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Servitization in a Heavy Equipment Company: A business model perspective

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Servitization in a heavy equipment industry

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ABSTRACT

Background: Servitization is a transformation process consisting of the integration of products and services in the value offering of the firms in order to increase value added and improve the customer experience. This process implies a transition from Product-Centric to Product-Service Systems. In this regard, the servitization implies that firms modify their business model in order to match a Product-Service System Business Model. This research explores the concepts of the product-service system business model and the readiness of the firms for servitization. In addition, it also examines the challenges that result from this transition to product-service system business model.

Purpose and Research question: The purpose of this research is to contribute to the servitization theory from a business model perspective and to understand the challenges for servitization by addressing the case study's readiness and business model. The research question is: *How could manufacturing firms improve their Business Model toward a Product-Service System Business Model?*

Literature review: The literature review was conducted to understand the existing theory of the field servitization and its drivers, benefits, and challenges. It also provides insight into the product-service system business model the readiness for servitization elements.

Case study: The case study is a firm from the heavy equipment industry, the firm provides heavy machinery solution for mining and construction sectors. The results were gathered from several participants from different departments within the firm.

Methodology: This is qualitative research, semi-structured interviews performed with a total of 7 company employees. The data from the interviews were analyzed in a thematic manner in transcribing the data, NVivo plus 12 for codifying and categorizing the themes to represent the findings of the study.

Findings and conclusion: The study's findings assisted us in gaining an understanding of how a heavy equipment manufacturer provides services alongside its products by utilizing a Product-service system business model. The results show that the elements of the business model have a connection to the different levels of transformation and maturity a firm can be. The results also show that the firm is ready for servitization and to move towards a more service-oriented

approach; nevertheless, there are challenges that the firm may face during the servitization process as well as challenges that the firm has overcome in the past.

Keywords: Servitization, Product-service system, Servitization transition, Servitization Readiness, Servitization challenges, Service paradox, Business model, and Business model Innovation.

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Waxaan rabaa xagaan inaan u mahad celiyo ilahay oo ii sabab ahaa inaan meeshaan soo gaaro, ka dib waxaan rabaa inaan u mahad celiyo reerkayga dhan iyo asxaabtayda oo si wanaagsan uga soo qayb galay waxbarashadyda iyo hamigayga inaan gaaro oo ugu horeeyo Aabo macaan, Mohyadin Mahamed. Guulshaan adiga baa iska leh.

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ABBREVIATIONS*List of abbreviations**Definition*

BM	Business Model
BMI	Business Model Innovation
PSS	Product-Service System

1. INTRODUCTION

This chapter will introduce a background with the main topics of this research which are the servitization and business model concepts; the case study, which corresponds to a heavy machinery company, their features, and current problem; problematization to be approached by the research; and finally, the research purpose and questions.

1.1 BACKGROUND

Forces like technology, globalization, and competitors are pushing the growth up of the servitization trend in many industries, this is happening as servitization offers new ways to create and keep customers as well as sustain competitive advantages (Vandermerwe & Rada, 1988).

Servitization is transformation, it is about manufacturers integrating a service offering into their products (Baines et al., 2013), this way, firms look for increasing value added and improve the user experience (Pinillos et al., 2021) and as a consequence, get some benefits such as staying ahead of competitors, attracting new customers, and differentiating their offer in the market (Neely, 2009).

Servitization also implies a shift that drives companies to modify their business models and internal organization (Mastrogiacomo et al., 2018). This transition requires changes in the way of delivering and creating value, and how firms deal with stakeholders and customers, consequently it is important not only to change the value proposition but redesign the whole business model from a product-centric one to a product-service system (Adrodegari et al., 2017). In this regard, it has not been until recently that the servitization journey is being addressed by the research community following the business model perspective (Adrodegari et al., 2016).

Thus, the Product-Service System concept arises as the type of business in which the firms that seek for new ways of doing business should focus (Barquet et al., 2011). Product-Service Systems are value offerings composed of non-tangible and tangible elements such as products and services (Barravecchia et al., 2021) that embrace a service-led competitive strategy (Baines et al., 2007). Moreover, one of the main challenges for companies adopting Product-Service Systems is identifying the specific requirements they need for their business model; thus, the identification of the PSS business model features facilitates the comparison with the traditional business models in order to observe the distinctions (Barquet et al., 2011).

In this regard, the servitization path is not exempt of challenges. Adopting a Product-Service System strategy implies facing cultural and corporate challenges (Baines et al., 2007). Moreover, there is a need for a major strategic alignment and integration, internally, and with customers and suppliers (Martinez et al., 2010). Failure to overcome these challenges not only implies not achieving the benefits expected from the PSS, but losing the investments made by firms to increase their service offerings (Gebauer et al., 2005).

1.2 CASE STUDY

The company name will remain anonymous in this research due to privacy. The chosen company has been in the market for more than 20 years and it is one of the largest firms in Peru that provides heavy equipment solutions mainly for the mining and construction sectors.

In the case of mining, it is usually required a series of demanding tasks that are carried out with the help of specialized machinery such as the movement of large amounts of materials in a short time. These are mainly made by shovels, front loaders, and excavators, those machines required to be selected and set up considering aspects such as productivity, cost reduction, fuel consumption, environmental care, and safety (Rumbo Minero, 2022).

As for the construction sector, the same as the mining, they look for high levels of productivity. Front loaders have to offer the best cost per TM moved, which relates to an adequate rate between operating weight and power, better traction and stability for loading tasks, and safety; then, to choose the suitable equipment is necessary to know the application, type of terrain, travel distances, and density, volume, and type of material planned to move (Perú Construye, 2021).

As a result, if one of the machines stop working this directly affects the production and put in risk the projects, then it is important to ensure the results expected by the customers, thus the provision of services such as regular maintenance made by a highly specialized team, having the productivity high is the main goal of the operation (Rumbo Minero, 2022).

Moreover, heavy machinery industry has been typically characterized for providing services in a traditional way that implied the minimal involvement of the firms, with top management that seldomly considered services as a strategic weapon that could enhance the product designs or significantly increase sales (Dausch, 2002).

This traditional type of service delivery usually relate to the services that customers receive only after the appearance of certain events, such as a sudden failure that ends up in a repairment

requirement. However, the modern service focus for this industry should be oriented to provide a more proactive service delivery which implies anticipating maintenance, problems, and components failures as this is going to be translated into maximizing the availability, improving the performance, and minimizing the lifecycle costs of the equipment for customers. Examples of this type of proactive solution relate to the long-term service agreements (Dausch, 2002).

In this regard, the firm's offering currently includes products and services that relate to different levels of involvement, as it is described below:

- **Products:** New equipment, used equipment, and spare parts for mining and construction (Company's website, 2022).
- **Services:**
 - *Technical assistance* and advisory, provided for preventive and corrective maintenance (Company's website, 2022).
 - *Parts and Labor Contract*, which is the maintenance for a fixed period that includes labor and equipment to support the service, spare parts are not included in the cost (Company's website, 2022).
 - *Maintenance and Repairment Contract* which includes labor, equipment, and spare parts, assuring the availability of the fleet for the operation (Company's website, 2022).
 - *Other: Rebuilding, Maintenance, Repairment, Training, Fleet Studies, Renting, and Financing* (Company's website, 2022).

On this subject, even when the firm has made efforts to include in their offer different types of services from the most basic ones to the more complex, this has not had the expected impact or representation in their incomes as the products still remain as the main source of them; however, it is considered that boosting services is a situation that needs to be addressed in the present, considering the performance of today could not guarantee the sustainability or their leadership in the future, as the entrance of new competitors to the market and the fierce competition with international brands with which the firm have a low differentiation level in the products offer, constitute a high level of threats for them (Participant 2).

Moreover, the firm has recently reformulated their strategic planning enhancing the customer-orientation as one of the main pillars (Company's internal communication, 2022). Then it constitutes a favorable scenario to research on their service journey and identify the challenges

that this process shows. Likewise, as the firm is located in Peru it could provide with a favorable scenario for research, as according to Baines et al. (2007), Scandinavia, the Netherlands, and Switzerland are the regions that are more willing and ready to adopt product-service system solutions than other regions in the world.

1.3 RESEARCH PURPOSE AND QUESTION

The purpose of this research is to contribute to the servitization and business model theory and explore the interrelation between both. Furthermore, it will pursue to understanding of the challenges of servitization by addressing the case study's readiness and business model.

Research question: How could manufacturing firms improve their Business Models toward a Product-Service System Business Model?

Sub question 1: How do the firms work with a Business Model that includes services?

Sub question 2: How willing and ready are the firms to improve in the service transition?

Sub question 3: What are the challenges that firms encounter when improving towards a Product- Service System Business Model?

2. LITERATURE REVIEW

This second chapter will provide information regarding the existing theory of servitization, its definition, drivers, benefits, transition, challenges, and readiness for servitization. Besides that, it will present the product-service system concept and its types, as the main representation of the service content in businesses, to finally introduce the theory of business model, especially the one oriented to the type used for product-service systems.

2.1 SERVITIZATION

2.1.1 Definition

The servitization concept has more than three decades of discussion in the business world (Pinillos et al., 2021). It emerged first in the academic field in 1988, Vandermerwe & Rada defined servitization of business as a movement of corporations adding value to their offer through services. For this research it will be considered the definition provided by Baines et al. (2013) in which servitization is the term given to a transformation process which consist in manufacturers integrating a service offering into their products. Thus, while some firms choose to servitize by offering conventional services, others provide almost pure services.

Moreover, in the servitization concept it is relevant to notice that products and services are very intrinsically linked, while products are usually defined as a material artifact, services usually refer to an offering such as repairment, insurance, or maintenance; then, services are economic activities that do not result in the sale of a tangible asset or in ownership (Baines et al., 2009)

Consequently, the servitization process implies a shift for manufacturing companies to add value from only selling products to selling through Product-Service Systems (PSS) (Neely, 2008) which are defined as value offerings composed by tangible content, product, and intangible content, services (Barravecchia et al., 2021), which as a result lead companies to modify their business models (Mastrogiacomo et al., 2018), that is “*the way in which a company creates and capture value*” (Goffin & Mitchell, 2017, p. 7).

