Board article on the market to their investors)

In the article "The Impact of a Green To-Go", 2020, Steve Roberts defines molded fiber as a type of raw material that is both renewable and sustainable, which could consist of either wood pulp or plant materials, such as wheat straw, bamboo, etc. A report by Future Market Insight (FMI), 2021 estimated the global MFP in 2021 to be over $7.7 billion with a CAGR of 5.1% between 2021 and 2031. Another report by Data Bridge Market Research 2021 suggests that the global MFP market will grow to approximately $5.61 billion by 2029 with a CAGR of 4.82% as seen in Figure 3.

Based on the report by FMI, Canada is anticipated to hold 12% of the total market in North America by 2031 due to Hartmann Canada Inc.'s strategic moves in that specific market. Furthermore, they expect that Germany will hold more than 20% of the Western Europe market between 2021 and 2031.

Moreover, they believe that China will account for 40% of the Asia-Pacific market, excluding the Japan region, with India around 25% of that market.

Figure 3: Graph showing estimated growth of the global MFP market in different regions (Data Bridge Market Research, 2021)

FMI also reports that trays (type of molded fiber pulp packaging) will account for 34% of the market until 2031. The reason is that they are lightweight and allow for 25% less consumption of material when compared to other existing solutions. Additionally, the FMI report points out that Transfer molded pulp products, which are products having a wall thickness between 3 and 5mm, are expected to hold 50% of the market. That specific sector is expected to perform so well, due to it targeting primarily the food and beverage market, which is expected to be the major end-user of the global MFP market. Finally, the FMI report suggests that primary packaging will capture 70% of the market between 2021 and 2031. The reason behind that being that such type of packaging has great qualities regarding product breaking and wear and tear.

2.1.5 Competition

As shown in the previous subsection, the global MFP market is immense and expected to increase significantly in the next decade. Numerous companies, including the case company, are beginning to launch solutions to address the growing interest in that market. Most companies in the market produce packaging without providing a machine and/or plant along as a solution. This subsection will focus on organizations that provide a machine and/or plant as well, as a solution for their respective customers.

One of the competitors in this sector is Kiefel, a company based in Germany that specializes in the design and manufacture of plastics processing and has a client in the medical, refrigeration, and packaging industries. Kiefel provides various products and applications for the packaging industry. They sell different types of thermoforming machines that can create different products. Thermoforming in this context refers to a manufacturing method during which plastic is pressed with heat into a specific shape inside a mold and then cut into the desired product of choice. Kiefel has several types of machines that can produce different products, such as trays, cups, or natural fiber products having waterproof, heat–resistant, or biodegradable packaging qualities.

Figure 4: Image showing the Kiefel NATUREFORMER KFT 90 Fiber Casting Machine (Kiefel, 2021)

Kiefel provides an all-around solution for their customers from beginning to end. This means they have clear, pre-determined steps from the moment the fiber arrives at the plant to when the final product is produced and leaves the plant. They provide fiber preparation machines with Kiefel NATUREPREP KFP – Kiefel Fiber Preparation, which takes in the natural fiber and converts it to pulp and other materials. Additionally, they provide fiber-casting machines with Kiefel NATUREFORMER KFT coming in different sizes, which process the pulp and convert it into the desired product of choice for the customer.

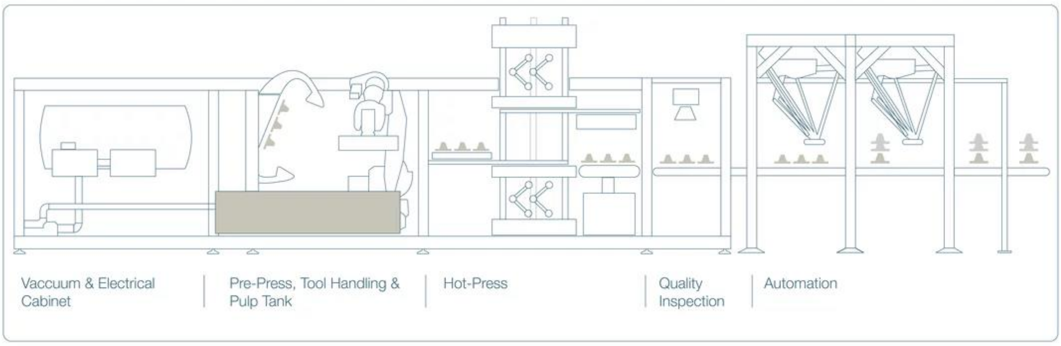

Figure 5: Image showing an inside view of the different processes of the Kiefel NATUREFORMER KFT Fiber Casting Machine (Kiefel, 2021)

As seen in Figures 4 and 5 the Kiefel fiber-casting machine includes processes that convert pulp into a product having certain quality standards which is automatically assembled into stacks that are ready to be packaged and sent to locations where end customers can purchase them. It is a complete solution that puts into practice the concept of modularity as seen in Figure 5 with the different processes such as Hot-Press, Quality Inspection, etc. being easily adjustable. However, compared to the case company solution, presented briefly in the next chapter, it lacks some modules that can be customized for various products, which the customer might need.

Another competitor is UFP Technologies, based in the United States of America, which provides molded fiber packaging solutions for their customers. UFP Technologies, as a $100 million public traded company, has a strong presence in North America with production capacity and resources. What is more, based on information provided on their website, they manufacture solely in the USA and have partnerships in Asia and Europe for customers that want to scale their project.


Figure 6: Part of the fiber-casting machine that produces egg trays (UFP Technologies, 2021)

The engineering and fabrication process of UFP Technologies does not include any information regarding their fiber-casting machine, only information on their process from initial design concept to production. As can be seen in figure 6, it appears that they utilize a fiber-casting machine to produce their molded fiber products. However, their solution appears not to utilize the concept of modularity in the same way that Kiefel does.

Another competitor with a global presence is Parason Group, a company located in India that manufactures supplies paper and pulp machinery. Parason provides an array of solutions to accommodate the production MFPs from pulpers to cleaners to deflakers to molded fiber production line machines. Their focus is on producing sustainable and biodegradable Tableware products utilizing various types of raw materials, such as agricultural waste, sugarcane leftover, fiber, etc.

Figure 7: Molder Fiber Production Line Plant (Parason Group, 2021)

Parason's MFP machine as seen in Figure 7 above includes a simple forming station, which means an area where the pulp is input and thermoformed into the desired product of the customer's choice. As observed in Figure 7, Parason's approach toward modularity is different from Kiefel's discussed above. Their MFP machine does not include modules that are present in the plant, as seen in Figure 7, such as the mold and trimming stations. Therefore, their machine is not truly modular, but rather their plant follows aspects of modularity.

Furthermore, another competitor operating in the MFP market is Huhtamäki, a publicly-traded company from Finland with a presence worldwide. Huhtamäki produces many different types of products such as cups, lids, containers, trays, as well as forming machines that can make those products. The machines they produce solely focus on making different products based on their specifications as well as integrating with already existing equipment in the customer's production facilities. Their forming machines do not include any concept of modularity or additional modules such as pulpers, quality inspection, and automation units.

Finally, the last major competitor in the MFP market is PulPac based in Sweden, which utilizes a more recent innovation called Dry Molded Fiber (DMF) for which they currently hold patents in Europe, the USA, and a few Asian and South American countries. DFP is a manufacturing technology where the drying process of the molded pulp is ten times faster, more energyefficient, does not rely on water resources, and produces up to 90% lower CO_2 emissions compared to plastic.

Figure 8: Image containing all modules of the Fiber casting machine PulPac Module PU300 (PalPac, 2021)

The company is currently focusing on cutlery and has created the PulPac Modula PU300 as a modular production line solution to create MFPs. The fiber-casting machine of PulPac includes different modules as observed in Figure 8. The solution shares similarities with Kiefel's modular machine. The great innovations of PulPac's fiber-casting machine are its patented technology, which converts pulp into separate fibers using air, and the fact all non–used material is recycled therefore achieving very high material efficiency. However, their solution does not include some modules that the case company has. What is more, it is currently limited to the production of cutlery.

2.2 Service Design

This section includes information on service design, its definition, principles, and how it is used in the project as well as a literature review that uses aspects of service design that are related to this thesis.

2.2.1 Definition

The concept of service design has evolved and been used more extensively in the last decade with the rise and presence of more advanced technology. However, prior to providing the definition of what "service design" is and where it originated from, it is of vital importance firstly to define what a service is. According to Nielsen Norman (NN) Group, a service can be defined as "*an exchange between entities to access intangible solutions without* *claiming ownership, such as transportation, hospital treatment, water, electricity, etc".*

The concept of "service design" originated from Lynn Shostack in 1982 as "*a method for organizations to organize and understand their internal processes and how those work together to make the organization as a whole more resilient and adapt faster towards arising opportunities in their respective market".*

NN Group defines "service design" as "*the process that occurs within an organization with the purpose to organize and direct its resources so that the experience of employees and customers is enhanced"*. While the Interaction Design Foundation (IDF) defines the concept from a different perspective that "service design" "*is a method that allows designers to create solutions aimed at all the stakeholders involved in a particular service that lead to improved experiences".*

2.2.2 Principles, Benefits & Methods

Service Design has several components, principles, and methods that an organization could follow to achieve action-oriented insights. Marc Stickdorn and Jakob Schneider (2010) believe that there are five basic principles that all services following the Service Design methodology need to have. Namely, these principles are that the service should be:

- user-centered which stipulates that the organization is required to conduct research on their different stakeholders to understand their point of view and include this in the final, deliverable design.
- co-created which proposes creating the solution together with the stakeholders and receiving feedback from them on the design along the process.
- sequenced which focuses on dividing the entire service into different, smaller user journeys with the goal of better designing the entire process.
- evidenced which refers to having a vision as to how the users would experience the service and trying to make it comprehensible, clear, and simple for them.
- holistic which describes the concept of designing the whole service experience based on the perspectives of all stakeholders.

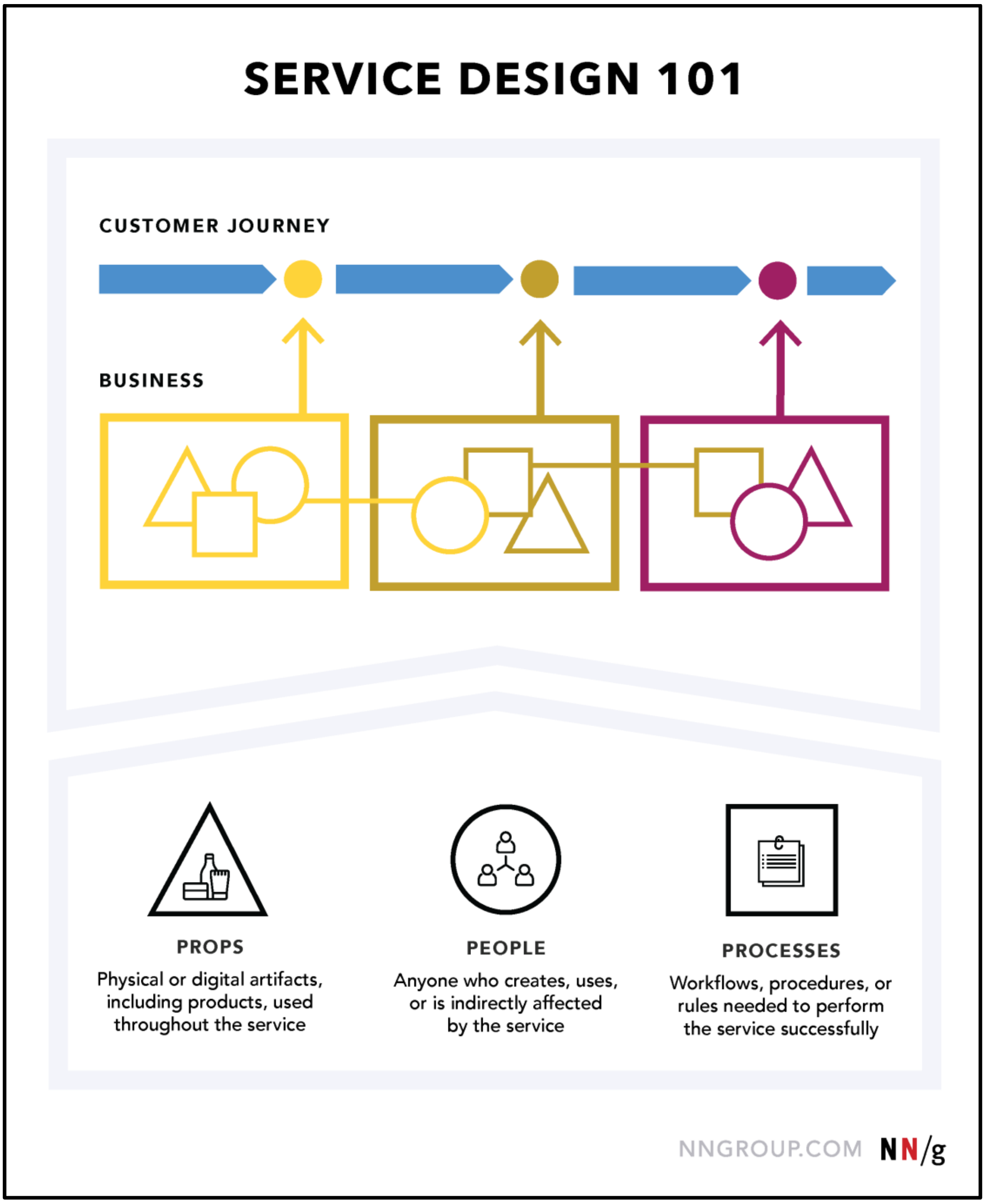

Figure 9: Components of Service Design and how they are used in the customer journey by Nielsen Norman Group (Sarah Gibbons, 2017)

What is more, there are several components that every service should identify which are useful in the design process. These components are people also known as actors, props, and processes. The first component, "actors", requires that all stakeholders be identified; the people who design the service, the clients whom the service is for, the end-users that will use the service, as well as any individual that is influenced by the service. The second component, "props", refers to any type of physical or virtual environment, object, or product that is vital to creating and delivering the service. Finally, the third component "processes" concerns all the methods utilized by the people creating the service as well as all the tasks the end-user or client performs along the service journey.

