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# **Business Model Product-Service System in the Context of Digitalization: Case Company X**

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Abstract

Digitalization has revolutionized the way companies operate, both in terms of the products they offer and the way they serve their customers. It has also made it possible for customers to receive information and services through various channels, including the internet, telephone, and mobile devices. In order to remain competitive in today's economy, organizations must embrace digital transformation and find ways to optimize their product-service systems.

As digitalization continues to sweep through businesses, it is important for companies to keep up with the changes. This means embracing new technologies, optimizing processes, and increasing sales. In order to do all of this, it is necessary to have a well-developed product-service system. A good product-service system not only provides excellent customer service, but also keeps track of customers' data so that they can be offered the best possible experience. The thesis aim to help the readers have basic knowledge of the business model product-service system and digitalization in the case company.

This thesis uses qualitative research as the main method of analysis and data collection. Semi-structured interviews were conducted to understand how the company is adapting and developing its business model. The result of the thesis is to help the readers understand background information on the research topic and to give more in-depth information on how the business model PSS is applied in reality by the case company. Based on key findings, businesses can consider using PSS as a tool to increase their competitiveness.

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### Appendix 1 Interview Questions

# 1 Introduction

## 1.1 Background

Since the 1980s, manufacturers have shifted from selling single products to providing integrated goods and services. The scope of providing manufacturing services is changing at an unprecedented rate in the Industry 4.0 era, as a result of quick advances in digital technologies like information and communication technology (ICT), big data, and Internet of Things (IoT) connectivity, such as the ideas of "Smart connected products," "Smart Service," and "Product-as-a-Service." They are altering how businesses communicate with their clients and the entire value chain. (Li, Rich, Found & Kumar 2020.)

Digital innovation is transforming industrial paradigms toward a product-service system in the era of Industry 4.0. From a business perspective, a product-service system (PSS) is nothing new: companies have long been offering customers the opportunity to acquire products and services together. However, there is still a lack of understanding of what product service systems are and how they can be designed. Digitalization is changing the ways in which companies produce and market these systems.

The author got the opportunity to engage in a project related to PSS to develop a concept for Company X. As a result of the project, the topic piqued her interest, and she decided to write a research thesis on how the company uses the PSS business model in the context of digitalization.

## 1.2 Case Company X

With over 145 years of history and expertise, Company X is a modern, internationally established family business that relies on close touch with customers and technical innovation. With roughly 400 employees, the company is now one of the world's top manufacturers of Instrumentation and Double

Block & Bleed Valves. Company X is the global market leader in the specialty Industrial Valves for Large-Bore Diesel Engines, such as those used in ship engines and power generation. Company X maintains an international network of subsidiaries and partners in over 20 countries to ensure that its clients receive technical know-how from the company all over the world. (Company X 2022.)

Sustainability also plays a big role at Company X, which has set itself the goal of designing and continuously improving its products, processes and production methods in ways that conserves resources and keeps emissions as low as possible. The company uses energy and water saving technologies and is developing strategies to prevent and recycle waste. (Company X 2022.)

### **1.3 The aim of the thesis and research scope**

This thesis aims to get an overview of how companies nowadays apply new digital technologies to their business models, in this case, Company X and PSS. Definitions of the PSS business model, digitalization and many digital technologies will be provided. In addition, the thesis would provide not only readers but also the author an insight into what PSS is and how it could be implemented to increase competitiveness in today's business environment. More importantly, with the case company analysis, readers can get familiar with and understand that digitalization is a significant source of transformation in the current economy.

This thesis analyses how digital technologies are applied on the business model PSS. As the subject of digitalization is so broad and encompasses such a wide variety of themes and areas of attention, it is critical to establish the scope of the study early in the thesis writing process. The topic is narrowed to focus on the application of digital technology as a support tool in the business model to create the company's competitiveness. Therefore, the research will not address technical issues or their remedies.

This thesis' findings are mostly based on interviews with stakeholders at the case company. Therefore, the scope of the thesis is confined to the company case only. However, the findings might be useful for organizations considering implementing a new business strategy. The scope of the thesis is summarized in the following questions:

How is the performance of digital technologies at the case company?

What are advantages and disadvantages of applying new digital technologies on a PSS at the case company?

How will this business model PSS help the company increase competitiveness?

#### **1.4 Research Method**

The theoretical framework and findings of this research will be further supported by the utilization of both primary and secondary data. Secondary data has been gathered by the author from published papers. The major source of primary data was then collected from the information of semi-structured interviews.

#### **1.5 Thesis outline**

The thesis consists of six chapters. The first chapter introduces the thesis background, research purpose, research method and the case company. Chapter 2 provides the knowledge base connected to the research topic, including a business model, products, services and a SWOT analysis. Chapter 3 defines key terms and theories which give a solid background of PSS, its elements, benefits and limitations. Chapter 4 overviews digitalization and examples of digital technologies. Chapter 5 analyses and explains data collected from the qualitative research. The SWOT analysis will also be mentioned in this chapter to show the pro and cons of applying PSS in the context of digitalization. The final chapter is the conclusion.

## 2 Theoretical Framework

### 2.1 Business Model

The phrase "business model" was first used to map business processes that were recorded as part of the introduction of data processing systems in the information, communications, and technology sector (Doleski 2015, 3). Since each researcher is investigating the business model in accordance with particular study goals, there is no agreement among them on this abstract concept. As a result, there are several approaches to understand the business model. It is obvious that business models have a significant impact on a company's ability to compete and succeed. According to Afuah (2004), in order to develop better customer value (low-cost or distinctive goods) and place itself in a position to appropriate the value, a corporation employs its resources to carry out certain activities. These activities are referred to as a business model.