In this regard, as servitization requires foundational changes in the culture, competencies, structure, channels for value delivery, and customer and stakeholders’ approach, then a redesign in the business model of the company is essential (Adrodegari et al., 2017). However, shifting from a product-oriented to product-service strategy is still poorly understood and the literature has

not discussed the concept of product-service systems' business model extensively (Adrodegari et al., 2016).

2.1.2 Drivers and Benefits

Servitization usually lies in three reasons as to why manufacturing companies should undertake this path and why companies are moving out from traditional product-centric systems; these are financial advantages, strategic competitive advantages, and marketing. (Baines et al., 2009)

Financial advantages relate to a higher profit margin or more stable incomes. In industries with a high-installed product base such as automotive, service revenues can be much greater than the sale of products; moreover, products with an increased life cycle such aircraft can get significant revenues from in-service support and are less sensitive to the price-based competition when they offer product-service combinations and finally, product-service offerings provide a better way to resist to economic cycles affecting investment and purchase (Baines et al., 2009).

As services are usually difficult to imitate, it is possible for product-service offerings to provide higher competitive opportunities (Baines et al., 2009). Markets are each time more susceptible to commoditization, then the typical differentiation through product innovation and technology is difficult to maintain over the time; then, there is still margin for services to increase value to the customers, providing a customized solution even when the products remain homogenous (Baines et al., 2009).

Lastly, services are capable of creating customer loyalty and constitute an important element that influences the buying decision making. When companies offer services, they are more open to hear the customer's needs and develop more customized offers (Baines et al., 2009).

On the other hand, in the case of the heavy equipment industry, the need for a solid service provision is based on certain expectancies customers require in relation to maximize the availability of the equipment, optimize the performance of the equipment, and minimize the lifecycle costs of the equipment which could be reached by the provision of proactive services that anticipate failures (Dausch, 2002).

Then the benefits that firms in this industry gain from that are associated to create more opportunities derived of long-term service agreements that could guarantee the availability for those customers; get more constant revenues from services as the service contracts are paid periodically; and reduce the servicing costs by improving planning as per the new processes and

flow of information needed. Likewise, it is relevant to mention that usually equipment require services for 20, 30 or more years, then the profitability firms can gain in the long-term are considerable (Dausch, 2002).

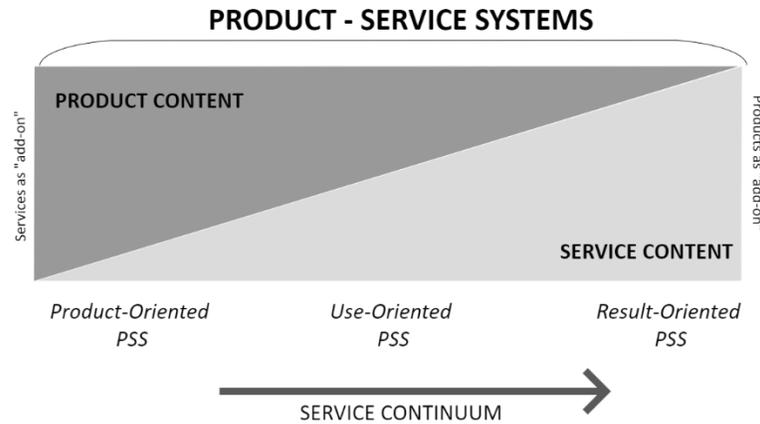
2.1.3 Product-Service Systems

According to Barravecchia et al. (2021) Product-Service Systems are value offerings that consist in non-tangible and tangible aspects such as products and services. Product-service systems' main distinction is looking to continuously satisfy the customer needs, be competitive, and be less environmentally impactful than traditional business models (Salwin & Kraslawski, 2020).

It is possible to identify a diversity of forms of servitization, defined along the called service-continuum, which shows the movement from the product to the service content within the product-service systems (Barravecchia et al., 2021). Several authors have categorized these types of Product-Service Systems within three main typologies, for Tukker (2004) these three main categories are described as:

- *Product-Oriented Services*, in which the sales of products are the main focus of the business with some services as add-ons such as the ones linked to maintenance contracts, financing plans, or advice and consultancy for the product sold.
- *Use-Oriented Services*, in which the product plays an important role, but the services are the core business, so the ownership of the product is not transferred to the customers, for instance, rental services; and
- *Result-Oriented Services*, in which the customers and the firm agree on a determined result, consequently the product is not specifically defined, some examples of this category are outsourcing, pay per service unit, etc.

Figure 1. Typologies of Product-Service Systems adapted from Tukker (2004) and Oliva and Kallenberg (2003)



The figure 1 above describes the main typologies of product-service systems and the service content along the service continuum, and even when it is possible to find other types of categorizations in the literature, the main goal of the typology is to define strategies for servitization and to highlight the continuum of the position along with the product-service transition from the conventional manufacturing to the service provision (Kamal et al., 2020).

Moreover, while some firms limit their offer to only product-oriented services such as traditional after-sales services, others offer more advanced services, having that it could exist a high level of heterogeneity among the service offering of each company (Kowalkowski et al., 2013). Likewise, PSS have to be designed on a case-by-case approach by considering the customers 'point of view, and it requires from firms to increase their involvement to look beyond the product production to the whole lifecycle (Baines et al., 2007).

In relation to the heavy equipment industry, it mostly offers capital-intensive equipment not easy to transport and with long lifetime, as a result, the provision of user-oriented or result-oriented services requires a strong financial support scheme, then it is argued that in many cases some of these services might not be profitable unless the revenues are higher than the ownership costs (Dewi & Van Voorthuysen, 2010).

2.1.5 Transition

According to Baines et al. (2020) there are some stages that are more common in the servitization journey which are:

- *Exploration stage*, where the firm attends to explore relevant industrial examples through benchmarking trips to prominent manufacturers in the servitization industry.

- *Engagement stage*, which refers to restructure the innovation team in order to streamline the project financially and organizationally, as well as articulate the benefits and hazards of the servitization journey.
- *Expansion stage* is about scaling a portfolio of sophisticated service offerings, generating a wider market sector, and increasing cultural transformation activities and
- *Exploitation stage*, the firm begins to place a greater emphasis on institutionalizing servitization across various business divisions and structuring their goods with the mindset required for the delivery of sophisticated services.

Along with this transition, firms face many challenges that they need to overcome. To this end, manufacturing organizations need to align their organizational culture with the servitization strategy, as long as enabling the focus on service innovation, as they have been traditionally focused on productivity and standardization, but a service central approach usually needs more heterogeneity and flexibility from them (Kamal et al., 2020).

Moreover, according to a prior study by Baines et al. (2020), a group of companies that offer basic services with the purpose of competing through advancing services went through the four stages of servitization mentioned above. As a result, it took the companies from 4 to 8 years to complete this transition, even when they were oriented to commit this process. However, there might be factors enhancing this transition pace such as customers, technology, organizational culture, value nature positioning, and organizational readiness (Baines et al., 2020).

2.1.6 Challenges

According to Oliva & Kallenberg (2003), servitization constitutes a major managerial challenge because of the need for not only new capabilities and incentives, but also business model changes, and despite of the benefits that could represent the adoption of services, there are not many manufacturing organizations with solid service-oriented strategies.

In this regard, according to Dausch (2002), in the heavy equipment industry, there is a long track record of service provision; however, this has been traditionally reactive as it occurs after some events, less involved, and typically oriented to the ordering and replacement of parts, equipment upgrades, and others to maintain the equipment. There are not usually incentives to enhance the service vision to be explicitly involved in the strategic planning and to improve the maintenance and reliability of the equipment in the long-term (Dausch, 2002).

Furthermore, according to Kamal et al., (2020) many firms can be averse to the service transition as they consider servitization is still a ‘black box’. In addition, Benedettini et al. (2015) argue that while some servitized companies achieve important growth objectives, others struggle to get profits from their service offer, then it is possible to see how in the academic field has arisen the service paradox concept.

According to Gebauer et al. (2005), the service paradox phenomenon is described as the lack of corresponding of the expected returns intended with servitization investment, this comes from some cognitive phenomena that limit managerial motivation in extending the service business, those phenomena are the risk aversion, the skepticism in the economic potential, and the overemphasis on tangible environments, which could be interpreted as barriers that firms should be overcome.

Furthermore, Martinez et al. (2010) argue that the deeper the level of the servitization in a firm, the more challenges they face; these challenges lie in the aspects of the five pillars which are:

- *Embedded product-service culture*, which corresponds to how firms embrace the thinking of the end customer.
- *Delivery of integrated offering*, which relates to an increasing in the number of touch points with customers, new issues and misunderstandings, and imbalance in the expectations.
- *Internal processes and capabilities*, related to the new capabilities and competencies needed for the service deployment.
- *Strategic alignment*, which corresponds to the understanding of the service provision and its alignment with the firm’s mindset, becoming more important to think as a customer; and
- *Supplier relationships*, as usually a greater cooperation with the supporting network is needed to deploy the integrated offering.

2.1.7 Readiness

According to Teso (2017), servitization refers not only to adding services, but to understand the potential and benefits of it, thus she provides a framework with nine dimensions identified as key elements for manufacturing firms to make a transition to service-oriented firms. The logic that this framework pursue is to assist firms to first, understand how ready they are for a change;

second, to describe motivations and factors that support its organizational change; and third, drive the firm from a traditional manufacturing state to a servitized state.