The benefits of service design are numerous. Among the most important are the identification of areas of conflict, setting the stage for difficult team discussions, decreasing the number of excess outputs coming from business, and the facilitation of better relationships.

Finally, one popular framework frequently used in service design, invented by the British Design Council in 2005 as a roadmap with various techniques to assist in the creation of products or services, is the double diamond. As it can be observed below in Figure 10, this design process consists of four stages, namely: Discover, Define, Develop and Deliver, all of which indicate how the process follows different stages of thinking and development. The first stage "Discover" focuses on gathering information and insights as well as understanding and defining the user needs. The second stage "Define" centers on understanding all the information from the first stage and defining a clear challenge to be tackled. The third stage "Develop" identifies ways of creating solutions through prototyping and testing them with the different stakeholders involved. Finally, in the "Deliver" stage, the project is complete and ready to be launched along with specific target and evaluation goals for that service.

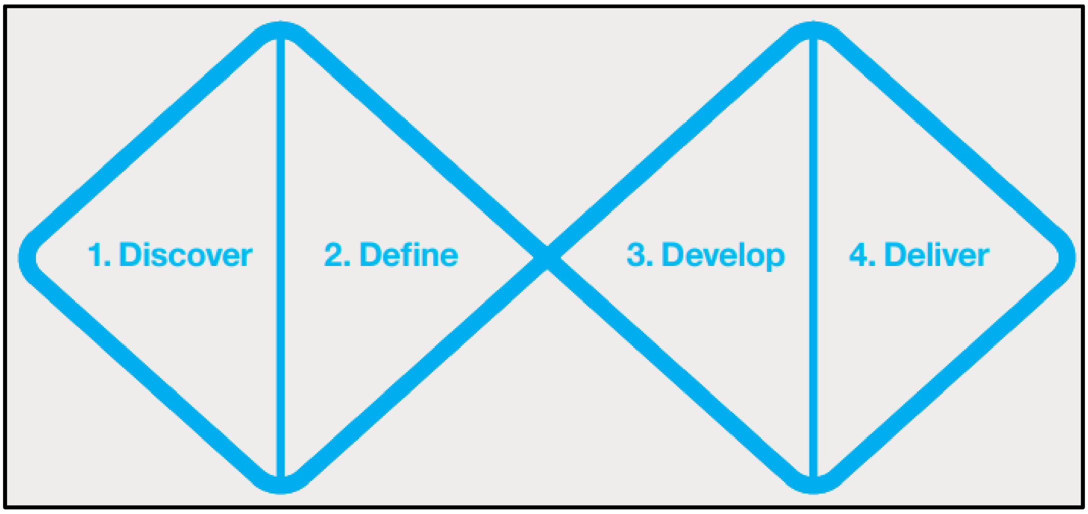

Figure 10: Double Diamond Framework by Design Council (Davies and Wilson, 2015)

2.2.3 How Service Design is used in this project

As mentioned in the introduction, this thesis explores methods of how to best enhance the experience of a fiber-casting machine that utilizes modularity concepts for different stakeholders. Service design concepts are used in this project to understand the topic of this thesis.

This study utilizes the service design concepts as a methodology for the thesis topic to follow. As discussed in subsection 2.2.2, the topic will be using methods from the double diamond framework such as customer journey mapping, interviews, and experience prototyping to explore and investigate the topic. These methods are used to identify experiential aspects of fiber casting modular technology and to formulate artifacts for the sales process that combine modularity and service design. The methods will be discussed further in the next chapter.

However, the literature review and research approach of this thesis suggests the combination of the service design methods and modularity concepts to achieve the purpose of this thesis and explore the topic. The study follows the service design methods to research and understand the topic as well as design and create artifacts. The modular concepts are used to present and articulate the case company's fiber casting technology.

Additionally, the literature review on service design and modularity will be used in chapter 5, "Discussion" to understand how the case company could use service modularity concepts in the development of the fiber-casting machine sales process.

2.3 Service Modularity and State-of-the-art

There is vast research that has been conducted on modularity as a concept and how it can be applied in different fields as discussed in the challenges and advantages of the modularity subsections. Researchers are exploring modularity from a service design perspective and this subsection will focus on different state-of-the-art papers in that area, how they use modularity, and present the possibilities that companies with services have should they consider the use of such approaches.

Pekkarinen and Ulkuniemi (2008) were among the first to implement modular concepts in business services and considered the concept of service modularity. According to them, a modular service must include the following four dimensions:

(1) a modular service that can be joined with other services and is accessible to the client,

(2) a modular process that was formed from several service processes and is related to physical operations,

(3) a modular organization that can effectively utilize organizational and external partner resources as well as flexibly configures supply channels to accommodate the service, and

(4) the presence of customer interaction with the purpose of identifying the customer needs and maintaining the relationship.

Additionally, Tuunanen et al. (2012) define service modularity as *"an architecture comprised of several independently working services with clearly specified functions that are shown via a standardized interface with which the modular service can be configured and personalized"*.

Poeppelbuss and Lubarski (2019) in their study developed a framework called Modularity Canvas for the initial phase of information capturing of a modularization project process to aid service providers when they are preparing to launch a modular service. Its main purpose is to help organizations visualize the process of managing service variety and modularity, while at the same time providing insight on how to best organize their internal quotation process. It is composed of eleven areas as seen in Figure 11 that represent various aspect of service modularity. The canvas is mainly comprised of two layers, namely: *Variety Management* and *Sales and Service Delivery*. The first layer focuses on providing further insights on the strategic decisions when building the modular service. Whereas the second layer examines the operational processes that are present in the modular service at run-time.

The researchers trialed the Modularity Canvas by organizing workshops with five German industrial service providers from the logistics, wind energy and automotive engineering industries. Each company brought two to five members from different departments to the workshops to sample the canvas.

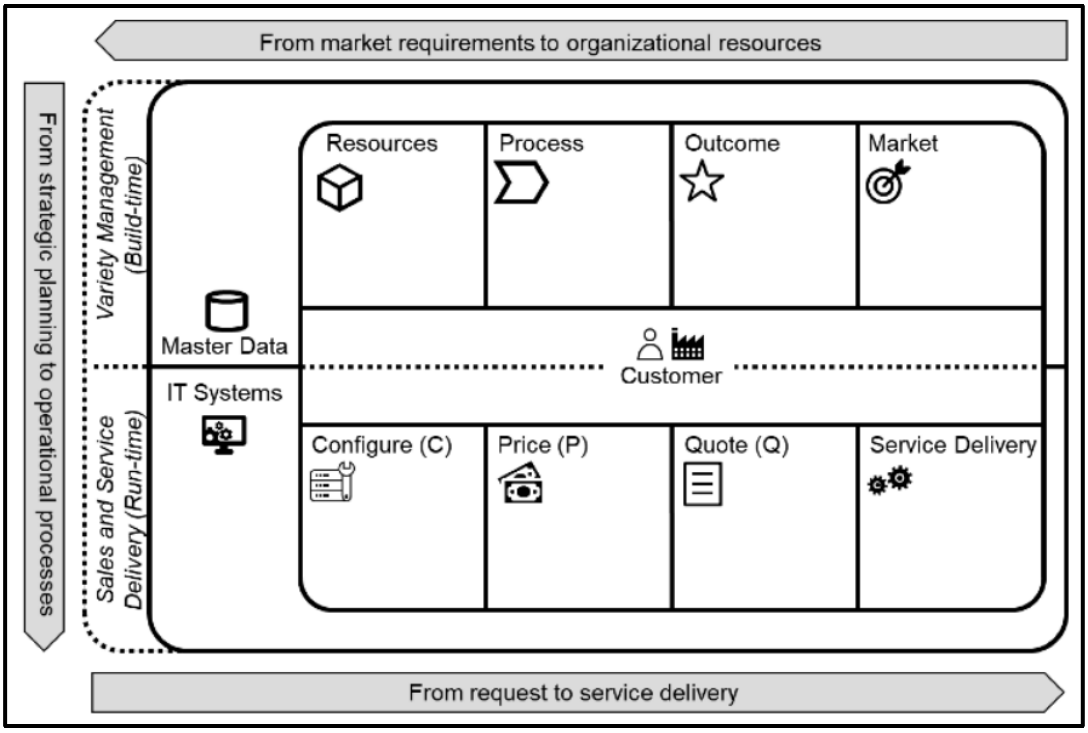

Figure 11: Modularity Canvas by Poeppelbuss and Lubarski (2019)

The feedback they received from the workshops was positive with the participants not only acquiring a new point of view on how things work in their organization but also achieving an understanding of the individual opportunities that can be gained from modularity. Ultimately, the researchers realized that while the workshops are well-structured in providing value regarding an organization's status quo, there is a lack of a systematic method in understanding the personal opportunities that can be gained with modular strategy.

The study by Knop et al. (2019) developed a model that outlines experiences for reaching a certain degree in service modularity projects as well as manifestations of modular services in practice. Initially, the authors began with a "*model development*" phase where they applied a mixed methods approach of semi-structured interviews with 21 German service providers. They combined that with existing literature reviews on product modularity and mass customization to derive concepts for the model as well as various hypotheses for the second phase, "*model validation*". (Figure 12) The model generated five constructs, namely: competitive pressure, customer integration, service characteristics, entrepreneurial orientation, and service modularity. During the second phase, the researchers launched a quantitative research study in the form of an online questionnaire using the derived constructs and items from the first phase with 258 feasible total responses from companies in various fields in Germany.

Fundamentally, the model confirmed all the hypotheses and generated three observations. Firstly, it was clearly evident that customer integration has an overall positive effect on service modularity meaning that a satisfactory customer relationship can assist in identifying the suitable modules. Secondly, it was found that service digitalization plays an important factor in service modularity meaning that companies would benefit from carefully created, demonstrated, and perceived services as well as the digitalization of their internal processes. Lastly, it was observed that the entrepreneurial orientation of the company and associated culture positively affected service modularity. However, the authors discovered certain limitations regarding their study. They stated that their solution cannot be generalized given the fact that the interviews and survey were conducted only with organizations in Germany. Therefore, additional studies in other industries and countries, as well as research focusing on how service modularity is used with customers and their use of configurators in industrial settings would need to accompany the results from their paper.