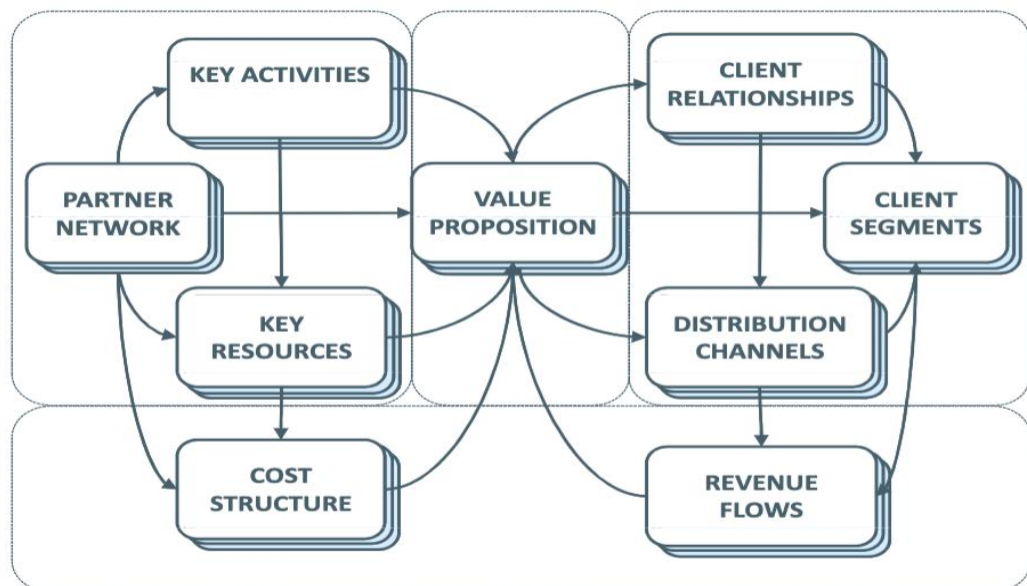


Figure 1. Business Model Ontology Canvas (Fritscher & Pigneur 2009, 29).

The technical inputs and economic outputs of a business are frequently connected through the use of a business model (Blaschke, Demel & Kotorov 2021). A business model must have asset of nine building blocks in order to achieve it (Figure 1). A business model is divided into four perspectives:

- Activity Perspective

Key Activities: A company must carry out a number of critical operations in order to establish a business model. These activities can be carried out by businesses directly or through a network of external partners. (Kleef, Noltes & Spoel 2010.)

Partner Network: includes organizations engaged in business partnerships. In order to build new complementary competitiveness, partners collaborate to share, enhance, and complement each other's resources (Kleef, Noltes & Spoel 2010).

Key Resources: also referred to as the ability of the business to deliver its goods and services. If an organization wants to succeed in a particular industry or line of business, it must possess a set of core competences. These assets provide the company with a competitive advantage. (Kleef, Noltes & Spoel 2010.)

- Product/Service

Value Proposition: a statement of the value that the company's product/service will provide to the customers. This will attract customers and encourage them to pay for the goods or service. (Osterwalder 2010.)

- Customer Perspective

Client Segments: are the primary target market for the firm and via their purchasing decisions. These customers determine whether the business can survive (Osterwalder 2010).

Distribution Channels: the channels through which we interact with our customers and deliver our value propositions (Osterwalder 2010).

Client relationships: A method of interacting and connecting organizations and customers. Customer relationship management is critical in the business model for meeting customer expectations. Customers in various segments will have varying expectations of the business's relationship with them. (Osterwalder 2010.)

- Financial Perspective

**Cost Structure:** The cost incurred by businesses in order to operate a business model (Lam 2019).

**Revenue Flows:** the stream via which the company will generate revenue from customers through value creation and customer interaction activities. These revenue streams are generated by one or a few customer segments who are prepared to pay for the value they receive from the company.

(Lam 2019.)

## **2.2 SWOT Analysis**

The SWOT analysis, which stands for strengths, weaknesses, opportunities, and threats, is a method used in business strategy to evaluate how a company measures up against its rivals. A SWOT Analysis may be used on a personal level, outside of business, to evaluate a person's position in relation to their competition. (Teoli, Sanvictores & An 2022.) Therefore, a SWOT Analysis is an essential tool for situational analysis, assisting managers in identifying organizational and environmental factors (Gürel 2017). The aim of the SWOT analysis is to determine for a corporation the internal strengths and weaknesses that are relevant to reacting to external opportunities and threats in certain circumstances (Mariani 2017, 39). Additionally, it helps an organization's understanding of which of its resources and competencies are most likely to be sources of competitive advantage and which are least likely. The organization may select the best strategy based on the results of the SWOT analysis. (Gürel 2017.)

Four sections are divided into two dimensions as part of the SWOT analysis. It consists of four components: "strengths," "weaknesses," "opportunities," and "threats." Opportunities and threats are external factors and attributes of the environment, whereas strengths and weaknesses are internal factors and attributes of the organization. (Gürel 2017.)

Strengths	Weaknesses
Characteristics that give it an advantage over competitors in the industry.	Characteristics that place at a disadvantage relative to others.
Opportunities	Threats
External environmental factors that have positively impacted organizations' competitive advantage.	External environmental factors that might be detrimental for organizations.

Table 1. The Components of SWOT Analysis, based on Gürel (2017).

Opportunities and strengths are helpful for accomplishing a company's goals. They are advantageous for organizations. Threats and weaknesses might prevent the company from achieving its objectives. They are not beneficial to organizations. Analyzing the internal strengths and weaknesses of the company as a result of the internal environment, and the opportunities and threats presented by the external environment serve as the foundation of any successful choice of strategy. In other words, the manager's job is to attempt and "fit" the analysis of internal and external factors, balancing the organization's strengths and weaknesses in light of environmental opportunities and threats. (Gürel 2017.)

### 2.3 Products

According to Philip Kotler, “A product is anything that can be offered to a market for attention, acquisition, use or consumption. It includes physical objects, services, personalities, place, organizations and ideas.” It refers to anything that may be provided to a market in order to meet the customer's needs or wants. A product has many dimensions beyond just its look. In fact, a product contains multiple layers, much like a "onion," and each layer adds to the overall appearance of the product. Philip Kotler states that the products with the best quality, performance, and features will be preferred by consumers. (GKToday 2016.)

Customers will make a purchase decision based on the perceived value of a product. They are only satisfied if the actual value is equal to or higher than the perceived value, which is measured by how closely actual product use matches the perceived value at the time of purchase. (CGMA 2022.) They will be dissatisfied if the product's actual value is less than what they expected.