Consequently, by addressing the firm's motivations and barriers they face towards the achievement of their goals, framed by the organizational challenges at strategic and operational levels, the readiness framework looks to tackle the servitization journey with a higher level of awareness, by promoting an attitude-driven and people-centric approach (Teso, 2017). In this regard, the dimensions of the readiness framework are the following:

- *Effectiveness*: refers to the past achievements of the firm, and how successful they have been in their offer of products and service which have constituted what they are in the present.
- *Experience*: refers to how the knowledge has been codified and new capabilities has been developed over time.
- *Service history*: Relates to the evolution of the firm's offerings and how the competences have changed over time.
- *External Engagement*: Refers how the company relates to their network and how they contribute for co-creation of opportunities.
- *Culture and Development*: Relates to which capabilities and learning mechanisms exists to increase the competences.
- *Creativity*: Relates to how the firm explore and test new ideas, how is the environment and motivation inside the firm.
- *Risk Propensity*: Refers to the attitude regarding the propensity to risk and novelty when a change appears.
- *Communication*: Refers to how the informal and formal information is exchanged, so it helps to create a service vision and be aware of its value.
- *Awareness*: Relates to how the firm recognizes services as a critical component in the value proposition they offer.

Moreover, the readiness framework looks for developing a service-oriented approach for firms in the servitization process to help them to face the challenges that said process imply. The main intention of the readiness framework is not to overlook at the processes, but to cover the front-end issues, as the deployment of the nine elements should allow the firms to understand their

readiness to servitize and leverage the service vision that Product-Service Systems require (Teso, 2017).

2.2 BUSINESS MODEL

2.2.1 Definition

According to Goffin & Mitchell (2017, p.7) a business model is “*the way in which a company creates and captures value*”. For Ammirato et al. (2022) a business model is described as a conceptual framework that represents the core logic or architecture of a business resulting from core-components connected. Moreover, Osterwalder, et al. (2005, p. 3) define the business model as “*a conceptual tool containing a set of objects, concepts and their relationships with the objective to express the business logic of a specific firm*”, which is the concept this research will consider.

The importance of the business model lies in that a well-structured one can reduce the complexity of the business logic as it presents the strategy of the company in clearer way and makes feasible to visualize the way companies create and deliver value (Barquet et al., 2011).

Moreover, companies that want to remain competitive and sustainable over time must innovate their business model and manage their performance, then the Business Model Innovation (BMI) arises as to the process of creating a new business model or altering at least one element of the existing business model (Ammirato et al., 2022)

BMI is especially attractive for companies within industries highly commoditized, they are threatened for aspects such as cost pressures, difficult differentiation, and substitution, then it is not a surprise that this type of firms is integrating services to their product offer creating Product-Service Systems (Velamuri et al., 2013).

Moreover, other drivers that contribute to the BMI activities are the changes in the demand of the stakeholders, new entrants and the competitive environment, and the appearance of new information and communication technologies (Pucihar et al.,2019).

2.2.2 Elements

The business model as presented by Osterwalder & Pigneur (2010) has been highly diffused in the academical world and has defined a general accepted guideline to understand the business model from the existence of different elements. In this regard, Adrodegari et al. (2017) proposed a framework based on those elements but considering the perspective of a Product-

Service System Business Model providing a service-oriented configuration and becoming a potential tool for companies to understand what could be needed for a transformation towards servitization.

Value proposition

This element is used to solve the customer problem and satisfy their needs (Osterwalder & Pigneur, 2010). As the value proposition for a Product-Service System is based on the integration of a product and service, it can differ from the traditional approach especially regarding the relationship between the firms and its customers (Barquet et al., 2011).

Then, it is critical in PSS BM to understand this element from the perspective of the customer and what source of value is extracted from the firm by the customer (Adrodegari et al., 2016). It also introduces a new formation of value proposition which consist in shifting from value-in-exchange to value-in-use (Adrodegari et al., 2017).

Customers

This element defines the type of segments the organization serves and what type of relationships they have with them (Osterwalder & Pigneur, 2010). For PSS BM this is a critical success factor in a servitized setting, and the type of relationships pursued are long-term, it also emphasizes the interactions of the company towards the customer and the level of information sharing, market insights, and the development of the customer segmentation to match the business goals (Adrodegari et al., 2016).

Moreover, PSS BM also focus on the interaction between the customers and the firm to deliver value and maintain the relationship throughout the product life cycle (Adrodegari et al., 2017). Likewise, having in account the different customers segments allow to address the ownership expectations, cultural differences, consumer habits, values, and behaviors, and build up direct relations and intensified contacts with customers so get long-term relationships (Barquet et al., 2011).

Channels

This element is described as the mean by which the value proposition is delivered, involving communication, sales, and distribution channels (Osterwalder & Pigneur, 2010). A change towards a PSS BM requires a revision of these channels in order to create awareness among potential customers about the benefits of the new offerings (Adrodegari et al., 2016). The new

service offering leads to the development of the competencies for the customer support (Adrodegari et al., 2017).

Likewise, through the channels the value proposition should look more attractive in comparison to the traditional product-based option, then training of retail and sales personnel and precise marketing campaigns are important (Barquet et al., 2011).

Key Resources

Set of assets required to offer and deliver the value proposition (Osterwalder & Pigneur, 2010). Even when the resources needed might vary depending on the type of BM, in PSS BM a higher level of service orientation is required within the corporate culture and human resources, plus bigger financial resources to support the new revenue model (Adrodegari et al., 2016).

In PSS BM, firms require to develop an entirely new sort of distinctive resources in the areas of competencies to handle customers, the development of the people training, and even additional personnel recruited (Adrodegari et al. 2017). Barquet et al. (2011), also agree that there is an important change in corporate culture and market engagement that implies time and resources, especially related to human resources for activities such as training, and the development of new capabilities for a better understanding of the customer's needs.

Key Activities

Set of activities deployed in order to offer and deliver the value proposition (Osterwalder & Pigneur, 2010). This element has been traditionally focused on the product, while PSS BM is necessary to target the activities that relate to the customers (Barquet et al., 2011). In this regard, to successfully implement a PSS BM, products might be designed to enhance a service vision, which could be related to the development of certain qualities such as maintenance, usability, upgrading, etc. that increases the value creation (Adrodegari et al., 2016).

Partnerships

According to Osterwalder & Pigneur (2010) this element involves the partners to which certain outsourced activities are entrusted as well as the partners that externally provide with resources. For a transition towards a PSS BM, it is important for firms to understand how the nature and length of the relationship with partners is going to change or move from price based to strategic base as well as short term to long term (Adrodegari et al., 2016).

Moreover, for Barquet et al. (2011), in PSS BM the relationship between firms and their stakeholders plays an important role in the supply chain structure, and it is also fundamental to see

at the partnership network in order to structure it by identifying the core competences needed and which actors can provide them.

Costs & Revenues

While the costs represent the result of all the elements of the BM, the revenue streams come from the value proposition that was successfully offered to customers (Osterwalder & Pigneur, 2010). Regarding PSS BM, it requires new capabilities in the pricing discipline that assure the profitability of the firm as it moves from cost-plus pricing to value-based pricing, and as the customers become more mature there will be room to put into place new revenue mechanisms (Adrodegari et al., 2016).

Furthermore, financial flows are also expected to change regarding the time scale for returns of capital from immediate to extend use period, then, holding enough financial resources plays an important role, and as a result, setting a suitable pricing is mandatory, which might be based on aspects such as frequency of use, availability, or final result (Barquet et al., 2011).

2.3 SUMMARY

Along this literature review, it has been possible to realize how the phenomenon of servitization has been gaining more interest over the years, that consist in the integration of services to the product offer which is called Product-Service Systems (PSS). There are various types of PSS, from those that prioritize the offer of products with service as add-ons, to those that prioritize more the service offer with products features as add-ons. Also, it has been seen that many companies may have a heterogeneous portfolio with respect to these types of PSS.

The benefits that servitization provides to manufacturing companies are many and those become the main drivers for them when deciding for a change; these are the financial, competitive, and marketing benefits. However, although the inclusion of services in the companies' offer constitutes a great opportunity to build competitive advantages and new sources of revenues, servitization implies the innovation of their business models, a shift from product-centric to product-service system business models, and this brings a variety of challenges both in the implementation and in any of the stages of the transition.

The main challenges firms face in this servitization process have been summed up in certain areas of greater relevance, such as the alignment of the strategy, service-oriented culture,

competencies, internal processes, relationships with suppliers, risk aversion, skepticism in the economic potential, overemphasis in the tangible environment.

In this regard, considering that servitization implies the modification of the business model, matching with the PSS BM criteria which properly contains a vision of service, has been set as the purpose of the servitization process, and for that the organization must also be prepared by working on the readiness factors, which would help them to address the described challenges of the servitization process.

3. METHODOLOGY

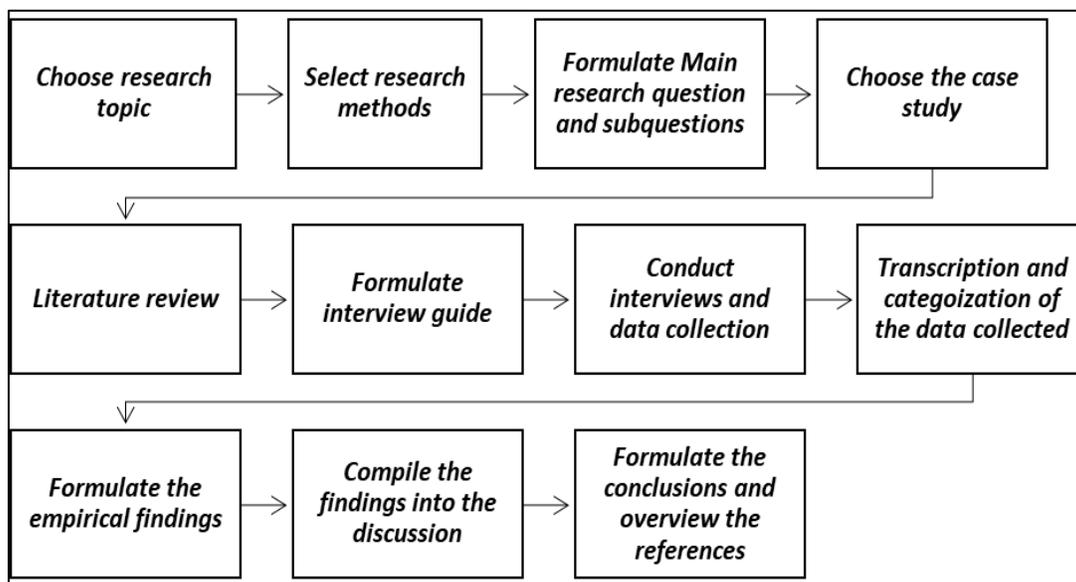
Chapter three of this research contains the methodology divided into six sections, the first one is the research process, which outlines how the study was conducted and the steps used. The second one consists of the research strategy which followed a qualitative approach, then, the research design which corresponds to a single case study, followed by the data collection methods and data analysis methods. Finally, the research quality section.