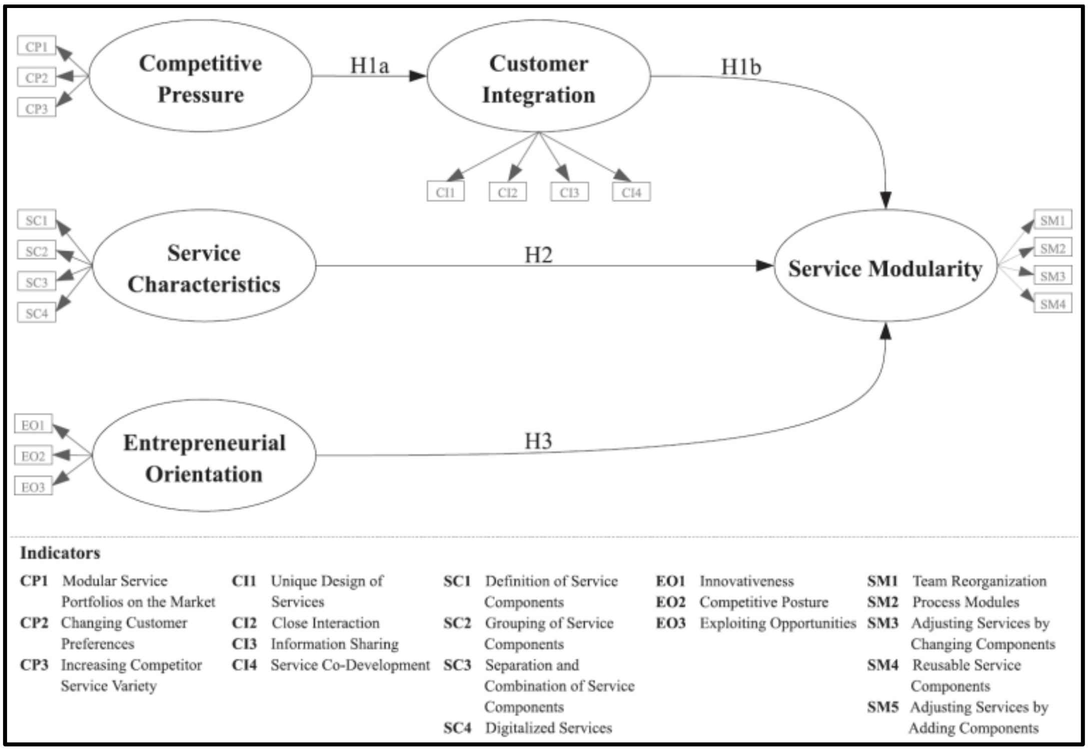

Figure 12: Research Model outlining the model constructs along with the hypotheses by Knop et al. (2019)

Lubarski (2018) in his paper developed a quotation process method that integrates with an organization’s current sales process using concepts of service modularity. Basically, he proposed how the structure of a quotation document following service modularity concepts should appear by identifying 15 requirements that provide IT support when preparing a quote within a Business-to-Business (B2B) context. The reason behind his paper is due to the fact that the processes in the B2B market have become overly standardized often requiring an extensive amount of time, sometimes several months, for the quotation process to be completed. He noticed that surprisingly there is no reuse of previous quotation documents in the process and little to no use of IT support, while relying heavily on the experience of senior sales executives.

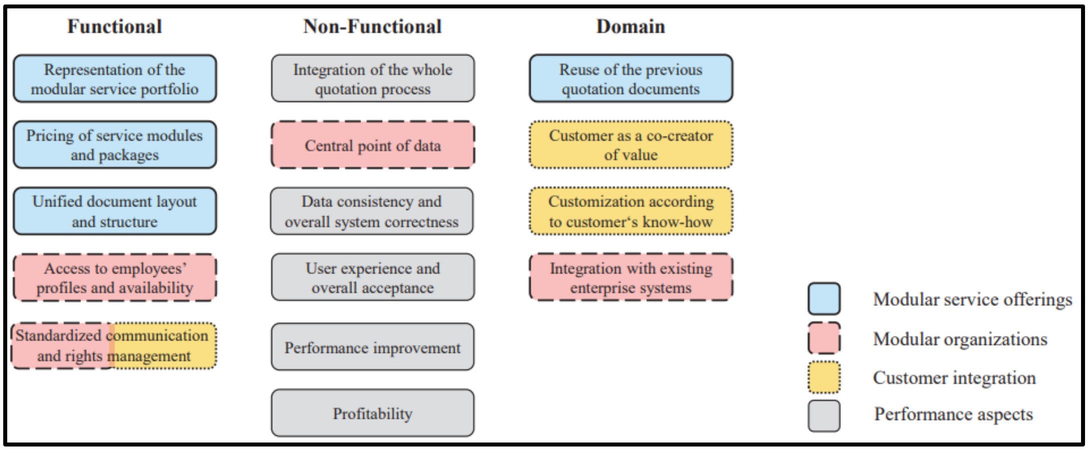

Figure 13: Requirements for IT Support that can be used in Quotation Process by Lubarski (2018)

His approach was firstly to implement a method for the quotation process, which is split into two phases, namely: *Build-Time* (long-term strategic perspective) and *Run-Time* (every day operational perspective). The *Build-Time* phase includes customer segmentation, which assists in defining customer opportunities, service innovation and service modularity all of which help with the standardization of the offered services. The *Run-Time* phase includes specifications from the previous phase as well as a Configure-Price-Quote (CPQ) process. Following that, a significant Monitoring and Reporting stage gathers the input from the quotation process and reuses it in future quotation requests to make any changes deemed necessary in the sales process. In addition to this, the author conducted qualitative research with 19 B2B companies to understand the challenges in the quotation process and identify requirements for IT support to this process (Figure 13). To enable the reuse of quotation documents, the author recommends that the proposed software solution not only be connected to the central data storage, but also linked directly to the organization's systems to avoid any data inconsistencies. Overall, the author is satisfied with his contribution and findings though he believes that the results do not lend themselves to generalizability, due to the small sample of companies and would thus require further research.

3 Methods, Surroundings and Data

This chapter includes the methodologies that were used during this study as well as the interview template and questions used in the discovery phase of the double diamond framework. In addition, it will be addressing the reason for asking the specific questions during the interview in the Discover phase.

Based on the competition analysis there are a few companies in the field that use MFP machines with the closest to the case company being Kiefel. The case company differentiates itself from the competition in how the entire plan for their project from the machine to the plant, to the method of selling this product has been laid out. This chapter also intends to show the product of the case company, without an excessive technical explanation of the different modules that are part of the fiber-casting machine and the plant. Additionally, it will discuss the methods being used in this study as well as the entire process for arriving to the final conclusion, deliverable for the case company.

Furthermore, this chapter presents the methodology that is used to respond to the research questions by investigating the sales process and stakeholders in it through interviews. Also, there is analysis of the data to formulate artifacts that would lead to visual sales material that would then be studied on their effect to the sales process. Those specific methods described in this chapter are used to understand and analyze the topic and the stakeholders involved initially and later to create tools to represent the technical concepts of modular technology in the sales process.

3.1 Methods Used

This section includes the different methodologies that were used during this study with background information about them. Specifically, it focuses on the double diamond framework as explained in the previous chapter, and the methods incorporated. For example, interviews, user journey mapping and experience prototyping, will be explained in detail.

To begin with, it is important to understand why the double diamond framework was chosen for this study. The stages inside the model cover everything involved in the creative process, from researching to defining the problem, to designing a solution, to testing and releasing the product (Justinmind, 2018). Moreover, it allows designers to organize their thoughts and because it is a nonlinear process, it provides the flexibility to revisit the different stages making improvements when it comes to identifying the problem or redesigning a solution. Thus, it is a great model in this study given the amount of information gathered and constant feedback from the different stakeholders involved.

Furthermore, additional methodologies that were used are interviews, user journey mapping, experience prototyping and phasing. According to Pernice K. (2018, October 18) user interviews refers to a User Experience (UX) research methodology in which a participant, through an interview, is asked to respond to certain questions about a specific area with the purpose of discovering insights regarding the topic of interest. Davies and Wilson (2015) define User or Customer Journey Mapping as the ability to visualize a user's journey through a given service or product with all its touchpoints, pain points and moments of truth, with the goal being to better understand the customer's path when using that service. Finally, experience prototyping refers to the idea of trying out new ideas or designs for the service with the purpose of gathering insights from users, improving the final designs as well as demonstrating to the different stakeholders how the service works.

3.2 Case company's fiber-casting machine and plant

The purpose of this study is to explore the experiential aspects of the fiber-casting machine and plant of the case company, which are being developed given the need for such solutions in the MFP and packaging markets as discussed earlier in subsection 2.1.4 "Market Potential".

The early pilot designs of the fiber-casting machine show that it contains a wet end and a dry end as seen in Figure 14. In more detail, the machine consists of the following modules: product handling, transfer units, a finishing area, and pressing units as can be observed in Figure 15. Also, the various structures as seen in Figure 16, which comprise the machines are the various modules that can complete a specific task, machine frame, and machine enclosure frame to reduce noise generated from the machine as well as increase the safety of operating it.

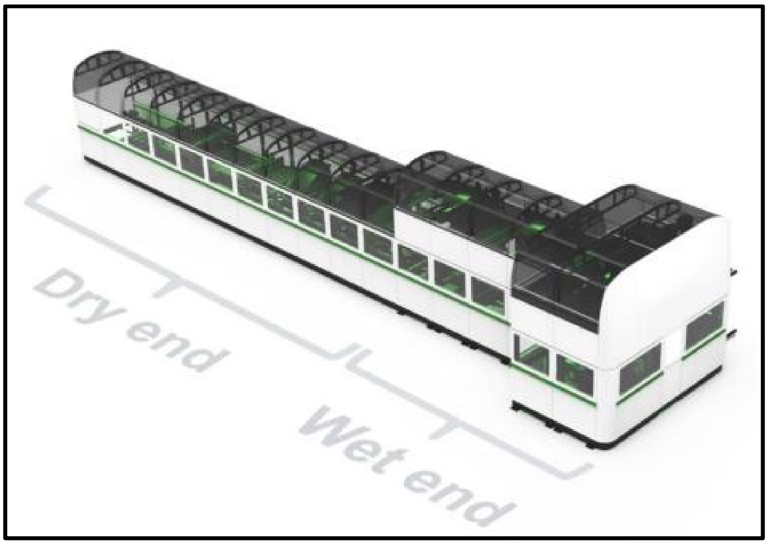

Figure 14: The fiber-casting machine pilot design (Case Company, 2021)

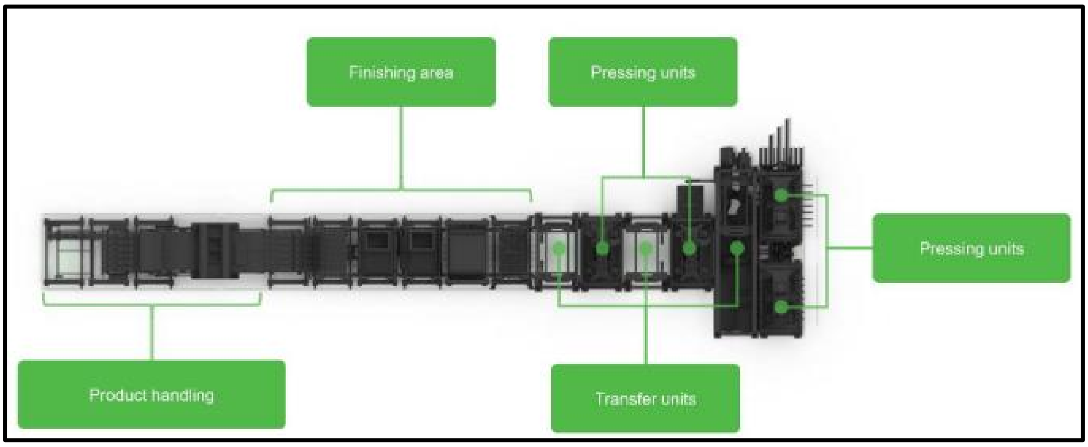

Figure 15: Overview of the modules of the fiber-casting machine (Case Company, 2021)

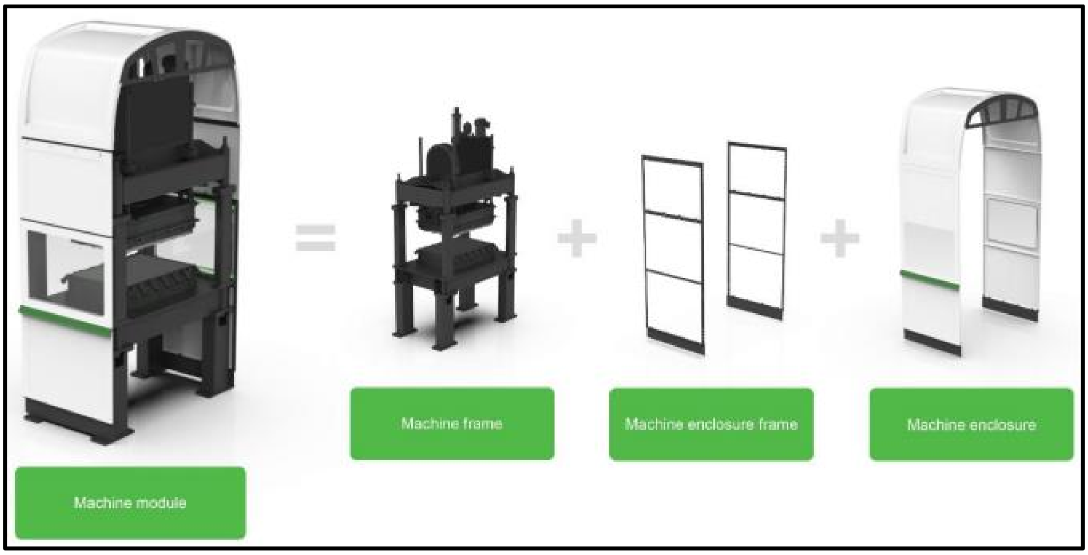

Figure 16: Structure comprising the fiber-casting machine (Case Company, 2021)

In addition, the early pilot developed designs of the production line working together with the various fiber-casting machines including several modules, namely: bale pulper, cleaner, stock tank, machine tank, refiner, and chemical system (Figure 17).