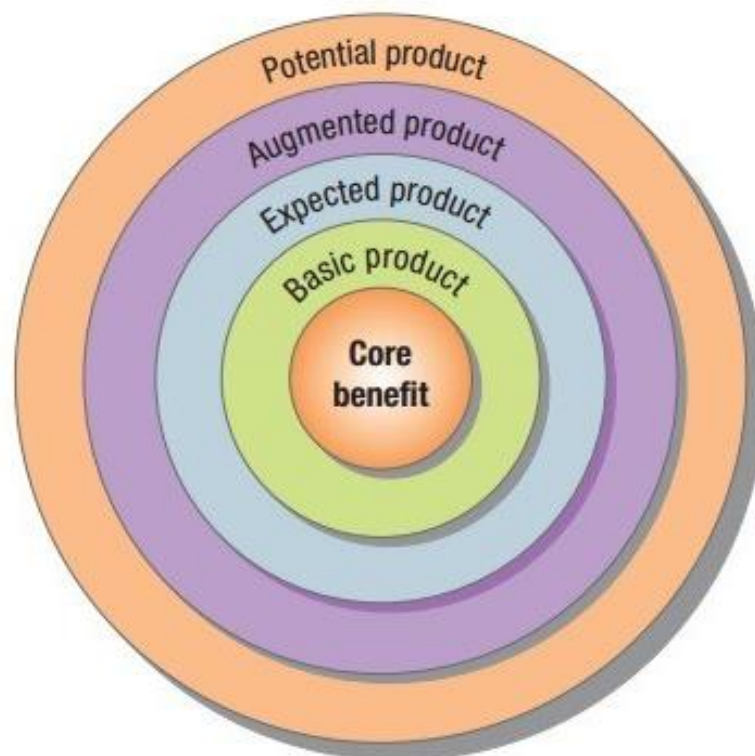


Figure 2. Kotler Five-Level Product Model (Kotler & Keller 2011, 326).

A model presented in Figure 2 by Philip Kotler recognises that consumers have five levels of needs, ranging from functional or core needs to emotional needs. The model also makes the assumption that the product is only a tool for satisfying the varied needs or desires of the consumer. (CGMA 2022.) The five-level product model shows the various needs that customers have for a product, including: core benefit, basic product, expected product, augmented product, and potential product.

- Core benefit: a basic need or desire that customers satisfy when they purchase a product.
- Basic product: the basic version of the product only has the features required for the product to operate.
- Expected product: features that customers expect to receive when they purchase a product.
- Augmented product: all the extra features that distinguish a product from its competitors and exceed customer satisfactions.
- Potential product: encompasses all future augmentations and transformations that the product may go through.

The main benefit of Kotler Five-Level Product Model is that it helps businesses in finding out how to meet customer needs and wants while differentiating themselves from competitors.

## **2.4 Services**

According to Kotler and Keller (2011), “Services are intangible, inseparable, variable, and perishable products that normally require more quality control, supplier credibility, and adaptability. Examples include haircuts, legal advice, and appliance repairs.” In contrast to tangible products that we can touch or handle, services are the non-physical, intangible parts of our economy. There is no transfer of ownership when a business offers a service and the customer pays for it. We are unable to ship or store a service. They only exist

while the provider is supplying and the customer is consuming. Service providers help customers by utilizing their expertise, ingenuity, experience, and skills. (MBN 2022.)

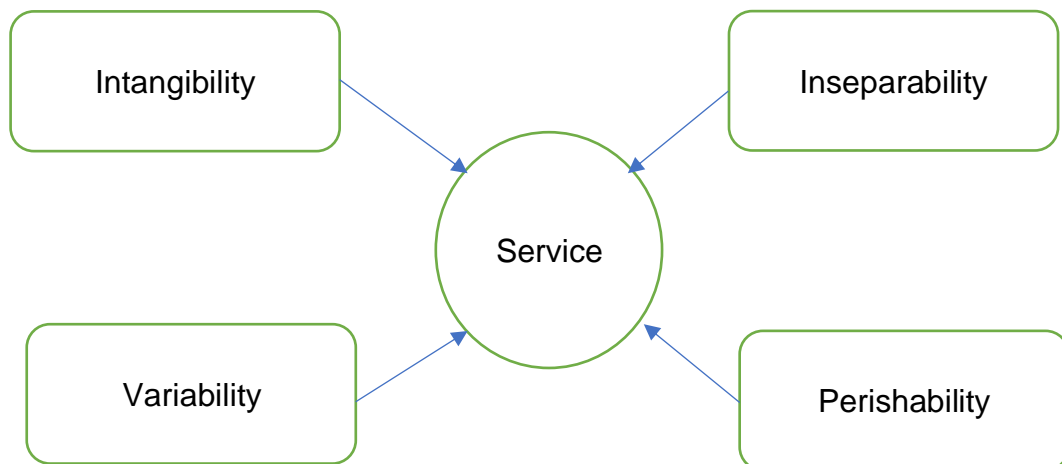


Figure 3. Four service characteristics based on Kotler and Keller (2011).

There are four characteristics of services that distinguish them from physical goods (Figure 3).

**Intangibility:** Services are not perceived by customers through their senses. Therefore, services are difficult to observe and evaluate (Kozslowska 2016).

**Inseparability:** Both the supply and consumption of services occur simultaneously. For example: a haircut only exists while somebody is cutting hair (Xu & Ilic 2014).

**Variability:** It is challenging to evaluate service quality since it depends on so many variables, including the provider, the client, the time, and the location of the service delivery (Parry, Newnes & Huang 2011).

Perishability: Services cannot be kept for later use. The services will permanently vanish after delivery by the service provider (Kotler & Keller 2011).

### **3 Overview of PSS**

#### **3.1 PSS definition**

The majority of companies today provide a combination of products and services rather than just one type of service or product. Creating a pure product without any extras or a pure service without any physical components is getting increasingly rare. (Hanski, Kunttu, Räikkönen & Reunanen 2012.)

According to Goedkoop's core concept of the product-service ecosystem (1999), it is a system made up of goods and services that entirely meet the needs of consumers. This crucial element is made up of a combination of products and services. The networked distribution of both products and services is made possible through a business model known as PSS. It is now conceivable, according to PSS models, to combine the consumption of products and services to achieve environmentally friendly results. (Kollmuss & Agyeman 2002.)