3.1 RESEARCH PROCESS

The research process describes how the study was conducted and the decision-making process. (Bell et al., 2019). As it is presented in figure 2 the process begins with selecting a research title that is related to the program of Innovation and industrial management which is the reason why the researchers have the interest to choose Servitization. The researchers have gained brief knowledge regarding the topic in previous courses taken during the program.

Figure 2.

An overview of the potential research process presented, inspired by Bell et al. (2019, P.358).



After the selection of the title, the researchers select the appropriate research method which is qualitative research using semi-structured interviews. Subsequently, the researchers formulate the main research question and complement it with 3 sub-questions to understand the main research question.

Then, the researchers chose the case study, and it was followed by the selection of the articles for the literature review by determining the main component of the theoretical framework and categorizing the sub-topics in the theory. After this step, the researchers formulated the interview guide which was aligned with the main component identified previously in the literature review, followed by setting the interviews with the case company and gathering the interview information, transcribing, and categorizing them.

Moreover, this step was continued by the formulation of the empirical findings using the categorized information and after that applying the empirical findings to the analysis to divide the findings into smaller groups of information and finally, answer the research questions through the conclusion part.

3.2 RESEARCH STRATEGY

This research is conducted as qualitative research. According to Bell et al. (2019), a qualitative approach emphasizes treating theory as something emerging inductively from the collection and analysis of data, so in that way it could be appreciated patterns instead of imposing preconceived notions on the data.

In this regard, this research expects to contribute to the servitization and business model theories in order to understand them, and consequently, it is expected that the close engagement with the case study will contribute to answer the research question. Therefore, the qualitative strategy emerges as the most suitable for exploratory research.

In order to obtain the exploratory research, it was decided to take an approach towards inductive theory. Bell et al. (2019) stated that inductive theory connects data to theory, it mainly targets a group of people by conducting interviews in order to develop a connection to the theory. Qualitative research concentrates in translating the data into words, which is useful in this research because it contributes to the data collection by conducting interviews and get insights from the participants (Bell et al., 2019).

3.3 RESEARCH DESIGN

According to Bell et al. (2019), a single case study is used to analyze and focus on a bounded situation or system in order to provide an in-depth explanation of a specific feature. It is the study in which the researchers unveil important aspects about the nature of the topic, it gives an accurate and precise explanation of the topic, and it is mostly used in business research (Bell et

al., 2019). The single case study was chosen over a multiple case approach because it illustrates the fundamental examination of an important theory (Yin, 2018).

The purpose of this research is to get a wide vision of the servitization journey and the performance of product-service system business models by investigating a company in the heavy equipment industry and examining the perspective of employees from different departments. In this regard, to demonstrate the nature of the theories, the researchers have conducted a single case study to understand the service activities of this specific firm.

3.4 METHODS OF DATA COLLECTION

In order to answer the research question, there are three data gathering sources that are used which are, primary data, secondary data, and literature review. The primary data is partially the key to obtaining a closer look into the condition of the firms investigated and to demonstrating the answers to the research question (Bell et al., 2019). The secondary data gathered in this research comes from the data collected by the company for their own purposes. The literature review is the theories that have been collected by someone else before, which is complementary to the primary data to ensure the coherence and sincerity of the research (Bell et al., 2019).

3.4.1 Primary Data

For primary data collection, semi-structured interviews are used. According to Bell et al. (2019), semi-structured interviews provide a flexible framework to collect data as they follow a list of questions connected to topics pretended to be covered. This allows to ensure a certain level of comparability among the analyzed cases, but at the same time, this method provides enough leeway to the interviewees about how to reply so that it is possible to gain a genuine understanding of interviewees' view out of the spectrum of the initial selection of topics (Bell et al., 2019).

Regarding the description of the participants, Table 1 below shows a detailed description of each interview regarding the department, the date, time, type of communication platform, and the lengths of the interviews.

Table 1.

Description of interviews based on department, date, time, method, and duration of the interviews.

	<i>Department</i>	<i>Position</i>	<i>Date</i>	<i>Time</i>	<i>Type</i>	<i>Length</i>
<i>Pilot interview with Participant 2 (P2)</i>	<i>Sales</i>	<i>Key Account Manager</i>	<i>17-04-2022</i>	<i>5:00 pm</i>	<i>WhatsApp Video</i>	<i>20 min</i>
<i>Participant 1 (P1)</i>	<i>Sales</i>	<i>Key Account Manager</i>	<i>27-04-2022</i>	<i>12:00 am</i>	<i>Microsoft Teams</i>	<i>30 min</i>
<i>Participant 2 (P2)</i>	<i>Sales</i>	<i>Key Account Manager</i>	<i>27-04-2022</i>	<i>12:30 am</i>	<i>Microsoft Teams</i>	<i>40 min</i>
<i>Participant 3 (P3)</i>	<i>Logistics</i>	<i>Analyst Inverse Logistics</i>	<i>29-04-2022</i>	<i>4:30 pm</i>	<i>Microsoft Teams</i>	<i>37 min</i>
<i>Participant 4 (P4)</i>	<i>Planning</i>	<i>Planner</i>	<i>29-04-2022</i>	<i>9:00 pm</i>	<i>Microsoft Teams</i>	<i>29 min</i>
<i>Participant 5 (P5)</i>	<i>Sales</i>	<i>Key Account Manager</i>	<i>29-04-2022</i>	<i>11:30 pm</i>	<i>Microsoft Teams</i>	<i>31 min</i>
<i>Participant 6 (P6)</i>	<i>Competence development</i>	<i>Capabilities Coordinator</i>	<i>02-05-2022</i>	<i>8:00 pm</i>	<i>Microsoft Teams</i>	<i>22 min</i>
<i>Participant 7 (P7)</i>	<i>International trade</i>	<i>Supervisor</i>	<i>04-05-2022</i>	<i>1:30 am</i>	<i>Microsoft Teams</i>	<i>23 min</i>
<i>Follow up interview with Participant 2 (P2)</i>	<i>Sales</i>	<i>Key Account Manager</i>	<i>17-05-2022</i>	<i>3:30pm</i>	<i>WhatsApp Video</i>	<i>30 min</i>

The researchers have conducted 9 interviews with the departments of sales, logistics, planning, competence development, and international trade. The participants' selection main criteria were the seniority and prior knowledge of the service context of the company. then, the participants have at least 5 years of experience working for the company.

All the interviews lasted less than an hour. The interviews were conducted in Spanish because the interviewees were more comfortable conducting them in their native language and one of the researchers speaks Spanish as native language, which ensured the communication flow. The interviews were conducted according to the schedules of the participants who follow Lima, Peru time zone which is 7 hours different from the time zone in Sweden hence, the reason the interviews were conducted at such times (see Table 1).

In order to get the confirmation and the acceptance to conduct the interviews with the company, the researcher had a *WhatsApp video call* as a pilot interview with participant 2. The interview was to explain the research scope and the research questions and to get a brief insight from participant 2 about the service context in the firm. This video call lasted for about 20 minutes, and it ended with the agreement with the company's participants to provide the researchers with the schedules for the interviews, where it was also agreeing the confidentiality and anonymity. After the interviews were conducted, the researcher also had a follow-up interview with participant 2 to gain further insights about the secondary data.

3.4.2 Secondary data

The secondary data conducted in this research is complementary to the interviews from the company. Some of the data collected were from the company website, while other data were collected from the company directly such as corporative magazines, and internal presentations. Further, the researchers also collected other industrial magazines in the mining and construction industries.

3.4.3 Literature Review

According to Bell et al. (2019), the literature review allows the researchers to determine the contributed concepts and theories and the type of research methods that have been used. In this regard, researchers gathered previous theoretical data published by other authors to supplement the findings from the primary data of the interviews.

The data obtained in this section were acquired early in the study, allowing the researchers to better comprehend and understand the research topic and develop the interview guide before proceeding with the primary data collection as figure 5 shows. This literature review covered the main topics and concepts using the research questions as a reference.

The search for the data was conducted using the search engines on the internet such as Super search provided by Gothenburg University, Google scholar, Summon database by Dalarna

University, and EBSCO by Chalmers Library. The articles chosen were written in English, and it was prioritized the selection of peer-reviewed articles.

Table 2.

The keyword criteria and the advanced search words for the Literature review

<i>Keywords</i>	<i>Advanced search including keyword</i>
<i>Servitization</i>	<i>Servitization + definition</i>
	<i>Servitization + Benefits</i>
	<i>Servitization + Drivers</i>
	<i>Servitization + Transition</i>
	<i>Servitization + Readiness</i>
	<i>Servitization + Challenges</i>
<i>Business Model</i>	<i>Business Model + Definition</i>
	<i>Business Model + Drivers</i>
	<i>Business Model + Elements</i>
	<i>Business Model Innovation + Process</i>
<i>Product-service system</i>	<i>Product-service system + Definition</i>
	<i>Product-service system + Typologies</i>
	<i>Product-service system + Business Model</i>

The searching was conducted using the keywords shown in Table 2, this was an iterative, and the researchers were constantly revising this part to match the empirical findings and feedback from the meetings with the supervisor.

3.5 DATA ANALYSIS

In qualitative research data collection, thematic analysis is the most general approach used (Bell et al., 2019). Thematic analysis simplifies the interview transcription for the researcher, it is considered as a code, where the data collected are categorized as a group of codes (Bell et al., 2019). This contributes to the research purpose and allows the researchers to observe the responses from the participants and gain insights by concentrating on the key fundamental of the interviews.