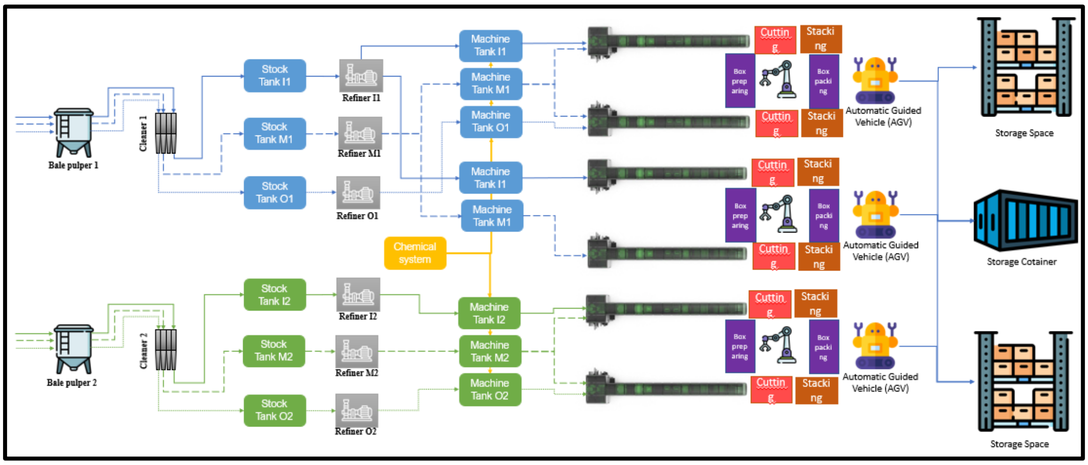

Figure 17: Pilot design of the production line (Case Company, 2021)

3.3 Interview & Questions

This section includes the interview format for the discovery (user research) phase of the study. Furthermore, it outlines the questions that were asked to the participants, the reason that those specific questions were asked by participants, the characteristics of the interviewees as well as whatever additional was done during that process.

3.3.1 Interview

As discussed in section 3.1 Methods Used, interviews are a qualitative UX research method with the purpose of finding out more about a topic of interest. Adams (2015) describes in his study the definition of semi-structured interviews (SSIs) as well as their advantages, disadvantages, how to recruit participants, the type of questions to ask and how to analyze results.

According to Adams (2015) SSIs are defined as a type of interview which feature an array of open ended and closed questions that may often lead to additional questions to understand the topic deeper such as *how* and *why*. During SSIs the interviewer typically has an open agenda and may jump between different topics depending on the participant's responses. SSIs are conducted with one participant with the purpose of being more personal and for the participant to not be distracted by the responses of others.

One of the risks of SSIs is personal bias in responses from both the participant and interviewer. Therefore, it is important to select participants carefully for the SSIs considering how their background and expertise can complement the study. Additionally, crafting questions properly with the intent of freely exploring the topic rather than asking to generate a needed response is important for the study's reliability and to reduce bias. It is essential to communicate appropriately with the participants in terms of time, place and purpose of the interview so that they can plan accordingly and be present during the session.

This study utilized SSIs as a qualitative research method. The participants were chosen based on their background and expertise with sales and how the current process works at the case company. In total, 4 people were interviewed with all of them having a background in sales, since the study hopes to explore what is happening in the current sales process and identify points of improvement.

3.3.2 Questions

As mentioned in section 3.3.1 Interview, this study utilizes SSIs as a method to understand the topic. Questions are a tool to gather information and in SSIs they need to be carefully crafted to not induce any bias and keep the study reliable.

The questions outlined in Table 1 below were chosen from the perspective of understanding more about the sales process used by case company sales professionals. They primarily focused on understanding how the customer needs are identified and then processed with the intent of leading to a sale. The focus is more on what happens between the beginning of negotiations (i.e. sales pitch) and signing of agreements as well as how sales professionals interact with the customer. Questions regarding the experience of the case company's salespeople were included to understand their experience and explore if there are any correlations between it and the sales process. Since the sessions were semi-structured, additional follow-up questions were asked depending on the participants responses.

Table 1: Interview questions in the discovery phase

Questions
How do you identify the need?
What are the things that the customer finds important/valuable in each step of the sales process?
What tools do you use to convince the customer to: • Make a purchase decision? • Get in touch with the customer in the beginning? • Identify the customer need? • Present a solution that the customer would find valuable?
What problems do you usually encounter when dealing with a customer?
What would you add and/or improve in the sales process?
How do you identify the champions that talk positively about the case company?

3.4 Analyzing Data

This section will present how the data gathered in the study will be analyzed following the process shown in the research paper of Taylor-Powell and Renner (2003).

The way to analyze data includes a five-step process. The first step in this method is to understand the data that has been collected. This entails listening or reading the data multiple times for deeper understanding, recording thoughts and impressions on that data for later, and making sure that the data is collected in an unbiased way to ensure its quality.

The second step is to narrow down how the data will be analyzed and what we would want to discover. This happens by writing down specific questions. Though, the data can be examined with two methods. The first one focuses the investigation by question or topic whereby data is evaluated based on the similarities or differences in the responses of the participants. The second method is to examine the data by individual, case, or group.

Furthermore, the third step is to group information by identifying patterns or themes such as specific phrases used, ideas, concepts, etc. in the data first and then putting them together into categories that combine them together.

Moreover, the fourth step is to discover similarities and connections both within the previously made categories as well as between them to evaluate the relative significance, which can be done in different ways. The first one is by making bigger categories to understand the concepts and material presented from a narrower perspective. The second one is addressing the importance of categories by quantifying the presence of themes in the data. The final one is the discovery of relationships between the different themes to get a better understanding as to why things happen in a specific way.

The final step in terms of how to analyze data is putting everything together and interpreting it. This can be done by writing down all the things discovered through this process by following the previous steps. Afterwards, it is important to ponder the learnings and what those suggest to the study.

3.5 Study Process

This section will be examining the whole process of arriving at the final deliverable for the case company including the methods used, discussed above.

Rephrase the first paragraph to address the process of the study and how techniques were used to arrive to a final deliverable

The study followed the double diamond framework as discussed in 2.2.2 Principles, Benefits and Methods. The study began by understanding the problem and request from the case company stakeholders during the inaugural meeting. Later, after consulting with the supervisor about the topic, the research questions in Chapter 1 were formulated as well as questions to be asked to the salespeople during SSIs as seen in section 3.3.2 Questions.

After the interviews, the data was analyzed, and various customer journey maps and artifacts were formulated to gain a better understanding of the pain points during the case company sales process as analyzed in the next section 4.1 Interview Results. Discussions were held with the stakeholders to talk about the project's progress and direction.

Then, following exploratory conversations with the supervisor, a more specific direction was implemented focusing on the beginning stages of the sales process. After being identified as such, this was the area that resulted in numerous back-and-forth meetings between the case company's client and the case company. The focus on that specific area would lead to a faster sales process and have an impact on the new fiber-casting project sales process since the customer needs would be understood in fewer meetings. It was then decided that a configurator tool prototype would be created as it would condense and explain more graphically the modularity concepts of the fiber-casting machine and plant as well as engage more with the case company's end customer and gather their needs.

A flowchart of the proposed solution was developed using draw.io and shared with the stakeholders as an image. After iterating the flowchart of the configurator tool utilizing feedback from the stakeholders, a wireframe was developed using the Whimsical software and shared with the case company's stakeholders and UX Designer to see if the tasks follow a logical order according to how the case company would want it to be.

During the final stages, a high-fidelity prototype was developed using the Figma software and discussed with the stakeholders and UX Designer in private sessions. Separate sessions were held with the other students conducting different modularity research, namely, plant and machine modularity, for the case company to overview. The purpose being to determine if the high-fidelity prototype - the technical parts that were being researched by them - functions as intended and performs in a comprehensible and smooth manner. The process concluded with a final presentation of the developed artifact (configurator tool prototype), responses to the research questions to the stakeholders. What is more, recommendations were provided and shared with the case company to ensure the future development of the artifact and its successful implementation.

4 Results

This chapter discusses the results from the SSIs with the salespeople during the discovery phase of the study. Additionally, it includes the results from the rest of the process, such as customer journey maps, various ideas presented and talked with the case company, flowcharts, wireframe and a high-fidelity prototype. The outcomes of this thesis as well as the artifacts present in this chapter will be shown in sections 4.2, 4.3 and 4.4.

4.1 Interview results

This section includes the results of the SSIs with the case company's salespeople as discussed in Chapter 3. The interviewees included 4 salespeople of varying nationalities (2 from Finland, 1 from Italy, 1 from Austria) and positions (1 Director of Product Sales, 3 Sales Managers) and took place online via the Microsoft Teams software.

Participants generally reported similar responses to the questions asked during the SSI sessions. In the first question *"How do you identify the need?"*, the interviewees responded that they try to identify the need of the customer during the first couple of meetings where they present the case company's solutions. The time spent between meetings can be a couple of weeks to a month. They mentioned that they receive the sales leads from marketing campaigns, cold calls and emails.

In the second question, *"What are the things that the customer finds important/valuable in each step of the sales process?"*, the interviewees explained what customers find valuable at different stages of the buying process. In the beginning stage known as solution development, the participants said that customers find important a solution that meets their basic needs for their own respective customers. During the first stage of the buying process, the respondents mentioned that typically potential customers have unclear needs, no set budget for the project, no team to move this forward or promote it and no specific project timeframes. Therefore, it is crucial that salespeople devote sufficient time (several meetings over a period extending from a couple of weeks to a few months) to the customer to pitch and explain the recommended solution and how it can move their business forward.

In the next stage known as evaluation, the participants pointed out that customers find it valuable how the proposed solution really solves their business needs with a focus on features, customization, benefits and costs. During this stage it was mentioned that the customers - buyers usually have defined their business targets, have set a timeline for the project, have assigned a team inside their company to move the project forward, have invited competing vendors to propose their solutions and have begun a budgeting process. Therefore, it is crucial to understand what the customer can afford and propose a relevant solution that can still meet their need without sacrificing quality and price.

In the final stage, known as commitment, the participants stressed that what customers find particularly valuable is the mitigation of risks outlined in the chosen vendor's solution. The interviewees mentioned that during this stage, the customers have a clear scope and understanding of the solution they need for their business, have well defined Return of Investment (ROI) for the project, receive offers from other vendors aggressively focusing on price and have begun analyzing the risks and putting a contract in place. Therefore, it is crucial that a good relationship is established early on at the initial stages. This will enable the customer to identify a champion (a person that speaks positively for the vendor and has influence within the customer's company) in order to move things forward and finalize the agreement.

The participants replied to the third question, *"What tools do you use to convince the customer?"* (along with the sub-questions), by saying that they rely on emails and phone calls to get in touch with the customer initially. Moreover, to mitigate the risk analysis, they present product specifications documents, communicate their process ahead, and identify a champion inside the client's company, whom they strive to convince for a purchase decision. Furthermore, to identify the customer's need and to present a solution to the customer, the participants responded that they utilize the Microsoft PowerPoint software along with images of their products to show the customer their product offering and capabilities.

What is more, the participants indicated in the fourth question, *"What problems do you usually encounter when dealing with a customer?"* that specific problems they normally face when dealing with customers are lengthy conversations, inability to find a champion inside the company and of prime concern being due diligence.

In addition, in reply to the fifth question, *"What would you add and/or improve in the sales process?"* the interviewees responded that they would like to be able to improve the time which it normally takes during the first couple of meetings with the customer to identify the need as well as speed up the process during the commitment phase, where the analysis of the risks occurs. The interviewees pointed out that the whole sales process can range from a minimum of one year to several years after the initial point of contact with the customers. By that time, the case company has rolled out improved versions of their original solution, which they may or may not propose to the customer.

Finally, for the final question, *"How do you identify the champions that talk positively about the case company?"* the interviewees indicated that in order to find out who a champion is they talk to various people with enough influence inside the customer's company and then identify those individuals that advocate strongly for them through their communication style.

Something of great significance, beyond the regular interview questions, which all the participants pointed out was that having good and successful customer projects is very beneficial as they can act as referrals for the acquisition of new business projects, especially in the Asian market. Therefore, for this project the lack of referrals would make it challenging in the beginning to acquire customers.

4.2 Customer Journey (Empirical Work Outcomes)

According to the data from the interviews, which cover the discovery phase of the double diamond framework, several artifacts (customer journey mapping, analyzing) were developed to better define the problem to focus on during the project.

After analyzing the results from the interviews as discussed in section 4.1 Interview results, customer journey maps were created to better understand the sales process, as seen in Figure 18. The interviewees contributed to the creation of a customer journey map through their responses in questions 1,2 and 5 presented previously in section 4.1. The interviewees identified how the typical step by step sales process unfolds for the case company as seen in Figure 18, which groups together all the participants responses from the first and second questions. The opportunities and stakeholders part of the customer journey map was identified by the fifth question as well as through discussions with the case company stakeholders.