Customers are driving the Product-Service System (PSS) strategy because it better meets their demands compared to traditional methods. Meeting the individual needs of customers is more crucial in a service-based economy than relying on mass production and consumption. Customers are more concerned with product availability or capabilities than they are with purchasing actual things. The advantages of greater usability benefit both the manufacturer and the customer. In terms of risk and unpredictability, traditional services are no longer applicable. (Vasantha, Roy, Lelah & Brissaud 2012.)

The PSS model was created with function, added value, and service-based research in mind.

Customers, throughout the purchase decision process, are not only seeking the major aspects of the product they need, but also the additional benefits that the product or service may provide. Businesses that reach out to their customers through services rather than actual products might fulfill more customer needs while reducing manufacturing costs. As a result, PSS should be outlined as a system of products, services, infrastructure and networks created to be competitive, meet customer needs, and be less harmful to the environment than traditional business models. (Goedkoop 1999.)

According to customer needs and desires, PSS refers to the transition of customers away from purchasing items and towards purchasing system solutions and services that might have a positive influence on the environment. For this, higher levels of client interaction and education are required. (Mont 2001.)

PSS calls for more responsibility from manufacturers and service providers for the whole product lifecycle, early consumer involvement in PSS design, and the development of a closed-loop system. (Mont 2001.)

### 3.2 PSS elements

Figure 4 provides a list of major PSS elements:

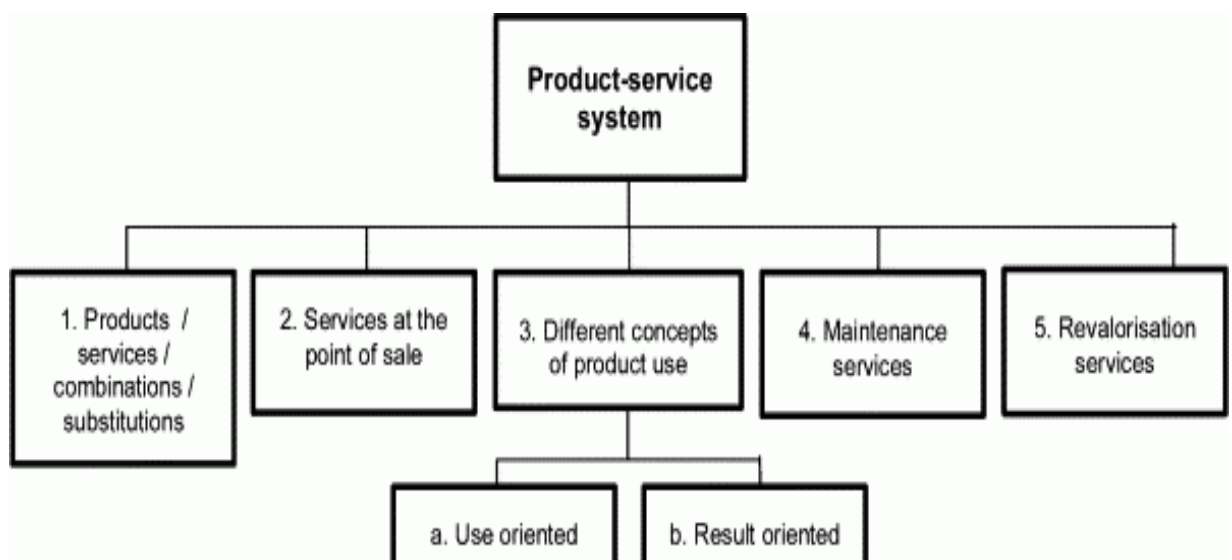


Figure 4. Classification of a product-service system (Mont 2001).

- A PSS might consist of products, services, or a mix of the two. Products substituted by services is a trustworthy list with few real or consistent instances, because any service, even physical, requires the input of energy or materials. (Mont 2001.)
- At the point of sale, services include in-store customer service representatives, customer financing options, product usage guidelines, and of course marketing. (Mont 2001.)
- Different concepts of product usage fall into two categories: use-oriented, where the usefulness of the product is extracted by the user, and result-oriented, where the usefulness of the product is extracted by the utility provider for the user. (Mont 2001.)
- Maintenance services include product maintenance aimed at extending the product life cycle through maintenance and modernization. (Mont 2001.)
- Revalorisation services include offers aimed at closing the product's material cycle through take-back, the reuse of used parts in new products, and the recycling of materials where reuse is not possible. (Mont 2001.)

According to traditional business models, after purchasing a product, the customer is in charge of monitoring its use, offering assistance, and ensuring that it is handled properly. Contrarily, with the PSS model, the manufacturer makes money from the consumer using the functionality offered. Therefore, ownership of the product may not necessarily pass to the consumer, and it may still be the manufacturer's responsibility to maintain it during its lifecycle and dispose of it properly. (Baines, Lightfoot, Evans, Neely, Greenough, Peppard, Roy, Shehab, Braganza, Tiwari, Alcock, Angus, Bastl, Cousens, Irving,

Johnson, Kingston, Lockett, Martinez, Michele, Tranfield, Walton & Wilson 2007.)

The most common categorization divides the PSS into three types: product-oriented services, use-oriented services and result-oriented services, as shown in Figure 5.