The researchers followed the thematic analysis method by first, conducting the interviews and transcribing the interviews using *Microsoft Teams* software, this software facilitated the interview process by automatically transcribing the interviews. However, the software transcription was not fully accurate, thus the researchers took the initiatives to double-check the

transcribed data and edited the informality, dialects, and fillers of the communication that were misled by the software.

Secondly, the researchers translated the interviews from Spanish to English and after that they compiled the transcribed data and transferred the data to a recommended software by Bell et al. (2019) called *NVivo 12 plus*. This software is used in categorizing data and it is useful when conducting unstructured and semi-structured interviews, participant reflections, brochures and pamphlets, emails, among other things.

Thirdly, the researchers categorized the coded data into themes corresponding to the elements of the literature review, the research question, and the interview guide. Finally, the researchers reviewed the themed data and renamed it and process it to present in the empirical findings.

3.6 RESEARCH QUALITY

One of the research criteria is to identify and measure the quality, according to Bell et al. (2019), validity and reliability are the two criteria relevant for qualitative research.

3.6.1 Reliability

The reliability of research is the grade of repeatability and addresses the consistency of the concepts in the business research (Bell et al., 2019) and the consistency of the results and observations (Cypress, 2017). Thus, this is shown in the visibility of research practices, research findings, analysis, and conclusion. According to Bell et al. (2019), reliability is divided into external and internal reliability.

The *external reliability* is the degree in which a study can be replicated, external reliability is a hard challenge to meet in the qualitative research because according to Bell et al. (2019), it is impossible to replicate the social settings of an initial study in a traditional sense. To address this, the researchers carefully chose the research topic, and developed the keywords to complement it on the selection of the articles in the theoretical framework.

Moreover, this continues with the careful choice of the methodology and the motivation of the selections of the interview guide questions, participants, transcriptions, and the tools employed in order to achieve the optimum of the external reliability.

On the other hand, the *internal reliability* is the process in which one or more observant agree or disagree of the findings, in another word, it is the consistency of the related indicators

(Bell et al., 2019). In this thesis, the internal reliability is the two researchers who ensure the consistency of the discussions regarding the matters of this thesis and the decisions making of the research process such as the participant selection, the case selections, etc.

3.6.2 Validity

Validity is broadly described and defined as the acceptance of principles or the quality of being well-founded (Cypress, 2017). In business research, validity is the examination of the quality of the information and findings identified in the research (Bell et al., 2019). According to Cypress (2017) validity was described as the research that attributes to the accuracy and sincerity. In the qualitative research, the term validity is divided into external and internal validity (Bell, et al., 2019).

The *internal validity* is the relationship and coherence between the observations of the researchers in the interviews and the concepts in the theoretical framework (Bell et al., 2019). The internal validity is achieved by the employment of the thematic analysis which relates the interview transcribed to the theoretical framework.

The extent to which findings can be generalized across social environments is referred to as *external validity* (Bell et al., 2019). Due to the researchers' proclivity to use case studies and small samples, external validity is regarded as a concern (Bell et al., 2019) that is why it is critical for researchers to be mindful of their own perceptions and ideas, as these may contaminate their research findings and conclusions.

Moreover, achieving external validity is challenging (Cypress, 2017), because the researchers choose to perform a single case study where the data will be extracted from one source. Semi-structured interviews in single case study leads to researcher bias, this is a challenge because researcher bias gives results that are selective and affective to the interpretation of the data which might build perceptions in the mind of the researcher (Cypress, 2017).

The researchers must remain in their own perception and concentrate on engaging in the interviews without involving their own perceptions (Cypress, 2017). The researchers are aware of this obstacle however, this challenge could be overcome by applying the triangulation method (Bell et al., 2019). In that sense, triangulation is achieved by cross-checking the findings (Cypress, 2017). That cross-checking was made accordingly by the fact of senior participants intervening in the interviews and addressing the same questions, following-up interview to double check the main

insights of the data collected, the usage of software to ensure the transcription and its further revision, and finally, the double check made by the two researchers.

4. EMPIRICAL FINDINGS

Chapter 4 consists of the empirical findings obtained from primary and secondary data, which have been organized according to two main topics that were part of the semi-structured interviews, those are business model, and readiness for servitization.

4.1 BUSINESS MODEL

4.1.1 Value Proposition

The most important sources of value for customers were the reliability of the equipment (P1), and the post-sales services as customers know that they will be supported during the whole life cycle of the product or project (P1, P7, P3), which implies not only the spare parts sale, but the diagnosis and technical advice (P6, P1) besides the inclusion of training services which was another feature highlighted (P6).

Customers value the reliability of the equipment and the after-sales service indeed, all the support provided to fleet and brand. They know the brand, which equipment is acquired, the benefits, which reliability, and secondly is that they know they will be supported during the whole life cycle of a product, not only for the spare parts sale, but also for technical assistance, diagnosis, and step-by-step support during the life cycle of not only the product but their project[P1]

Moreover, the brand's reputation inspires more reliability to the customers (P2, P6), while price, guarantee (P2), and responsiveness (P2, P3, P4) were also crucial factors for customers. On the other hand, the commitment of the agreements as the time and planification within the projects were the key success factors for them, then they needed a reliable partnership that can commit responsiveness and offer a suitable proposal according to their needs (P5, P7).

What I think the customers value the most, is the responsiveness and the availability, the service level [P3]

Finally, the advantages that can provide the incorporation of new technology in the products was a factor highly valued by customers concerned about what benefits that they can get from that (P5).

(...) and now the technology aspect, the technology is important, and it is everywhere, from how to obtain the product, for what it be used, if it has an additional feature, what benefits it can be provide, etc. [P5]

4.1.2 Customers and Channels

The segmentation criteria include the type of industry: mining and construction, mining is divided into open pit mining and underground mining while construction consists of big customers and small customers. (P1). Moreover, the mining segment is concentrated in approximately ten main customers, while the construction one has more than three hundred customers (P2).

There are two big criteria, first is what is mining and construction. Mining is segmented by what is big mining which corresponds to the open pit mining and minor customers which usually corresponds to underground mining, and among the construction sector, they are separated mainly by billing amount (...) to separate big and small contractors [P1]

On the other hand, in order to consider the customer needs, there is an annual survey to measure the customer's satisfaction in products and services offered; this survey is taken by a third party to ensure impartiality (P1, P2, P3). In this regard, the firm establish working plans for the coming year, in order to improve the areas in which the customers showed a low approval (P2).

We have a survey about satisfaction at the end of the year, they select key customers and a third party makes the survey, and with that result, we work during the year, for example, an improvement area could be responsiveness, then based on that we make working plans [P2]

Moreover, the value proposition is designed starting from the customer's needs as before presenting the proposal it is necessary to make a study (P1). The needs of the customers vary from project to project in aspects such as the type of material to be moved, then the type of product needed would be constituted of more resistant materials (P5). Likewise, this value proposition design is developed by a multidisciplinary team composed of commercial, technical, service, and the workshop department (P2)

(...) an effective proposal for a mining project, is very different from another. (The idea) is to support the customer and adapt the proposal according to their needs, in order to be attractive (...) [P5]

Furthermore, for the mining segment, engineering, and maintenance teams hold meetings biweekly in order to correct any issues that has been identified with the customers. Besides they also hold meetings every two months with their customers in order to present KPI and where the customer participates and has the chance to provide feedback. (P1)

Regarding the channels, there are different channels to reach customers, being that in the case of the big mining segment each project portfolio has a key executive who acts as one-face contact for any of the requirements the customers might have. In the case of the construction

segment, especially in the small segment, as there are things of less value and size, the digital channels have played an important role in the last two years, when the firm decided to develop more these types of channels which has helped them to capture new customers as well (P2)

The sales channels for mining are the sales executives (...) In the construction site as it is about smaller and less valued things in comparison with mining, the digital channels have been developed, around two years ago to capture new customers or improve the relationship with the current customers (...) these channels have been gaining importance [P2].

4.1.3 Key Resources

The financial support is a key resource to deploy the value proposition (P1), in most cases assured (P5) and it is mostly decisive to gain the business (P2). Moreover, many services require holding equipment and spare parts available in inventory to supply the customer's need while the services such as maintenance and repairment are executed, as a result, the financial backs play an important role supports the operation, in this regard, the firm had made progress in processes such as in the overhaul time, then allow a faster flow of financial resources (P3).

(...) in most cases the customers prefer to work with the brand because of the guarantee and the scope, and also because of the financial support, because a competitor with fewer sales amount cannot be compared to us. For big business the financial aspect is a decision factor[P2].

(...) if for example, you deliver a component and I returned in two months (...) then for that the firms need an important financial support in spare parts that they could have in inventory and consider they won't move it, 2 o 3 million dollars, that are going to help to make an overhaul [P3]

On the other hand, the infrastructure of the operational centers was important to attend the different service demands (P2), even when the firm could account with highly qualified staff, if they do not have the installed capacity to attend the demands, the response time will be directly affected (P3). It is also important to have a qualified staff who can executed the services activities (P5, P3), accounting for a good inventory allow to provide a good service level regarding availability and response time to the customers (P1), and the improvement of IT platforms has been improved in the last few years and has constituted an important tool to support the daily activities (P2).

The staff, the operational team, as our strength should be the capacity that has the operational center to respond to the demands (...) from my point of view, the most important. Secondly, it is the installed capacity, because we might have the best staff, but if we don't have enough capacity, we

can't make it in an efficient time (...) (The company) have improved a lot in the increase the capacity of the centers.

Moreover, it is important to developed empathy with the customers, in order to understand their needs, and also being aware of the urgency, as it was important not only to know what the customers need, but when they need it (P7), then aspects like the management of customers key account was a challenging activity that requires certain skills such as technical knowledge and working under pressure (P2) and the resilience and adaptation capability within a changing environment, plus achieving the customer's trust by offering immediate solutions to solve issues were the key (P6).

4.1.4 Key Activities

In the case of the mandatory activities that the company must assure, is the safety (P1, P2). All the working plans must be built within the scope of safety, otherwise the risk of losing a contract or the company's prestige is high (P1). Moreover, it is important to ensure the efficiency of the service's processes, as if a repairment is not properly made it could cause an accident in the operation (P3). Thus, the service's processes should be efficient in order to be distributed properly the installed capacity and human resources in order to commit the time and reliability required by customers (P1).