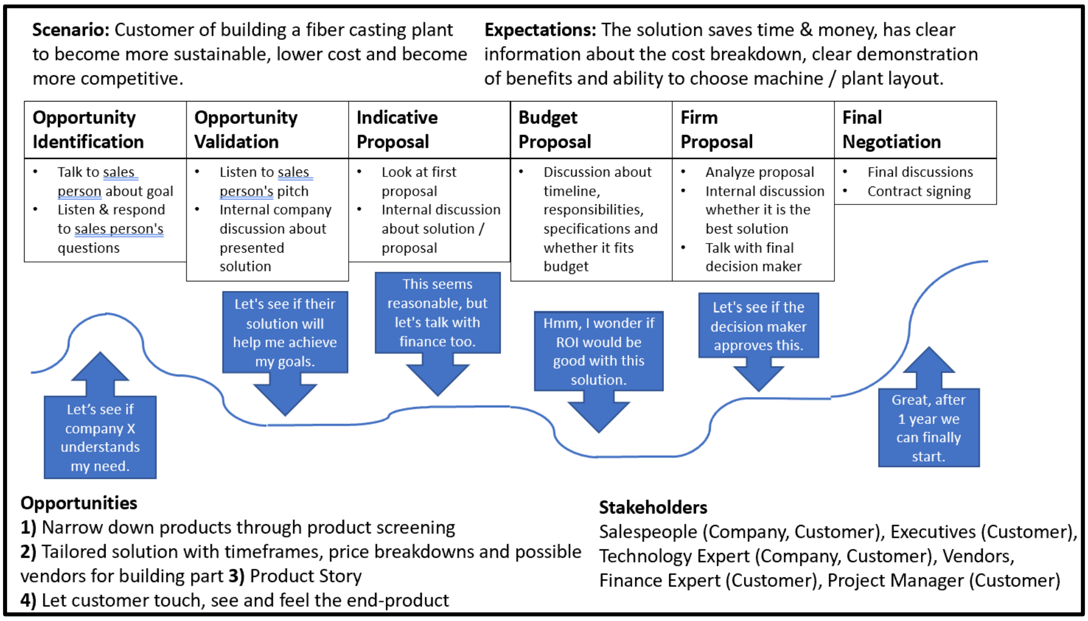

Figure 18: Customer Journey Map of Sales Process

Moreover, another outcome from the interviews was to outline ways so that the customer experience could be increased/improved. For that part, various ideas were identified, included in Table 2, where they are presented in detail. Those ideas resulted from responses to the fifth question as presented in section 4.1 as well as in discussions with the case company stakeholders when asked as to how they would improve or increase the customer experience of modular products.

Table 2: Ideas to increase and or improve the customer experience

Ideas
Configurator tool, which would enable • Inclusion of the developed product as an interactive online tool • Tailored solution • Creation of a solution with customer • Ideal demonstration of the technical components • Price breakdown of the component • Emphasis of the modularity aspect
Product Story around developed product
Understand customer satisfaction throughout sales process • Evaluate sales pitch • Evaluate customer feedback on proposal
Personalized interactions and content on sales pitches

The creation of the customer journey map as well as the contemplation of various ideas that could improve the customer experience led to discussions with the study supervisor in terms of the direction of this study. The outcome of the meetings resulted in a narrower focus intended to reduce time spent in meetings between the salespeople and the customer in the initial part of the sales process. What is more, it is vital that the proposed direction addresses the issue of lack of referrals for the new product, which is an issue of critical importance identified during the interviews by the salespeople. Therefore, the question that arose was, "*How might we reduce the timeframe needed for explaining the solution and let the customers come to the company with a proposed tailored solution that works for their business needs*?"

To achieve that, it was chosen to focus on developing a configurator tool prototype, which includes personalization and modularity aspects, which is the topic of this study and could present both the technical components of the developed product as well as demonstrate the whole product itself in a more interactive manner.

4.3 Flowchart and Prototyping

Since the area of development for the case company was chosen with the creation of the configurator tool prototype and the journey of their customers was created, it was time to create an initial idea of how the configurator tool would flow by creating a flowchart. After creating a first draft as seen in Figure 19, it was discussed with the case company stakeholders and other thesis workers covering the plant and machine modularity topics, how to obtain a better understanding of the initial vision and direction of the configurator tool. The initial draft as seen in Figure 19, depicts a simpler tool without the specific plant and machine modularity details. It was based on the conversations with the case company stakeholders and salespeople, since it would be useful to include a direct line of communication with the case company's salespeople.

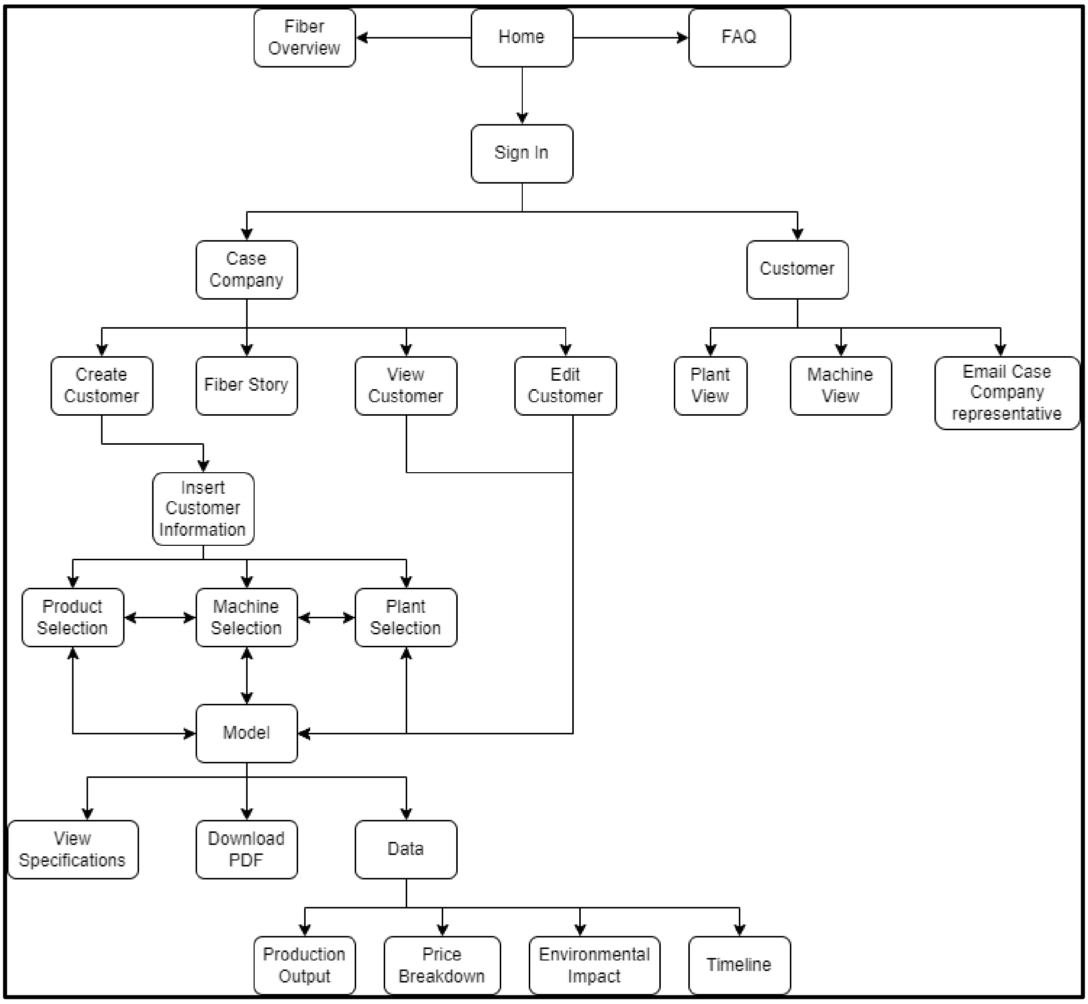

Figure 19: First version of the configurator tool flowchart for both the fiber-casting machine and plant

In Figure 19 it can be observed the initial idea of navigating through the configurator tool for both the fiber casting machine and plant products. The solution allows the customer to view the fiber-casting plant and machine as well as understand more about how fiber works in the works through the "Fiber Overview" area and even inquire a case company representative about it. The tool allows the case company to manage and configure the fiber products as well as the fiber-casting machine and plant for the customer and share that with them in the end through their view access.

To produce Figures 20 – 22 that depict improved versions of the configurator tool flowchart, the following steps were taken. Feedback from the first sessions were given to create separate configurator tools for the plant and machine modularity parts of the fiber-casting machine, since they represent different products and would not want them to be tangled together. Weekly meetings with the case company's stakeholders and with the supervisor were held online through Microsoft Teams to discuss how the flowchart depicted the essentials that would describe each product and help to understand the customer's needs. The flowcharts shown in Figures 20 – 21 resulted from the need to reduce the time spent between meetings as discussed in section 4.1 and to focus on the identification of the customer's needs to move the sales process forward.

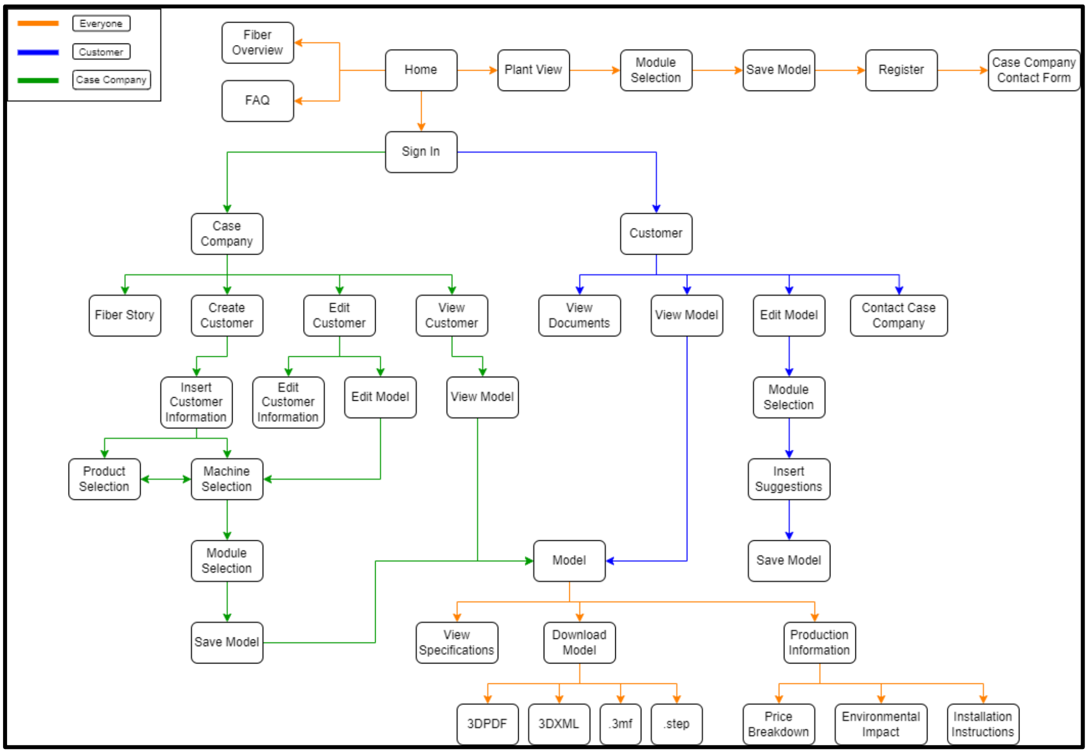

Figure 20: Updated version for the configurator tool flowchart including only the machine modularity part of the fiber-casting machine

In Figure 20, it can be observed how the configurator tool would be for the machine modularity of the fiber-casting machine. Compared to the initial version in Figure 19, in this version it was chosen to allow the customer to configure the machine model, which adds to his experience and was the initial intention of the configurator tool. Additionally, the customer can make suggestions that will be viewed by the case company's representatives and also access product information and specifications that allow him to make a more informed decision.