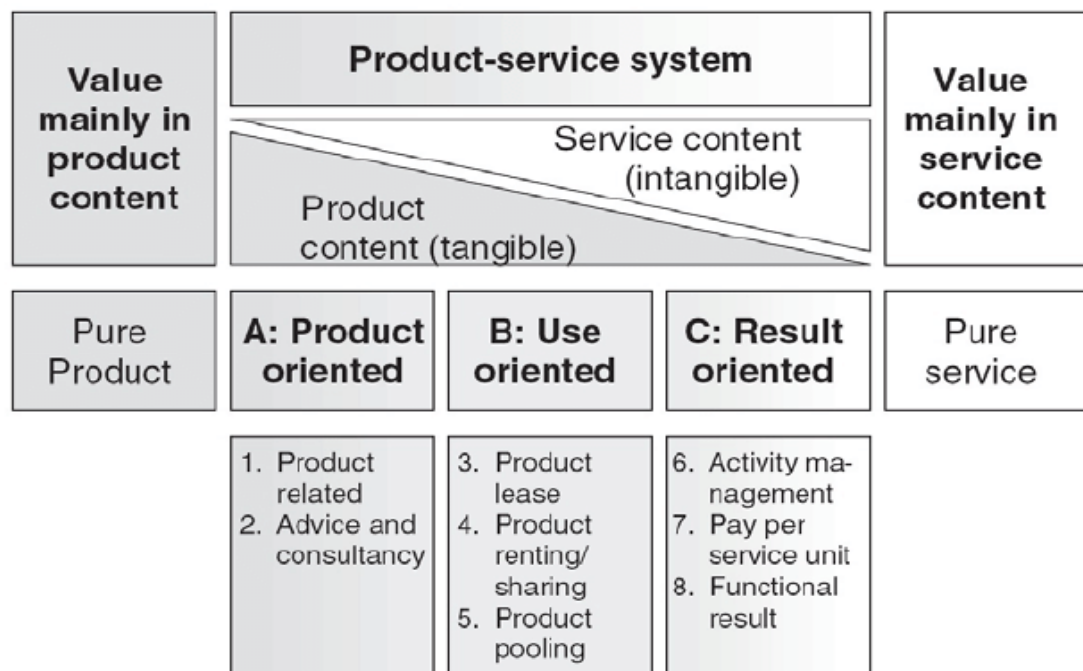


Figure 5. Three types of PSS (Tukker & Tischner 2006).

- Product-oriented: refers to the conventional sale of a product, in which the buyer retains ownership of the product even when certain associated services are also provided. An illustration is after-sales support to guarantee product performance and longevity (maintenance, repair, reuse, recycling, training and consulting). The company is motivated in this instance to use PSS in order to reduce usage expenses throughout the course of the product life cycle. (Barquet, Cunha, Oliveira & Rozenfeld 2011.)

- Use-oriented: The producer who sells the product's usage or functionality, is the owner of the product (e.g. rental, sharing, etc.). To maximize product use, fulfill demand, prolong product life, and reuse materials, the company has motivation to develop a PSS in this situation. (Barquet, Cunha, Oliveira & Rozenfeld 2011.)
- Result-oriented: Selling a capability or result is more important here than selling a specific product. Companies provide a range of personalized services; when the result is transformed into a product, the PSS provider retains ownership, and the consumer just pays for the result. (Barquet, Cunha, Oliveira & Rozenfeld 2011.)

Companies offer capabilities or results rather than tangible goods in result-oriented PSS. The product is given more prominence in use-oriented PSS. Use-oriented PSS providers sell the capacity to access and use certain products, as opposed to result-oriented PSS. Finally, in product-oriented PSS, the intangible product is sold, and its ownership is changed. Then, further services are offered to guarantee the product's durability and proper performance. (Diehl & Christiaans 2015.)

### **3.3 Benefits and Limitations**

The benefits of PSS considering the internal factors of organizations, particularly economic organizations, are frequently highlighted in many publications. Mahut, Daaboul, Bricogne, Eynard (2017) and Annarelli, Battistella and Nonino (2016) cite more of the internal benefits of PSS. Because services are more difficult for rivals to imitate, differentiation from competitors is the most frequently cited internal benefit. The majority of them take into account the potential financial benefits of PSS (such as "raising profit margins") (Moro, Cauchick-Miguel & Mendes 2020). Both the company and the customer benefit from the PSS concept. According to Baines et al. (2007) and Mont (2001), the main advantages of each are:

Customers benefit from PSS because they have more alternatives in the marketplace, such as maintenance and repair services, numerous payment schemes, and the option of a variety of product usage plans that best satisfy their ownership responsibilities. More personalized, higher-quality offers (from product/service and delivery/offering) benefit customers. Essentially, the service component creates unique product and service combinations that are better suited to changing requirements and conditions. Consumers may be relieved of responsibility for a product that is owned by a producer during the course of its life. Through PSS, consumers may quickly learn about the environmental attributes of products and how they can contribute to reduce the environmental impact of their consumption.

For companies, understanding PSSs provides the opportunity to identify new market trends, significant market opportunities, and competitive adjustments when environmental restrictions influence production and consumption habits. The PSS concept encourages incremental innovation while also having the potential to provide financial benefits. It may also increase the overall value offered to customers by enhancing service aspects and providing access to data regarding product performance during the usage phase.

PSS has limitations as well: in terms of business management, it requires a significant shift in how organizations view themselves and their industries. Businesses must match this business model with their corporate strategies. Almost every aspect of company operations, including purchasing, accounting, management, marketing, and more, might see significant changes. Depending on the company's original status, the concept may require organizational adjustments. The influence of PSS principles has to be investigated in order to determine which functions could be affected, to what extent, how easily businesses can transition, and what skills are needed. (Shehab and Roy 2006.)

## **4 Digitalization**

Innovative digital networked products produced by digitalization have cleared the door for new services and business models. A few studies that looked at

how business models were impacted by digitalization described how social media and big data were used to innovate new business models. These came to the conclusion that these elements enhanced business performance. Online platforms and social media are examples of situations where supply and demand could collide. Several recent studies have looked at the significance of digitalization in the shift to a circular economy and circular business models. Research has been done on how businesses promote circular strategies by using digital technologies. (Tunn, Bocken, Schoormans & Hende 2020.) For example, Ingemarsdotter, Jamsin, Kortuem and Balkenende (2019), come to the conclusion that while some companies use the Internet of Things to extend the life of their products, relatively few do so to help shorten material and product cycles.

Other factors influencing the employment of digital technology in PSS include environmental sustainability and close customer relationships. Digital technology, for example, may benefit the environment by:

1. mechanical component simplification, replacement or upgrade by software via remote control, and
2. minimizing physical commodities transportation. For example, additive manufacturing can give PSS suppliers new ways to produce spare parts closer to end customers.

Because digital technologies enable manufacturers to develop connectedness and interaction, as well as capture customers' latent requirements and disclose potential prospects for future value co-creation, they also support new types of customer intimacy, such as value co-creation. (Li, Rich, Found & Kumar, 2020.)