The main factor I consider before anything is the safety, (...), from that we can make real working plans, regarding how many hours we can schedule (...) without the safety base, accidents might happen and it could be resulted in the lost of contracts and the prestige of the company (...) the planning department that supplies with spare parts, and the operational center which covers everything, who account with the installed capacity to distribute machinery and personnel hours [P1]

Additionally, it is important to have the right inventory planning, as some of the service contracts implies having a predefined security stock to attend repairments and maintenance, but if the life cycle of the project or the contract is about to finish, the company might generate important losses if they keep inventory of spare parts and components for a project that is over, and sometimes it that can be hardly placed in another project or be returned to the factories(P3).

For instance, the maintenance and repairment contract (...) we are expecting to see if it is going to be renewed or not, as it could have an impact of approx. 6 million dollars of lost (...) because of the inventory will not be able to sale, there are not other equipment in the country that can use

these spare parts, (...) this is something that has not been measured. It has the risk of becoming a liability [P3]

On the other hand, the supply activity is important for the after-sale services, as it guarantees the inventory of spare parts and components to provide good performance indicators regarding availability and response times (P1, P4). Moreover, even if the quality of the products offered are good, it is very important to provide a good support in after sales (P6)

Finally, the concerns of the firm are focused on the development of technology which might help to develop new services related to monitoring and new equipment that operate with alternative energy sources. (P5)

4.1.5 Partnerships

The firm has a bonded and long relationship with the factories which supply with equipment and components and ensure an exclusivity contract, providing them an advantageous position in the market. Moreover, they maintain a constant flow of information regarding the last product's updates and innovations made, then the firm can offer the best option available to their customers (P1).

Besides, the involvement of the factories in the business is high (P2), they influence in the value proposition offer, from the availability of products to the customization of them, as per in their recently participation in the sale of machinery for a big project was a key aspect, as they have participated from the begging of the proposal, helping to customize it in order to satisfy the specific needs of that customer (P7).

They definitely intervene a lot. From the initial process, if there is availability or not, or if they customize the product. It has happened recently with mining trucks for a special project that they have begun from zero. Then, I think that definitely the suppliers have been a key, and the headquarters. They have customized the proposal. It takes time and money, but it resulted. [P7]

However, regarding the information flow, it can still be improved, even when in the last years they have built better platforms for the information exchange that have facilitated them the execution of certain purchasing and supply procedures that were not automatized before (P7).

4.1.6 Cost and revenues

The firm has a separate department for service support, which is responsible for process the service orders, controlling, matching, and reporting the costs, sales, and profits (Company's magazine, 2016). Moreover, these departments constantly receive training about financial matters (Company's magazine, 2017); however, there are still misunderstandings among the other

departments that intervene in the process, as the lack of knowledge about certain financial concepts has created confusion in the financial terminology during the costs and expenses registration in the system (P3).

(...)regarding how to translate the financial concept to the spare parts department, for example, the inventory concept to the financial level, what is consider a expense or what is considered a costs (...) terminology matters (...) I think there is still work to do to reinforce those concepts (...) I told you because it happened to us, the firm does not know how to classify some expense we were incurring, (...) and when the financial department asked why certain amounts were being considered cost when they were expenses, then we realized than in the spare parts department, nobody has idea of what they were talking about, then the financial department came to train us[P3]

Moreover, as it was stated in the key activities, the company have had some troubles regarding the inventory management for long-term service contracts which have the potential of becoming a liability (P3).

Furthermore, the firms assume some businesses that implies waiting a longer time for the return of the financial flows as P2 argued they were participating in a project by offering a fleet of trucks of the last generation for a trial period in order to been tested and increase the chances to get new contracts.

When we place equipment in trial period in the projects, the machinery still belongs to our firm, (...) in the 99% of occasions at the end of the trial period, the mine decides to buy it. (...) (it happens) generally after one year [P2].

A summary of the business model main findings is available in appendix 7.2

4.3 READINESS

4.3.1 Effectiveness

The reasons of success could vary, the price of the product has not been the main success factor of the firm, but the responsiveness capacity of the firm (P2, P5). Moreover, the service, quality of products, the highly demanded products which are the preventive maintenance products that clients rely on are considered also important (P3). Finally, the quality of the product in terms of working hours and efficiency of the complementary services is also considered a success factor (P4).

I would say is the responsiveness, (...) we have always had the responsiveness capacity, not only by the firm, but also the factories have been involved, and that is one of the things (the customer) have valued a lot (...) we could make mistakes, because it is acceptable and normal, or something that might happen, but the interest of the company and the solutions and time in which those are proposed, it is one of the variables that the customers has taken into account to choose us [P2]

4.3.2 Experience

The firm has modified the information management systems (P2) and some aspects such as implementing better planning method to simplify the purchasing process (P3) also, the firm developed training of personnel in the administrative and technical groups, with better results in the technical side (P6).

In previous years, we didn't work with planned purchases for consumable products, then the factory has a policy that state that if you buy under a planned purchase it will help to improve the attention time, and to reduce the prices. This allowed to have better margins, before it was tried to be implemented but we were not very aligned with the factory mechanisms and instead of helping us, that hit us (...) that was improved and the planning worked better [P3]

4.3.3 External Engagement

The firm uses a third-party to conduct year-end satisfaction survey for the clients by a third party (P1, P2, P3), and from this, working plans are made (P2) they also hold periodic meetings to evaluate indicators and receive feedback (P1). Moreover, the firm is relating more with the customers' needs by sending staff to the client's sides in order to evaluate their needs and requirements (P7). Also, factories engagement in the development and delivery of the value propositions has been very important in terms of availability and customization (P7).

(...) Yes, I consider the company listen to their customers (...) Customers that before worked with our competitors has came because of our technological side, because I think and consider that we do listen to the customers' needs finally or we are able to work on what they want (...) I know there are instructors, engineers that go to the mines, for instance, and they focus a lot in the needs (of the customers) and work on that to offer a quality product [P7]

4.3.4 Culture and Development

The firm provides training courses which are supplied to both the administrative and the technical group, having address the needs of the technical side better than the administrative side (P6). Moreover, regarding the daily work, they make pauses in order to discuss relevant situations in the operations for others to learn from those experiences (P7). Also, when is it about safety,

there are documents that are filled every time a technical service or operation is completed in order to verify the safety conditions and occurrences of accidents (P3).

Talking about the technical side, they have a very well defined career lines for each worker, according to their position, then I consider the technical side is well planned, and developed (...) If we go to the other side, administrative, I think there are still deficiencies,(...) because the administrative side is very varied for each position in each department, not necessarily an analyst of certain department will need the same than the analyst from another one.[P6]

4.3.5 Creativity

One of the primary goals of the firm for the current year is that all the departments should focus on developing projects related to innovation in order to create value for the customers (Company's magazine, 2022). P1 argued that the process for presenting ideas is simple, as they only need to talk with the direct boss, and they can be rewarded for it, moreover, the innovation could come from any of the department not only those related to the developing of services or products (P1). Finally, the company also established "Meeting your president" sessions to promote sharing ideas with the president (P3, P6, P7).

Each department commit its functions, and all the innovations wont go to the product (...) for instance the engineering and maintaining departments can provide their ideas in their field, because they are in the position to provide those type of innovations (related to products/services), but there are other departments that also can propose innovations, for instance logistics or the warehouse, someone might suggest a methodology to reduce the dispatch time (...) [P1]

4.3.6 Risk Propensity

According to P1, when a new idea that is supported with financial indicator it is likely to be accepted by the firm. Moreover, the firm is in a temporary situation, where the international prices might stall projects (P2). Also, there are situations that create uncertainty such as pandemic in which the company has ensured communication regarding rumors of layoffs and other situations around (P7). However, the response time for these official communications should be shorter (P6).

In the case of change acceptance and participation of employees in new projects, they remain open for it (P2). However, this situation depends on how the managers are implementing the changes, it is important to provide employees enough time to execute these changes without affecting their regular work (P3).

(...) I think so, but it is also important how they approach them. It is ok to have new challenges, and everything, but it is also important to provide a balance to the workers regarding their

capacity. If you are busy, I won't say let's implement this project that is going to take 3 hours of your day, right? (...) [P3]

Moreover, one of the last projects in which the firm has participated is in the offering of a fleet of trucks in order to be tested in mine. This test will be carried out for 1 year in, and the machinery will remain owned by the firm (P1) which implies a higher risk for them.

4.3.7 Communication

There are opportunities to improve the communication between different departments, especially for the operative departments, planning, and technical centers. It is important to make these departments more participative (P2). Moreover, some departments make pauses to discuss the most relevant issues presented in their work (P7).

I'd say there is chance to improve. If I ponder this from 0 to 100, I'd say 75, there are improvements to make in the operative departments, planning, and the operational centers, there is lack of communication sometimes, but in the other departments it flows faster. (...) planning is more oriented to take care of the stock, but they are not very familiarized with the impact of their actions, if they can understand better the impact in the business, they would look the things differently [P2]

Furthermore, the communication flows in the daily activities, but there are some situations such when the terminology used between departments has created confusion (P3).

On the other hand, the firm has promoted campaign that promote periodic meetings between the top management and workers at different levels in order their feedbacks, ideas, and questions (P3).

4.3.8 Awareness

Participants recognized that even when the sale of spare parts could provide a high profit to the firm, it is the service offering which brings more positioning and results within the market, because it ensures the continuity of the business along the project's life cycle (P1).

Economically, the sale of spare parts is what brings you more margin, but which give you more positioning are the service contracts in which the brand manages the fleet, to begin, it ensures the (business) cycle, (...) you close a business with all the spare parts, planning, maintenance, involve all the department and transfer this to a contract (...) [P1]

Moreover, P7 argue that the sale of machinery only constitutes an entrance product but considered that the firm was more focused in the after sales stage, which involves the offering of services. In this regard, P5 argue that the company was oriented to differentiate by the offering of an integral solution which involves guarantees and training.