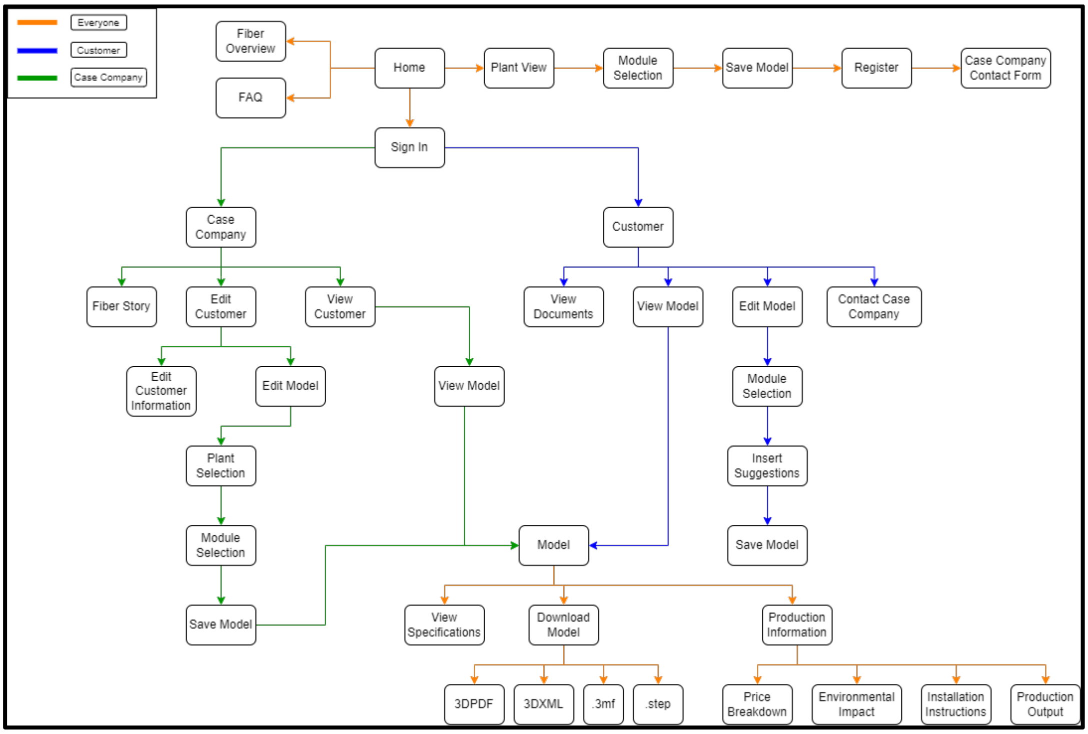

Figure 21: Updated version for the configurator tool flowchart including only the plant modularity part of the fiber-casting machine

Figure 21 indicates similar aspects as in Figure 20 with the machine modularity. The only difference is that the previously made machine model is connected to the plant model to create a fiber casting plant model that takes it into consideration. Therefore, in this case the customer is configuring only the plant model.

Following several version changes and discussions with all the stakeholders involved, a final view of the flowchart was drafted, which split the plant and machine modularity into two different configurator tools. Later, after the wireframe was created, another version of the flowchart, as seen in Figure 22, followed that included more details of the product and combined the plant and machine modularity aspects of the fiber-casting machine. This consensus was reached after discussions with the engineers and UX designer of the case company. It is widely accepted that this version promotes the aspect of modularity as well as improving the experience of the potential customers by not having to interact with two separate platforms.

The final version of the flowchart for the configurator tool contains parts that are connected to the thesis topic. Those parts include the 3D models of the plant and machine modularity with their different modules that can be configured by the customers. Those parts of the tool include product information and specifications that allow the customers to view what they are buying, what it includes and how it performs as a product.

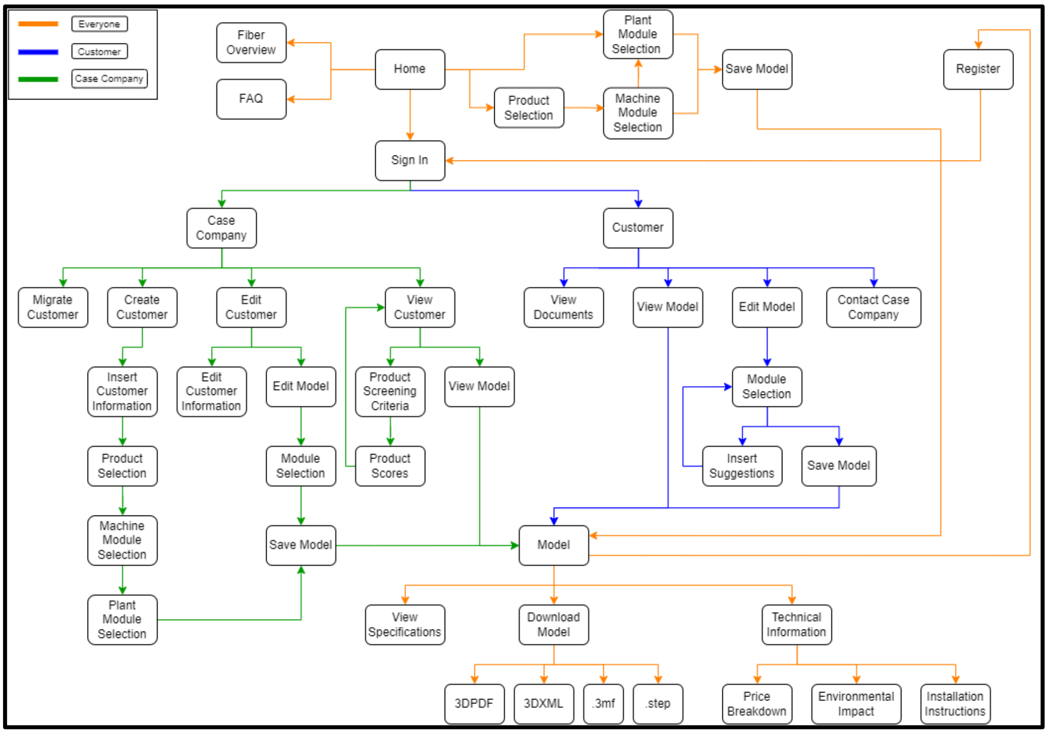

Figure 22: Final version for the configurator tool flowchart for the fiber-casting machine including both plant and machine modularity aspects

In Figure 22, it can be observed both the plant and machine modularity aspects of the fiber casting technology. It was decided to combine them together to allow the customer to interchange between them and begin their configuration from either product. This is important for the experiential aspect of the tool as it allows the customer to create custom products and understand their capabilities while configuring.

Following the flowchart, the low-fidelity drawings of the configurator tool for the fiber-casting machine were created using pen and paper, as seen in Figure 23, which provided the skeleton and helped in the initial creation of the design of the wireframe screens. The low-fidelity drawings were based on the Figure 22 final version of the flowchart. The solution was decided to be tablet-based and web-based in the beginning that's why there's resemblance to both. The wireframe, as seen in Figure 24, provided a preliminary view of the direction of the configurator tool. The wireframe screens were developed using the Whimsical software tool. The drawings from Figure 23 and the flowchart were used as the base for the wireframes as well as information from the case company's website and other web tools for specific items in the design of the wireframes.

When all the wireframe screens were developed, they were shared with the case company stakeholders, who proposed changes to how the plant and machine modularity concepts interact. Following the implementation of the changes proposed in the feedback, the high-fidelity prototype of the configurator tool was designed, which will be discussed in the following section.

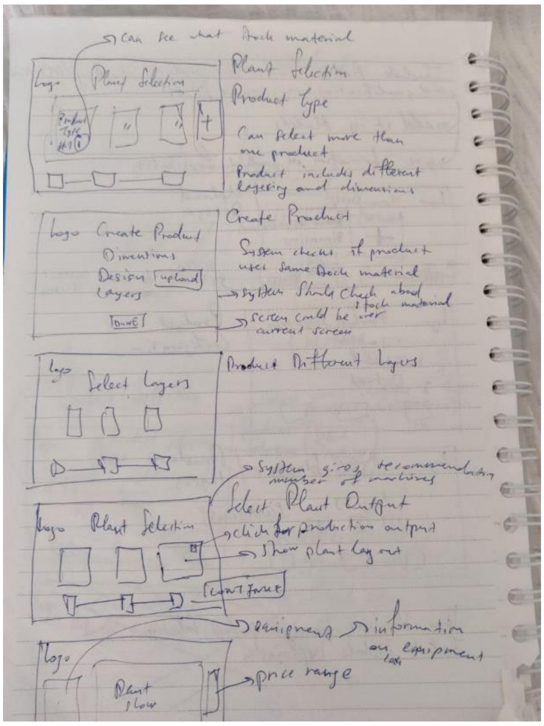

Figure 23: Low-fidelity drawings of the configurator tool for the fiber-casting machine

In Figure 23, it can be observed five different sketches from the configurator tool. The “Product Selection” part of the tool is depicted there, where the customers choose the different characteristics that their product would have before proceeding with the fiber-casting machine. The “Product Selection” is the first part of the experience for the customer with the case company since their solutions can be customized according to the chosen product in that first step.

Figure 24: Some of the wireframe screens in the Whimsical software of the configurator tool for the fiber-casting machine

Figure 24 displays the wireframes of the configurator tool. As mentioned before, the design was based on the flowchart and low-fidelity designs as well as the fact that it was initially intended to be designed for tablet and web. Also, it gives an initial look of how the sign in and home screen would look.

4.4 Final product

This section will be examining the final product of this thesis, which is the high-fidelity prototype for the fiber-casting machine. What is more, it will feature what this prototype includes, how it was developed, as well as how the plant and machine modularity concepts are used within it.

The final product of this thesis, the configurator tool of the fiber-casting machine was developed using the Figma software following the wireframe screen designs and the flowchart as seen in Figures 22 and 24.

The high-fidelity prototype was developed through feedback sessions with different stakeholders of the case company. Various meetings were held with the UX Designer of the case company to ensure the configurator tool prototype follows the design system and language of the case company. Feedback provided by the UX Designer of the case company on the high-fidelity prototype's intuitiveness and simplicity to use was one of the goals from a UX perspective. This facilitated its use for potential customers as well as salespeople and engineers, since the product includes numerous technical terms that are quite challenging for non-technical individuals to understand.

Feedback sessions were also held with the engineers and salespeople of the case company to address whether the technical machine and plant modularity concepts within the prototype are clear, during which, the prototype was shown and shared with them. After being exposed to and interacting with the prototype, they indicated in their feedback that the configurator tool prototype displayed the modularity concepts in a comprehensible and definitively visual manner, which should satisfy their own internal stakeholders as well as future potential customers.

Additionally, sessions were held with the other thesis workers working on the plant and machine modularity of the fiber-casting machine. The purpose of these sessions was to understand how to depict and display the plant and machine modularity concepts in the configurator tool prototype. The high-fidelity prototype was presented, and feedback was given on how the concepts should be designed following the modularity concepts. Their feedback stated that the final product (high-fidelity prototype) not only appropriately depicted the plant and machine modularity concepts but also the work they were doing in their own thesis studies.

A glimpse of how the high-fidelity prototype appears is presented in Figures 25 to 29, with each Figure depicting a different part of the functionality that would be supported by the configurator tool. It is important to display the developed functionalities shown in Figures 25-29 to show visual material and simple design is used to display complex technical terms. Those presented aspects add to the experience of the customer as he can create custom models and products, navigate easily in the application and understand easily the technical modularity terms.

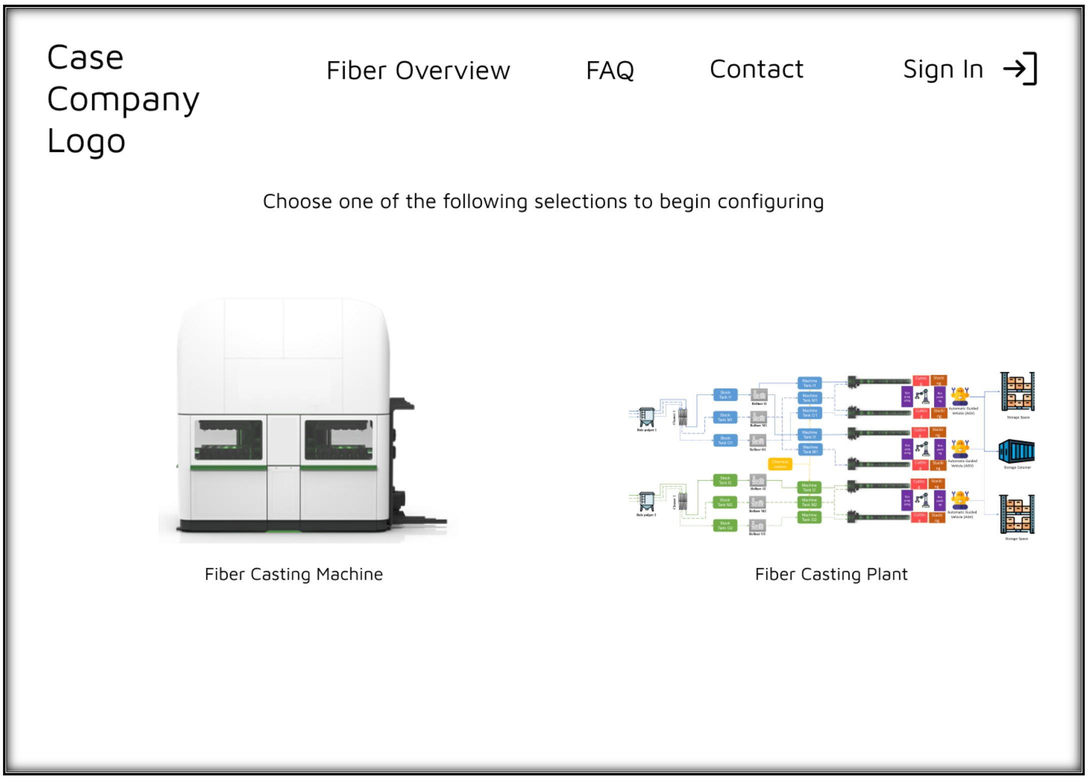

Figure 25: Home screen of the configurator tool high-fidelity prototype for the fiber-casting machine

Initially, Figure 25 displays the home screen with an option to choose between creating a fiber-casting machine or fiber-casting plant as well as additional options such as an "FAQ" about the two products – machine and plant. There is also a "Fiber Overview" page that further explains the fiber products coming from the machines as well as the technology used to create them. The "Contact" page enables users to quickly connect with a case company representative in case there are any inquiries. Finally, the "Sign In" page is available for both clients and case company employees providing them with different access.