#### **4.1 Internet of Things (IoT)**

Kevin Ashton, the British technology pioneer, first introduced the term "Internet of Things" in 1999 to define a system in which actual things may be connected to the Internet through sensors. The first smart device was a Coca-Cola vending machine at Carnegie Mellon University in the early 1980s. Students were able to connect the machine to the internet by developing

software that allowed them to "check the status of the machine and determine if there is a cold drink waiting for them; and so the students can decide to take the trip down the machine" (Tohanean & Vasilescu 2019). The term "Internet of Things" is now frequently used to refer to scenarios where a variety of commonplace devices, sensors, and items are connected to the Internet and have access to computational power. With the potential to generate billions of dollars worth of value for business and the global economy, IoT is a revolutionary, completely linked "smart" world of development, efficiency, and opportunity. (Singhania 2015.)

Digital business models are increasingly utilized in actual industries. The division between the physical and digital industries has been abolished. The Internet of Things, which provides potential hybrid solutions that integrate physical products and digital services, is the driving force behind this revolution. (Fleisch, Weinberger & Wortmann 2014.)

The global market for the Internet of Things is predicted to grow 18% in 2022, and McKinsey Global Institute research indicates that the factory setting, which includes standardized production environments in manufacturing, will account for the majority of the potential economic value from the IoT, or about 26%, in 2030. IoT-based business models, especially in the manufacturing industry, have been steadily expanding over the last few years. (Hasan 2022.)

Simply, IoT is the capacity to link everything around us to the Internet with intelligent behavior, while also taking into consideration the presence of some degree of autonomy and privacy, starting with (i.e. Machines, Devices, Mobiles, and Cars) even (Cities and Roads). IoT generally has three primary requirements: first, a shared knowledge of users' circumstances and the apps they utilize. Secondly comes software structures and ubiquitous communication networks for the collection and processing of contextual information. The third requirement is IoT analytical tools for the development of autonomous and intelligent behavior. (Hassan, Ali & Badawy 2015.)

## 4.2 Industry 4.0

Because Industry 4.0 describes itself as a digital transition founded on earlier industrial revolutions, it also draws on its past to inform its current thinking. As an illustration, the second industrial revolution made models more efficient, less expensive, and quicker. The third industrial revolution has been dubbed the era of computers, computation, and automation. It is predicted that the fourth revolution, which is primarily driven by Industry 4.0, will alter how we live, act, work, and conduct business. Additionally, Industry 4.0 can be defined as the "smartnessization" of the processes involved in product and service creation, production, and distribution. Consequently, it is anticipated to develop into more than just the digitalization of processes. (Lugnet, Ericson & Larsson 2020.)

The key components of Industry 4.0 are:

- Less time to get to market.
- Economic feasibility to provide customization on demand or in a single-unit batch.
- Flexibility and agility in product development.
- Accelerated decision-making through decentralization.
- Development that is both economically and environmentally sustainable. This is achieved by converting industrial-era products and processes to ones that are information and knowledge-oriented.

These characteristics are seen as motivating factors for new PSS business models with altered development logic. Figure 6 illustrates three layers of abstraction to show how a digital platform or service might reflect the real world in a digital one. (Lugnet, Ericson & Larsson 2020.)

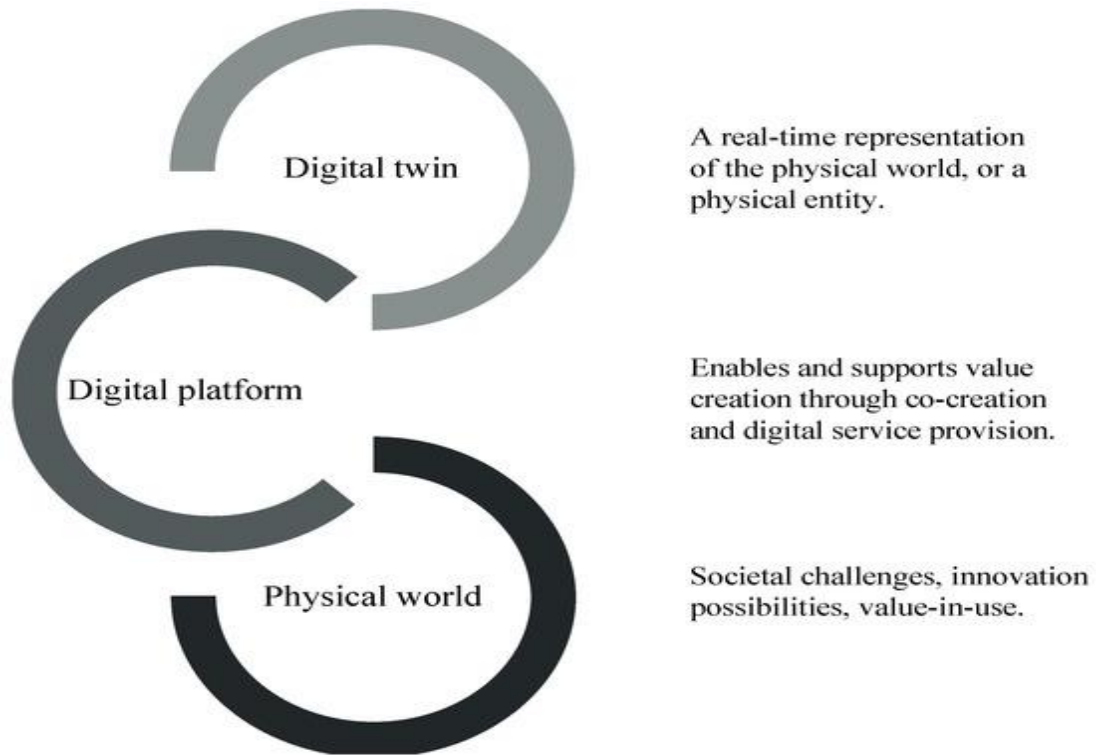


Figure 6. Three abstraction levels for Industry 4.0 (Lugnet, Ericson & Larsson 2020).