The firms seems to be aware of the importance of the services in their business, as they manifested that the signed of a service contract ensure production to the Rebuild Center, it allows them to have a good planning of the spare parts and services to be executed, and it creates barriers for the entrance of new competitors (Company's magazine, 2017) ; however, P2 consider the firm still lack enough creativity to try to negotiate businesses by offering new services.

4.3.9 Service History

The firm has been offering services for more than 20 years. One of the main business units is the Rebuild Center, which was created in 2008, however, the electric and mechanical subcenters started to operate in 2010. In 2016, they started the centers of welding and refurbishment and in 2020 the electric components lab (Company's website, 2022).

Along these years, there has been a different perspective about the service orientation. In 2018, the CEO manifested that the most important aspects the company must ensure in order to be chosen for the customers was overcome the competitors in terms of efficiency and reliability (Company's magazine, 2018).

However, in 2020, one of the main shareholders of the company considered that it was necessary for the firm to modify the mission, vision, and values they used to have, as the previous one was developed in 2004, and the environment has radically changed since then (Company's interview with shareholders, 2020).

In this regard, the mission, vision, and values were changed, including in one of the strategic pillars of the firm, the importance of the customers focus. Moreover, for 2022 the new CEO argued that the customers recognize the firm because of the team and the support that the company provides (Company's magazine, 2022).

A summary of the readiness main findings is available in appendix 7.4

5. DISCUSSION & ANALYSIS

Chapter 5 is about the discussion; it contrasts and compares the empirical findings from the interviews with the concepts of the literature review. The chapter consists of three parts: Product service system business model, Readiness, and the challenges.

5.1 PRODUCT SERVICE SYSTEM BUSINESS MODEL

According to Dewi & Van Voorthuysen (2010), as the heavy equipment industry is capital intense and with long lifetime products, the provision of the use-oriented and result-oriented services requires strong financial support.

Table 3.

Portfolio of services

<i>Product-oriented services</i>	<i>Use-oriented services</i>	<i>Result-oriented services</i>
<i>Technical assistant, maintenance, repairment, financing, and training for product.</i>	<i>Renting and training in service.</i>	<i>Parts and labor contracts, Maintenance and repairment contracts.</i>

However, the firm is currently offering a set of services that relate to the 3 main typology of product-service system suggested by Tukker (2004), these services are classified as shown in the table 3. This occurs as the firm is characterized by having a strong financial back argued by the participants who also stated that it provides them a competitive advantage over certain businesses.

Moreover, the type of services that implies a major risk assumed by the firm in terms of ownership, such as the maintenance and repairment contracts, requires them also to have a large investment in the inventories to support the operations which means to have a high level of awareness of the different procedures, by looking not only in present activities, but also to take a future look towards the whole life cycle of the service contract in order to prevent possible drawbacks.

On the other hand, it is important to consider that the result-oriented services provided by the company does not imply the total ownership of the equipment in the operation, but only the

items such as some components and spare parts required for the commitment of the maintenance and repairment, as also keeping the ownership of the fleet would be something non profitable for them, as per the reasons explained before.

Moreover, according to Adrodegari et al. (2016), it is important to understand the value proposition from the customer perspective. With that in mind, the firm believes that the elements the customers value the most are those related to reliability, technology, and training, regarding the product features, and responsiveness, guarantee, availability, commitment with agreements, and being supported during the whole life cycle of the product or project.

In Product-Service System business models, the type of relationships with customers that are pursued are direct and long-term, with an emphasis on information sharing (Adrodegari et al., 2016), based on the needs of the different segments (Barquet et al., 2011), and trying to keep the interaction along the product life cycle (Adrodegari et al., 2017). In this regard, it was possible to realize that the company address two big markets to which they deliver the value proposition under different strategies. While the mining market, which accounts for approximately ten customers, is characterized by having sales executives usually dedicated to only one account exclusively, the construction market was more dispersed, accounting for approximately three hundred customers, as a result, there were sales executives attending many accounts.

The different strategies to address both markets show a different level of maturity regarding the customer vision that pursues the PSS business models as the mining segment seems to be more customized, with more intensified relationships, and exchange of information, while the construction segment seems to be more mass served and less interactive with customers.

Moreover, the firm seems to have in account the customers' needs by conducting an end-year satisfaction survey to collect information for that working plan, also in the mining segment, the executives sustain periodic meetings in which they receive feedback from customers. In this regard, in PSS BM, emphasizes the interaction with customers and the level of the information, and the market insight obtained (Adrodegari et al., 2016).

However, regarding the channels to address the customer segments, the company has made recent efforts to address the dispersed construction segment by the use of digital means to reach them in a better way. In PSS BM, the channels usually need to be changed or adapted in a way they can create awareness of the benefits of the offering (Adrodegari et al., 2016), being more attractive than channels used for the traditional offer (Barquet et al., 2011), and firms even need to

invest in the development of new competencies regarding the implementation of this channels (Adrodegari et al., 2017). From the information collected it was also possible to realize the growing focus of the firm on the development of soft skill capabilities within the sales team which relates to the customer service approach.

Regarding the Key Resources, there is an evident need of financial resources to support this type of business argued by the participants, and it alone constitutes a source of competitive advantage as in the mining segment there are only few competitors because of the high investment required to serve this market. In this regard according to Adrodegari et al. (2016) it is usual that PSS BM requires more financial resources than the traditional BM to support the new revenue model. Moreover, according to Dewi and Van Voorthuysen (2010), usually, in this type of industry, it is required strong financial support in the offering of use-oriented and result-oriented services.

Moreover, once again the investment in the development of the human resources capabilities is also a need for PSS BM (Barquet et al., 2011) and according to the participants this is something the firm has been working on during the last few years. However, those are not the only key resources the participants argued to be important, but the installed capacity of the centers, good inventory levels in order to attend on time the requirements of services, and better IT systems that were implemented in the last few years.

In this regard, certain activities have become more important such as the stock planning, management of installed capacity, and the development of technologies to support the value delivery which would be aligned with the requirement of more activities that enhance the service vision (Adrodegari et al., 2016) and relates to the customers (Barquet et al., 2011). Another activity that relates to the customer was ensuring the safety, as without the safety the company might lose the contracts with the customers which would affect the firm's reputation.

Nevertheless, the fact that participants have recognized the importance of those activities does not mean that they are performing as it is expected in a PSS BM, and as it was argued by some of them, there are novelty improvements in the performance of those activities, and some more challenges in others, specifically in the inventory management the firm is realizing the existence of possible drawbacks in this matter when long-term service contracts finish and they potentially keep unnecessary and difficult to relocate inventory which might generate an important financial loss.

In relation to the partnerships, one of the most important parts recognized by participants were factories, they influence activities such as the supply function, exclusivity contracts, and innovation. They also influence in the value proposition delivery by supporting and customizing the products offered to customers in new projects.

According to Adrodegari et al. (2016), in PSS BM the length and nature of the relationship with partnerships is strategic based and long-term, in this regard, it has been seen that relationships established with them are long-term and the level of involvement display a strategic support along the value delivery. However, there are still elements such as data exchange with them that some participants have stated as an improvement opportunity.

Furthermore, according to Adrodegari et al. 2016 in relation to the costs, firms should be moved from cost-plus pricing to value-based pricing. In this regard, the firms have a specialized team that is in charge of all the supporting activities relating to services such as cost control matching and reporting. Moreover, the firm has also provided training in accounting capabilities to the department that leads that process. However, it has not been directed to all the actors involved in the process as it was argued for the participants, as there have been situations in which the lack of knowledge of those concepts has caused troubles in the costing activities.

Likewise, the firm seem to have no prevision of the inventory planning that relates to the long-term service contracts as they have the risk of keeping stocks for this contract that will be no longer used. Then, it would have a potential negative impact on the financial side.

Finally, according to Barquet et al. (2011), in PSS BM regarding the revenues, financial flows are expected to change from immediate to extending use period. In this regard, the firm seems to be aware and open to waiting for a long period without financial returns as they have placed the last version of trucks in one of the mining projects in order to be tested for a year until the customers decide to buy it or not. This assures the after-sale business and generates long-term revenues.

5.2 READINESS FOR SERVITIZATION

According to Teso (2017), the effectiveness of the firm is shown in the past achievements as a rate of success as it describes what the company has made so far to achieve where it stands today.

In this regard, the participants recognize that the main factors that have promoted previous success have been holding products with a recognized quality, the capability of the company to

constantly innovate the lines of hot products and the responsiveness of the firm. As a result, it has been seen that many efforts of the firm are oriented to the exploration of new technologies especially for monitoring capabilities, digitalization, and environmental care. However, these past achievements relate mostly to the product side than to the service.

Regarding the experience, it is stated that the knowledge and capabilities developed over time will support better the readiness in the servitization (Teso, 2017). Moreover, the firm has shown capabilities of getting insights from past experiences, as the firm has been able to make improvements in information systems, purchasing processes, and training programs.

Moreover, the external engagement determines how the firm interact with their outside in order to create opportunities (Teso, 2017), then the more engage they are with their stakeholders that could create value, the more ready they are to develop a PSS. Regarding the customers, the interaction channels might differ, but the most important customer feedback they receive comes from an annual survey that serve as source for working plans. Also, their relationships with the main suppliers look strategical and long-term and they intervene in the value creation and delivery.

Furthermore, the culture and development element provide a base for the development of service capabilities further by looking at the learning mechanisms and the current skill that firms have (Teso, 2017). According to the participants, the firms promote training courses following career lines depending on the employer's profile if it is administrative or technical, however, those programs still need to be better adapted to the different needs as the administrative staff requires more dispersed career lines. Regarding daily operations, even when there are some initiatives in order to learn from the negative situations, this is carried out in an informal form. Finally, regarding safety, the firm seems to follow a strict procedure to register the conditions of the operations and the services executed.

Likewise, firm has shown a high level of commitment towards the creativity element which has been evidenced in the periodic meeting sessions with the top management, the corporate goal of implementing innovation in all processes towards value creation for customers, and mechanism of presenting ideas. In this regard, Teso (2017) argue that if the creativity and motivation are promoted then the firm will be more prepared for servitization.