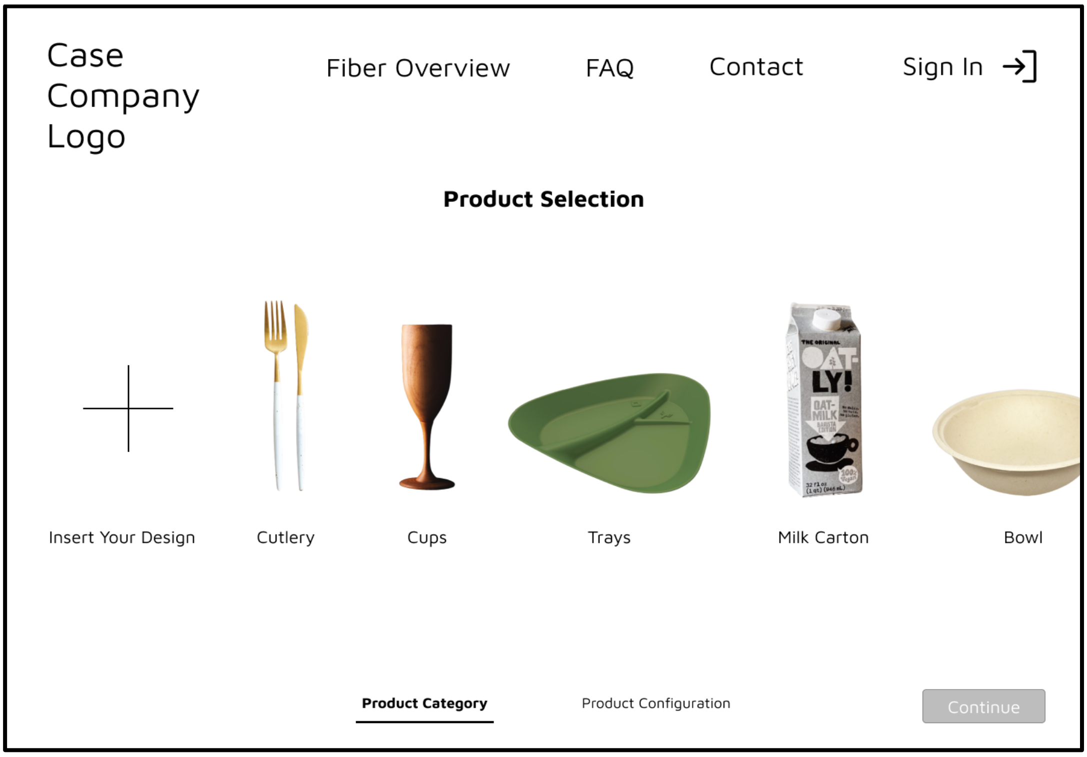

Figure 26: Product Selection screen depicting the possible products that can be created with the fiber-casting machine

Figure 26, indicates the type of products that can be made at the particular moment, based on case company pilot tests. It also provides the option of inserting a personally designed product with its production feasibility being tested at a later stage of the configurator tool.

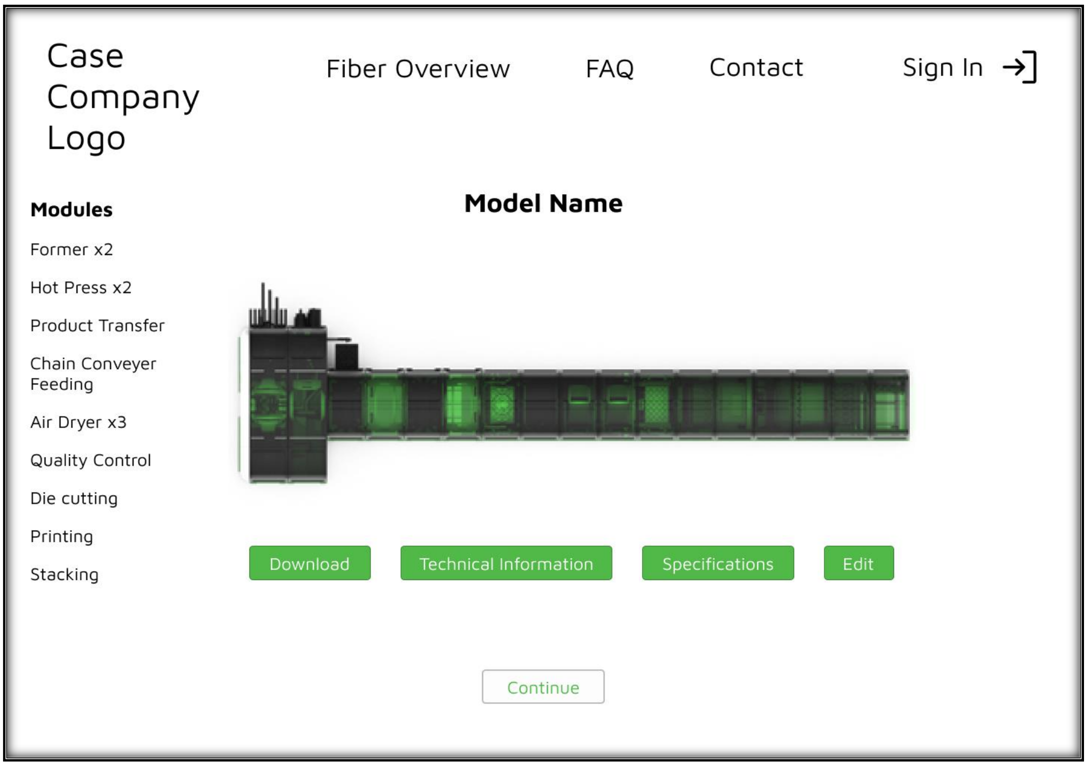

Figure 27: Machine View screen depicting the fiber-casting machine modules of the configurator tool high-fidelity prototype

In Figure 27, a possible fiber-casting machine view can be observed with its different modules, which can be added or removed depending on the end user's (client's) needs or desires. The client is then provided with the option of downloading the created model in a format of his own choice, which can be reviewed later. He also has the option of seeing technical information regarding the fiber-casting machine.

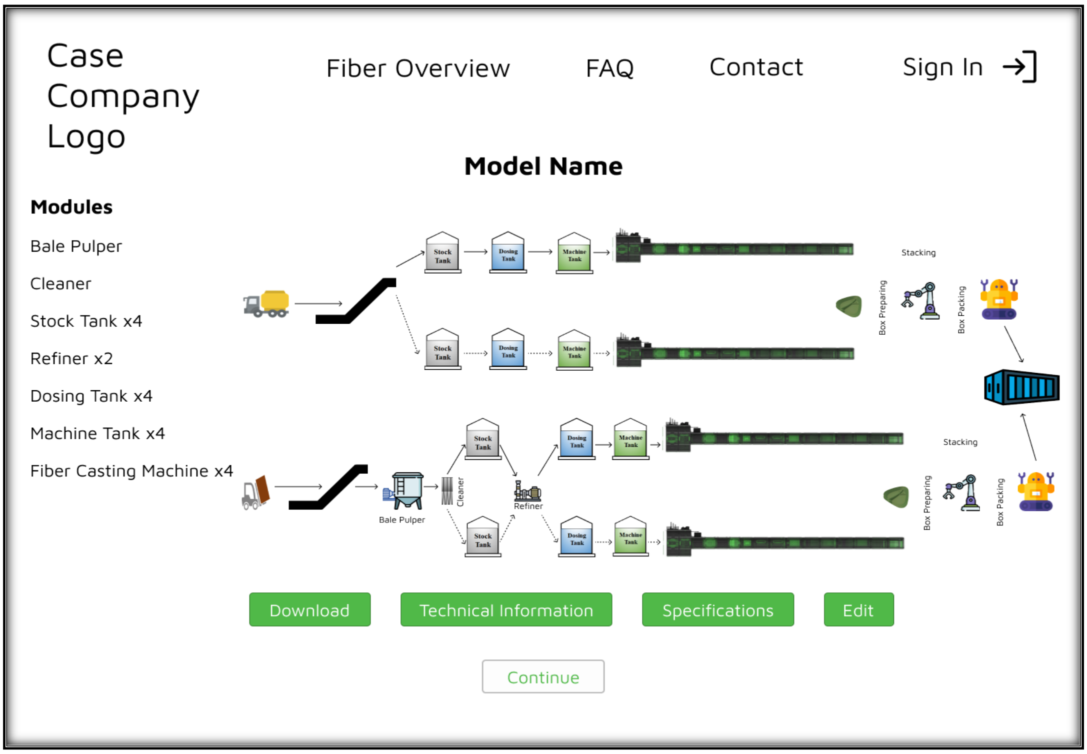

Figure 28: Plant view screen depicting the plant modules including the chosen fiber-casting machine

In Figure 28, a possible fiber-casting plant view can be seen including the fiber-casting machine model previously created. The client is provided with the option of adding or removing modules to create his own plant, which would correspond with his vision and meet his business needs.

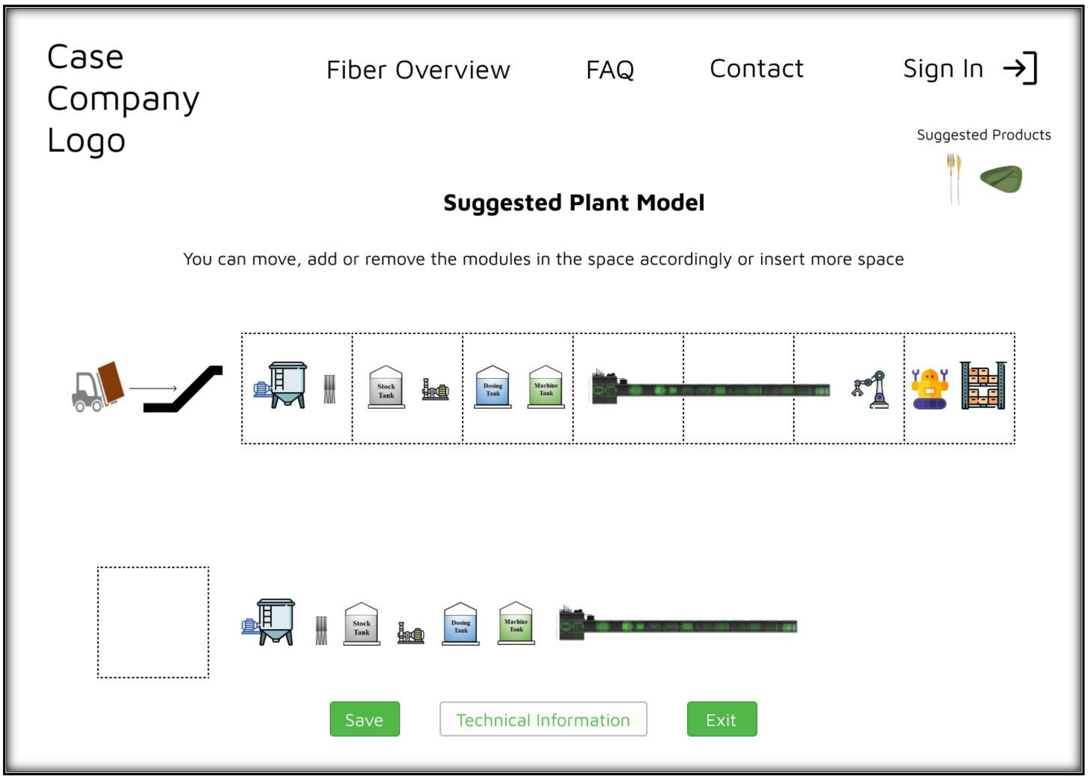

Figure 29: Suggested plant model with option of choosing modules

Finally, Figure 29 depicts a suggested fiber-casting plant model. This particular approach allows clients who are more technically minded to begin from a different point by starting with the creation of the plant. The system would then propose a fiber-casting machine, possible products that can be made and the layout for the plant.

4.5 Findings with respect to Research Questions

This section will discuss the responses to the research questions presented in Chapter 1 Introduction. The results to those questions came as an outcome of the artifacts created during this study.

The research questions that address the topic of modularity in fiber-casting technology are the following:

RQ1: What is the effect of visual sales material on the customer in the sales process of a newly developed fiber casting machine?