### 4.3 Digital Twin

A digital twin is a representation of a physical product, service, or procedure in the digital world. To create the digital representation of the current product, service, or process, it makes use of data modeling, virtual reality, and augmented reality. This technology uses these copies to forecast how well the product, service, or process will work and to offer updates on its status and health. IoT, condition monitoring sensors, and algorithm analysis are all included into digital twins to enhance their output. (TWI Global 2022.) Different sectors employ digital twin systems, some of which have significant advantages throughout manufacturing. Atos studies show that this technology offers a higher level of product quality and can result in savings of up to 20% through decreased waste. The next major sector that stands to benefit greatly from digital twin is manufacturing. The twin's existence before its physical counterpart is very helpful to engineers. Engineers are free to test out their different ideas. Additionally, twins might make product customisation easier. A digital twin's objective is to forecast how a product or manufacturing procedure will function.

These applications can also be integrated with IoT (Internet of Things), AI, or analytics tools to boost productivity. The Digital twin, which can duplicate a product's production process, helps businesses in testing items before they are released to the market. (A4BEE 2022.)

The use of digital twin technology has a number of advantages, including the ability to provide feedback on a product that is still under development in order to help it improve, as well as the ability to create a digital prototype and test it as if the final product had already been built. By doing so, the number of issues with the product are reduced, and the product can enter the market more quickly, thus lowering the cost of materials and labor for maintenance. The constant monitoring of machines and components' state results in an overall increased dependability. It also reduces the danger of unplanned failure and downtime, which means objectives are not affected or missed as a result of unforeseen maintenance or repairs. One drawback of this technology is that it could make the application for which a business has invested in it too complex. Some applications, such as the previously stated preventative maintenance, simply do not call for this degree of complexity and might be carried out in a more economical manner. (TWI Global 2022.)

## **5 Findings**

This chapter presents research results by presenting the major findings from the author's qualitative research and the author's participation in the project with Company X. Overall, the research objective was accomplished because all research questions were fully addressed in accordance with the research design.

### **5.1 The current status of Company X**

Currently, the company is planning to go in the direction of "valve as a service". The company started thinking about the PSS business model with the development of a Digital Valve Kit and renting out their valves in the future. The

service around the valve, which is more important than simply the valve itself, ought to make a difference. Although there are many rivals in the market, the company's primary goal is to increase profits rather than to remain competitive. Customers do not have to worry about maintenance when renting a valve from the company because it is all handled. Due to the company's desire to raise customer satisfaction, this is a significant benefit for them.

A digital product pass that has already been implemented, helps customers access the data and order maintenance easily with a scanning barcode. Company X could consider adding a new tool (QR code scanning provided by a startup firm) where it has an inside service assistant taking care of issues whenever Company X files tickets. Digital twin technology is used by Company X on their valves as shown in Figure 7 to test new products and to keep track of the condition of current operating valves. This gives them a ton of information they can use to present their upcoming products to potential customers. The use of this technology with their valves enables operators to more readily evaluate a valve's condition and identifies when adjustments are required to improve the condition. Additionally, it provides early warning signs to technicians and maintenance engineers of when a repair or maintenance may be required to prevent problems. Since this technology is new, not all rivals are using it.

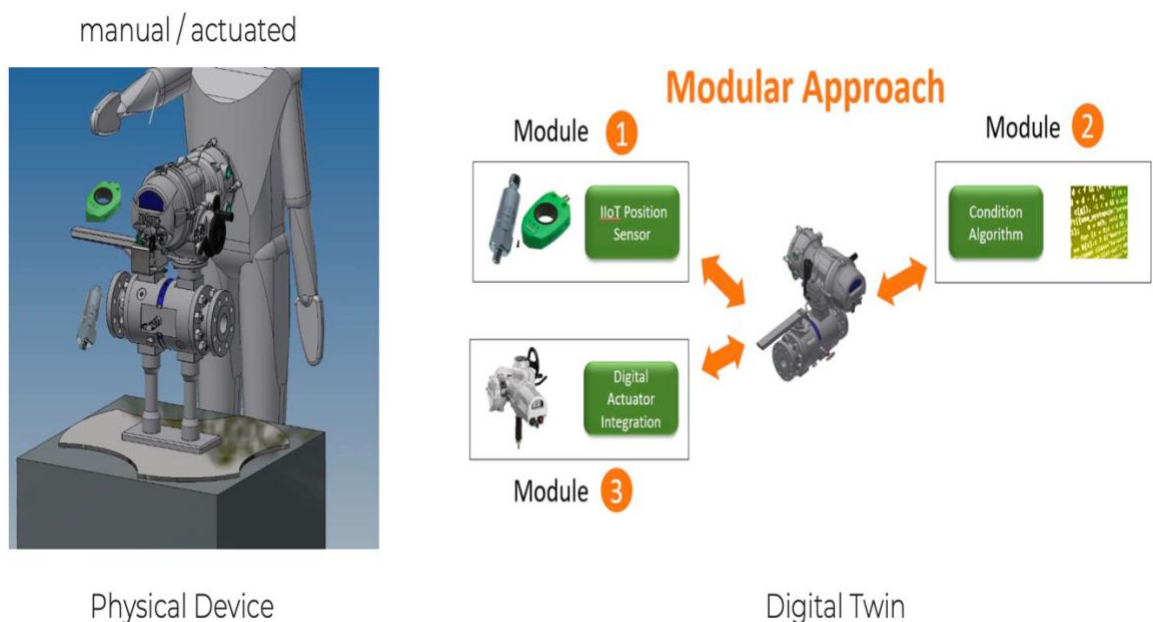


Figure 7 – Company X digital twin system (Company X 2022).

The company has already developed a variety of scopes for the digital twin demonstration, primarily focusing on lowering the effort required to monitor and change the status of the valves while also taking into consideration the high potential future of predictive maintenance.

Company X is not in the current plans to refurbish valves. It is not economically feasible to repair smaller regular valves since it is too expensive, and they need to be washed or analysed. Since valves are also contaminated, it is easier to throw them away.

On the other hand, the Taurus valve, valued around €30,000, is worth refurbishing. Sustainability can be implemented through a QR code, a unique identifier of the valve. The information collected from the QR code may be used to recycle the valve. The valve does not need to be thrown into landfill and may be recycled according to the information stored on the QR code. The valve could be reused.

## 5.2 SWOT Analysis

Table 2 analyses strengths, weaknesses, opportunities and threats in implementing new technology on PSS to assist the case company to understand its situation.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>- Start-up firm provides a service to scan QR code.</li> <li>- New and innovative business model.</li> </ul>	<ul style="list-style-type: none"> <li>- Limited resources</li> <li>- Limited capital</li> </ul>
Opportunities	Threats

<ul style="list-style-type: none"> <li>- Entering a new market</li> <li>- Increasing competition barriers</li> <li>- Building closer relationships with customers</li> </ul>	<ul style="list-style-type: none"> <li>- Time consuming for customers to adapt with the changes.</li> <li>- The model already exists in the industry.</li> </ul>
--	--

Table 2. SWOT Analysis

### Strengths

Company X already has a start-up company providing a service to scan QR code. Based on this, the company can flexibly access the latest changes and innovations in areas which they do not have expertise. The company will get the benefits of a team of experts without having to worry about recruitment, training and costs. In-house engineering team just needs to focus on the core business without being distracted by complex problems and problems caused by new technology. The company differentiates itself from the rest by implementing new innovative technology in its business model. By being innovative in its field, the company could overcome uncertainties and maintain its relevance through difficult times.

### Weaknesses

Many small business entrepreneurs come across limited resources as a weakness. Due to their global business, Company X currently cannot afford to install service. Because of its small size, it works with partner businesses, and the company has partners in this area that provide this service. This calls for trust and training, but if the problem is difficult or requires an important fast acting solution, they may need to send representatives. To participate in the new business research, the company had to spend a lot of money. Spending on R&D does not always lead to success and superior performance. When initiatives are regarded as successful, some businesses benefit from investing a

lot of money on R&D. On the other hand, businesses might still experience poor performance losses even after making significant annual R&D investments. (McClure 2022.)

### Opportunities

The company has a good opportunity to expand to a new market while using a new technology since its operation now is only in the oil and gas industry. Based on its history and expertise over the years, it can prevent new competitors from easily entering the industry. The company could provide additional services such as pre-sale and after sale customer service. This help to build closer relationship with the customers. The long-term success of a company depends on developing cooperative relationships with its customers. Customers feel more safe and connected to brands when there is a strong relationship built on trust and good communication. This may enhance customer retention and repeat purchases.

### Threats

Some people have a hard time to understand the new changes and technological advances the company is proposing. Customers need time to adap with new changes and there is no guarantee that they would accept it or how long would it take. Even though “Valve as a service” already exists in other industries, some companies do not see how this works for the oil and gas industry. There are also many competitors applying this model, and Company X is not a pioneer in implementing this model. Therefore, the business needs to set itself apart from its rivals even if it does not aim to compete in the market.

## 6 Conclusion

The research questions that were presented in the first chapter will be addressed in this chapter. The overview of the main findings in this chapter

assists in summing up the thesis. The thesis is concluded with a reflection on the author's self-improvement during the whole thesis process.

### **Key findings**

The objective of this thesis was study the business model PSS by the case company in the context of digitalization. To obtain the answers to the research questions, theoretical knowledge and the results of an empirical study were combined in this research. The thesis started with a theoretical background and was followed by the analysis of the current status at the case company. A SWOT analysis was conducted to help the company to understand its important issues. The main findings of this thesis are summarized below.

How is the performance of digital technology at the case company?

The concept of digital twin has been studied to gain more understanding of new technology in the business context. In general, digital technologies that are handled properly are a necessity for every business rather than an option. To foster innovation and improved customer experience, technology initiatives must be implemented throughout the company. Based on the results of the interviews and the author's own observation, it can be stated that the performance of digital twin at the case company is still a challenge to the company when proposing changes to the customers, especially if everything had been working out well for many decades.

What are advantages and disadvantages of applying new digital technologies on a PSS at the case company?

Applying new digital technologies can help the case company rapidly catches up with the competitors in the industry. It could also help the business to be more efficient and effective in terms of managing their product and service offerings. Additionally, it can help to improve customer experience and increase retention rates. However, the company is currently in the early stages of

implementation as the technology is still new and under development. In particular, the application of new digital technologies can lead to a number of challenges for businesses, including the need for new skills and knowledge, the risk of disruptions to existing business processes, and the possibility of increased competition.

How will this business model help the company increase the competitiveness?

PSS is based on the idea that a product or service can be delivered to a customer through a system of elements that work together to provide the desired result. The concept of PSS has been found to be particularly useful in the area of product development and manufacturing. PSS can help organizations to more effectively develop and produce new products and services. The case company is working on use-oriented PSS to focus on customer needs by investing in innovation and technology. The company is trying to offer the best alternatives to customers and differentiate itself from the competition.

To sum up, this thesis has achieved its main objective as a result of providing a solution to the main research question that will help to address the issues arising from the current process. PSS in the context of digitalization is considered as a potential tool to enhance the competitiveness of manufacturing companies. Digitalization leads to a fundamental transformation of manufacturing companies and their business models.

### **Personal learning process:**

The author has gained a lot of knowledge through writing this thesis. First, the author developed a thorough understanding of the new business model PSS when developing the theoretical part. Also, the author had a chance to learn how a company is developing its strategies and applying it in the business environment. Finally, the author would like to thank the following people:

The case company's managers for their contributions to the research interviews, and the team members, who had worked with the author on the project. Last but not least, the author would like to thank her thesis supervisor for all the knowledge, constructive feedback, and ongoing assistance to finish this thesis.

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## Appendix

### Appendix 1. Interview Questions:

1. Is the company using the PSSs business model and when did you start using it?
2. Why did the company decide to change the business model?
3. Did you encounter any problems during the transition?
4. What new tech technologies is the company using?
5. What kind of changes did you already make compared to the previous model?
6. How did you propose your new service to customers, and did you receive good feedback?
7. How do customers and the company benefit from this business model?
8. Do you think digitalization affects your business?
9. Do you think it is difficult for the customers to approach new technologies – your service?
10. A business model is designed to help a company build a competitive advantage so how long do you think the company intends to use this PSSs model?
11. Any other ideas, comments, hopes or wishes regarding this topic?