RQ2: Who the stakeholders are, their characteristics, and what do they consider to be valuable?

For the first RQ, the study discovered that the effect of visual sales material in the sales process would have a positive effect on customers who would want to purchase it. Positive effect equates to faster sales; the visual material would lead to conversations with salespeople of the case company more quickly, enabling the salespeople to have a better understanding of the customer's needs, which would speed up the sales process. Additionally, the configurator received positive feedback in terms of user experience, expectations and capabilities from the case company stakeholders. This is another indication that attests to the positive effect of the visual sales material.

However, during the research phase it was discovered that the customers would firstly need to understand what a fiber-casting modular machine is and what it is capable of and at the same time how the machine works as a part or module of the plant and what products it can create. Therefore, the fiber-casting machine and plant concepts would need to be presented and explained elsewhere to make them absolutely coherent which would not only assist the use of the configurator in the sales process but would also help in the generation of leads for the salespeople.

For the second RQ, the stakeholders identified during this study are the case company's salespeople, project managers, engineers, and customers. The salespeople, since they are the ones that are involved in the sales process of the fiber-casting machine and plant, will be engaged with the configurator tool that would produce leads for them. Also, as they are the non-technical stakeholders involved in this project, they would need to clearly understand how the technology and the product works to sell it successfully to end users - customers. The project managers and engineers of the case company are the ones who have prepared and promoted the actual fiber-casting machine and plant project forward for the pilot. Additionally, they understand the technical concepts of the product and can explain it clearly to salespeople and customers when needed. Finally, the customers, who are the ones that would interact with the configurator tool in the beginning part of the sales process, purchase the fiber-casting technology solution, and create products for their end consumers.

It was discovered during this thesis that the case company's salespeople consider straightforward and comprehensible sales material valuable, as it can help them with selling the fiber-casting machine and plant, reduce time between customer meetings, and generate referrals that would help to get more customers. For the project managers and engineers what was found to be extremely valuable was to have proper documentation of the fiber-casting machine and plant modules and process, as well as to be able to correctly interpret in a simple and coherent manner the technical concepts inside the configurator tool. Finally, what the customers consider valuable is the ability to easily understand the technical terms to purchase processes that are simple and quick.

In practice as mentioned in the Chapter 1. Introduction, the aim of the thesis is to define a sales tool that includes experiential aspects of technical concepts that includes ideas from the customer journey of the sales process. As soon as the aim is reached, we can begin with the creation and evaluation of the sales pitch and how the sales process will be monitored as described in the questions below, which will be answered in a future study.

What is the effect of a created sales pitch on the customer experience?

What are ways that the sales process can be monitored to improve both the customer and salesperson experience?

5 Discussion

This chapter presents the results, provides further suggestions for the case company to improve the validity and reliability of the configurator tool prototype as well as how to use this sales tool artifact to reach their business goals. Finally, this chapter includes the limitations present in this study and discusses the research questions.

Overall, the configurator tool prototype as seen in Figures 25-29 is highly adaptable to different clients, business goals and technical expertise. It was designed with the purpose of being used and understood by non-technical people so that it is highly usable and should help reduce meetings between the salespeople and the customers. Moreover, it follows the modularity concepts and topic of this thesis as seen in Figures 27-28 that depict the fiber-casting machine and plant.

5.1 Suggestions

As the study came to an end with the final presentation to stakeholders from the case company, there are a few suggestions regarding the developed artifact (configurator tool prototype) that the case company could take into consideration as it starts the development of its sales process for this product. These suggestions can be used to further expand on the developed sales tool artifact or as building blocks for another thesis that would seek to further research the sales process of modular technologies.

Firstly, the areas of "Fiber Overview" and "Specifications" in the configurator tool prototype would need to be extended to include useful and relevant content for the customers, as seen in Figure 30. The "Fiber Overview" section could include material on fiber technology and how it is used in the fiber-casting machine and plant. The "Specifications" section focuses on the detailed technical documentation regarding the fiber-casting and plant. It is an important section for customers as it explains on a deeper, more technical level what is included in those modular structures. Following the simplicity and ease of use of the sales tool artifact, it would be suggested that the "Specifications" area is designed in a similar manner.

After the feedback sessions and presentations to stakeholders it was communicated that the fiber-casting plant layout as seen in Figure 28 would need to be rearranged and presented in a more precise and clearer manner. Presently, the design includes a lot of information making it difficult to communicate the plant modularity concept to customers. Therefore, it would need to be further researched and developed with better visuals and more spacing between elements to maintain its simplicity and still be easily understandable by non-technical customers.

Moreover, from sessions with non-technical individuals, it was noticed that the fiber-casting plant part would need to be explained more plainly both inside the developed artifact prototype and during sales pitches. The reason being that it contains many technical terms that need to be understood prior to a customer knowing what they want to build and buy.

Subsequent to the implementation of the previous suggestions, it would be beneficial to present the sales tool concept to trusted customers to gauge their interest and gain insights on the performance of the artifact. Showing it to customers could help to make changes faster and identify which parts of the artifact still need further development.

Finally, there are some areas from the state-of-the-art information presented in subsection 2.2.3 Service Modularity and State-of-the-art that could be used to improve the experience of the sales process and customer experience of the fiber-casting machine and plant. As analyzed previously, Poeppelbuss and Lubarski (2019) developed a framework called Modularity Canvas with the purpose of providing insights into what a modular service will look like when it is launched. This framework could assist in the development of the customer experience of the modular product. The state-of-the-art research by Lubarski (2018), which developed a modular quotation process could help in the improvement of the sales process since it includes aspects of service modularity and is meant to be used in a B2B context. The method that was developed could be used alongside the configurator tool prototype to further reduce the quotation process and improve future customer experience by reusing previously developed quotation documents.

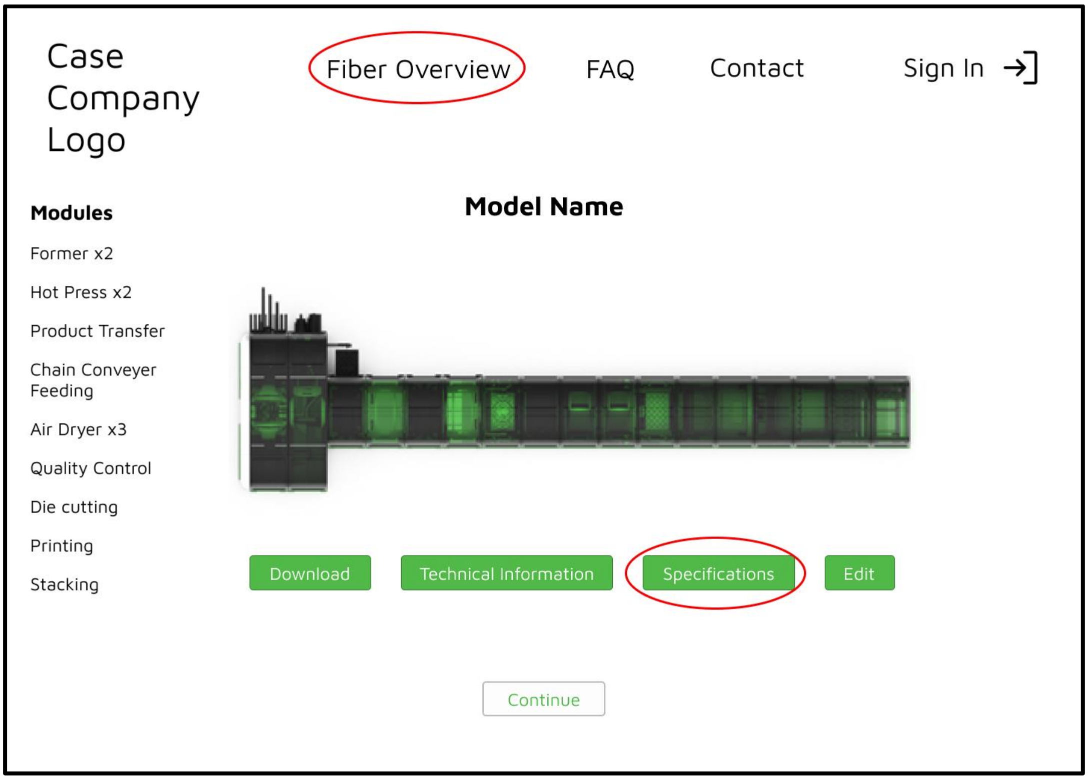

Figure 30: Focused suggestions for the case company on the configurator tool prototype

5.2 Limitations

This section discusses certain limitations that were present in this study that influenced its results and need to be taken into consideration when choosing to conduct future research.

Initially, this study required more time for research and evaluation of the developed sales tool artifact. The lack of sufficient time resulted in not being able to talk to different stakeholders (actual customers) and evaluating the performance of the configurator tool prototype.

Moreover, undertaking additional user testing with actual customers would be needed to test the design of the configurator tool prototype before it is developed and added to the current sales process. Doing that would increase reliability and validity of the developed artifact as this study's validity is lower due to the lack of interaction and discussion with actual customers. The arrangement of these meetings was difficult on the part of the case company to arrange due to lack of time and an inability to identify the appropriate people to approach. Therefore, internal sessions were arranged as it was much easier.

A final limitation which effected this study is that there was limited time to conduct the entire research since the initial focus of this study as discussed in Chapter 3 Methodology was quite broad, and it took time through interviews and meeting with the supervisor to narrow down and identify the focus area of this study.

5.3 Research Questions

This subsection discusses all the research questions in more depth including both suggestions and limitations that need to be taken into consideration.

For RQ1, the visual sales material developed in this thesis could be included in the sales process of the modular product following a modular quotation process from the Lubarski (2018) study. Additionally, the visual sales material would need to be tested with actual customers to identify its effectiveness and areas of improvement before implementing, which was mentioned in the previous subsections of this Chapter.

For RQ2, not all the stakeholders could be identified in detail due to the lack of access to actual customers. For a more thorough outcome, the characteristics of those stakeholders would need to be identified from the case company as well as what they consider to be valuable, which could be different in this modular product. Therefore, utilizing a Modularity Canvas and reusing sales material could help in the identification of what is valuable for the case company's end users.

6 Conclusion

This study presented how modularity concepts and service design can be used to create and explore experiential aspects of fiber-casting technology in the sales process. The study utilizing service design methods explored the sales process of developing modular products. Although it started from a wide area of research, during this study, it was narrowed down to the initial part of the sales process, which typically takes a substantial amount of time and extensive back and forth meetings with the potential customers.

The entire process from the initial stage to the development of the configurator tool was presented in Chapter 4 Results with an explanation of the methods used in this study included in Chapter 3 Methodology. In Chapter 3 Methodology, the various methods that were used such as customer journey mapping, semi-structured interviews, the interviews questions that were asked, how to analyze the qualitative data as well as the entire process were presented. In Chapter 4 Results, the results of the interviews are shown, which lead to the creation of the customer journey map and the narrowing down of the research to the idea of focusing on developing a configurator tool prototype. Also, it further discussed how the configurator tool was made through different versions of flowcharts, low-fidelity designs and wireframes that lead to the high-fidelity prototype.

The developed artifact of this study included concepts from machine and plant modularity with a focus on the simplicity of use and relevant understanding of these technical concepts by non-technical individuals. To enable this, the configurator tool prototype was developed through sessions with salespeople and engineers from the case company in conjunction with other thesis students that focused on the machine and plant modularity areas of the product.

As discussed in Chapter 5 Discussion, this study lacked interviews with actual customers that evaluate and provide direct feedback on the developed artifact. This is something that the case company would need to take into consideration before it begins implementing it in their sales process. The aim of the study was to define an improved understanding of the customer journey and the sales process with a corresponding tool to present the technical concepts in the sales process. The thesis contributed towards that through the configurator tool, which included ideas from the customer journey of the sales process as well as the simple definition and display of technical terms.

The first and second RQs were sufficiently covered through sessions with various stakeholders, though further research would need to be done by the case company. This research could include identifying the characteristics of their customers, what they find valuable in a modular product and talking with them to understand the effectiveness of the configurator tool, which could greatly reduce the time for the sales process.

To put those research questions into practice, we can create a sales pitch for the sales process and identify ways to monitor the customers and salespeople's experience. This is an area where future work can be done through another thesis or research from the case company.

Finally, the developed artifact received adequate and useful feedback from the case company stakeholders. However, further development and research with their customers would need to be undertaken by the case company at a later stage to further improve the sales tool. This development could focus on explaining, through simple terminology, both the technical modularity concepts presented as well as the specifications of the fiber-casting machine and plant.

Overall, this project presents concepts and ideas, such as modularity and service design, which more traditional companies could adapt in their sales process. The case company would need to take into consideration further modularization ideas presented in the state-of-the-art and trial them with their customers. The study sufficiently achieved the creation of a sales tool that incorporated experiential aspects of fiber casting technology into the sales process by taking into account the current sales process, feedback from stakeholders, modularity terms and service design methods.

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