Regarding the risk propensity, it will define the tendency of the firm to assume risk and novel situations (Teso, 2017). The less risk averse is the firm, the more ready is to adopt a PSS. On this, the participants manifested that there are certain situations that could make the firm care

more in assuming new risks, especially when the external environment turns particularly unpredictable. However, the acceptance of employees for new challenges is usually positive as long as their schedule for daily activities is not highly affected.

On the other hand, the dimension of communication implies that the better the information is exchanged through formal and informal means, the easier would be to build up a service-oriented vision (Teso, 2017). In this regard, participants argued that when it is about the daily activities the communication is more fluent, however, there are some departments that have been considered to have a low communication and vision of the business as they were more careful of the operational aspects of their department and not the general goal of the firm. There are also some confusions regarding the technical concepts used between departments. Moreover, there are channels to make the communication flows from the employees to the top management.

Likewise, participants have recognized that it is the service offering that provides them with more advantages in terms of differentiation with competitors and ensuring the revenues of the business along the project life cycle, then it is possible to realize of a high level of awareness of the service value. However, it seems that there is not much creativity to offer new services to the market. According to Teso (2017), a firm that recognized services as a critical component in the value proposition shows more readiness to develop capabilities towards a PSS.

Finally, according to Teso (2017), a firm's readiness for servitization should be observed from the evolution of their offerings and the competences changing over time. Regarding this, even when the firm have been providing services for many years, the strategic vision that the services have had within the top management have been poor as in almost the whole history of the firm they have been mostly product oriented.

It is in 2020 when it was possible to see a tangible alignment in the managerial thinking with the service vision by the inclusion of the customer focus as a strategic pillar. However, it is possible to realize that most of the participants interviewed were very aware of the importance of the services in the value proposition of the company.

5.3 CHALLENGES FOR SERVITIZATION

Even when the firm has more than 20 years in the market, and they started providing products and basic services related to them since then, the strategic alignment regarding services has been changing over the years. Then, it is possible to notice that not many years ago, in 2018,

the CEO of the firm provided more emphasis to product-oriented features and lack of inclusion in the customer thinking on the strategies of the company.

This is not an uncommon situation in this industry as traditionally it has been offering services in a reactive way, and usually there are not incentives to enhance the service vision (Dausch, 2002). Moreover, according to Gebauer et al. (2005) there are some cognitive phenomena that limit the managerial motivations to extend the service business such as the overemphasis on tangible environments, which is evidenced in the former firm's vision of enhancing the productivity, efficiency, and profit in order to overcome the competitors and gain the customer preference.

Nevertheless, it is in 2020 when the strategic principles of the firm changed. The introduction of a new system of mission, vision, and values have boosted the idea of the customer satisfaction as strategic pillar of the organization. In this regard, Martinez et al. (2010) considers that the strategic alignment is a common challenge in the servitization process, which is related to the firm's mindset aligned with the customer thinking.

Moreover, the firm's current CEO manifested that customer recognize the staff and the assistance provided by the firm, which seems to be current mindset of the firm. However, it is difficult to determine the influence of this change in the short term, as per previous literature it could take a long time to fully achieve a service transition, yet, the customers, culture, technology, among others can enhance the transition pace (Baines et al., 2020).

In relation to the business configuration, Martinez et al. (2010) manifested as another common challenge for servitization the internal capabilities and competencies needed for the service deployment. In this regard, these competencies seem to be a work in progress for the firm that have started just a few years ago, with the development of training programs that needs to be improved, especially in the training programs that are provided to the administrative staff.

Furthermore, regarding the delivery of the integrated offering, Martinez et al. (2010) argued that this situation might create more touch points with customers, issues and misunderstanding, and imbalance in the expectations might arise. In this case, the firm has been working on developing training for employees, not only at the hard skills side, but at the soft skills side which might contribute to face these challenges.

Moreover, the channels to address the customers' requirements have been recently modified by the firm, as the construction segment was a more disperse, then required the support

of digital technologies to reach them. Finally, in order to balance the expectations of the customers, the firm is elaborating working plans based of the feedback received through different means such as surveys, meetings, and others.

Further, in relation to capabilities in certain key activities such as the inventory planning, it seems to be a field of improvement, as the lack of planning in this activity when it is about service contracts seems to be a potential source of financial drawbacks in the long-term.

According to Benedettini et al. (2015) while some servitized companies achieve important growth objectives, others struggle to get profits from their service offer, in this regard, it is important for the firm to ensure there are no activities that could create financial losses in the future and make them fall in what Gebauer et al. (2005) call the service paradox, that corresponds to a situation in which the service investment does not fit the expected returns.

Finally, Martinez et al. (2010) stated another important challenge in the servitization process relate to the supplier's relationship, which corresponds to greater cooperation with the supporting network that allows to deploy the integrated offer. In this regard, the firms manifested to have long-term and strategic relationships with their main suppliers, which are the factories. However, in relation to the information flow, it was argued that there is a field for improvement.

6. CONCLUSIONS

The last chapter of this research answers the main research question by addressing the sub-questions that were presented in the introduction chapter. It also introduces some limitations found and proposals for future research.

6.1 ANSWER TO THE RESEARCH QUESTION

Regarding *how the firms work with a business model that includes services*, it has been concluded that servitization is not a linear process, and even when firms can be delivering product-service offerings for a long time, they might not be a proper Product-Service System provider. One of the most important reasons that could play against this is the lack of awareness of the service contribution to the main strategy that the top management pursues, then there will be no execution of actions related to increasing the customer orientation that PSS enhance.

Moreover, it is not a linear process as the elements of the business models such as customer segments might present different levels of transformation and maturity. In this regard, firms that are working with services might realize that more sophisticated services require more developed, closed, and personalized relationships with customers, and it could exist segments or product lines with a more developed product-service system features than others, as they have developed a closer relationship with their customers, or they had the possibility to get more personalized communication channels.

Likewise, it was possible to see that as the theory stated that the most relevant resources to execute a product-service offering were the financial and human resources. Thus, the development of skills that relates to the customers is essential as well as anticipating financial issues regarding the provision of the offering during its whole life cycle. Moreover, for this particular industry in which the offerings are capital-intense, the financial resource resulted even more critical.

Additionally, even with the key activities might vary from industry to industry, it is important to guarantee that the activities destined to satisfy any of the components of the product-service offerings are properly executed, like in this case they were planning, safety, and workshop facilities activities. In the regards to the key suppliers, they play an important role in the provision of the product-service offerings because they ensure the availability and responsiveness that firms will provide later and are capable of intervene in the design of the value proposition, not only in the product design but in the product-service delivery.

Likewise, it is important to ensure that the teams involved directly and indirectly in processes that are related to cost or pricing disciplines for PSS are properly trained about the financial aspect. Moreover, it is imperative to know very well the product-service offering features during its entire life cycle, in order to avoid losses caused by scenarios that were not considered during the proposal's design.

In relation to *how willing and ready are the firms to improve in the service transition*, it was found that the firm that corresponds to the case study committed a high level of the readiness criteria for servitization, as their performance, especially regarding creativity and culture and development, have been reinforced with several action plans over the years. In this regard, as it embodies a more mature company in the servitization journey, it could bring to practitioners a set of practices that have been implemented from their experience and have made them possible to reach a higher level of readiness.

Yet, it is relevant to point out that as the firm has many years providing complementary services, it might be possible that the development of capabilities for readiness, consciously or unconsciously, have been developed over the time by virtue of this. Certainly, there were found small areas of improvement such as communication, but the most important was the awareness of the top management, and in this regard, it results important not only taking into account readiness for the servitization journey but willingness, especially the one manifested by the higher levels who build up the strategy the company must follow.

Regarding to *the challenges that firms encounter when improving towards a Product-Service System Business Model*, it was realized that even when the firms might be able to recognize many of the features that customers value in the offering, which can be substantially tied to service characteristics, the service vision and customer orientation that is intended to be constructed in a PSS is not going to be fully implemented until the strategic levels of the organization lead that transformation. Consequently, the strategic alignment and overemphasis in the tangible environments were the main challenges for this transition. Especially when these challenges relate to the top management of the organization.

Likewise, reaching customers through the proper channels proved to be an important activity to execute in PSS, and it could also be a challenging task if they are not properly segmented, or their needs are identified. Moreover, it is important for firms to work on the development of customer-oriented capabilities and ensure the new key activities of the process are

working financially properly in order to avoid losses that can create future liabilities. In this regard, one of the potential difficulties related to the financial side was the lack of prevision of cost contingencies along the life cycle of the offering.

As a result, to answer *how manufacturing firms could improve their business models towards a Product-Service System business model*, it is essential to begin with the strategic alignment and the willingness of the top management to focus the efforts in building up a proper PSS orientation in their business model. This might be a challenging task because of the overemphasis companies could have about tangible environments and due to their risk aversion, but failure to address these challenges will play against the expected returns of servitization.

Moreover, it is relevant to identify the types of PSS that are pretended to be reached, being that not all types of PSS are suitable for all contexts. It could be necessary to establish different strategies to address different product lines that correspond to different typologies of PSS or customer segments whose needs vary or demand different level of efforts to reach the parameters of the PSS.

Likewise, a diagnosis of the current business model and the identification of gaps with the expected parameters of PSS will be the main focus of the efforts in the transition process. In this regard, every element will play an important role because of their interrelation to express the business logic of the firm; while the value proposition, customers, channels, and partnerships will play an intensive contact role with the outside of the firm to understand the customers' needs and identify in the network the actors that will contribute to delivering the value proposition through the most suitable channels; the key resources, key activities, and costs and revenues mechanisms will be very important to guarantee the sustainability of the new offering in the time and will allow the success of the value delivery.

In this regard, the findings of this research suggest special attention to the identification of the customers' needs for the development of the value proposition, and the proper selection of the channels to reach them. Moreover, even when the activities, partners, and resources are important, special consideration should be put into the activities that might generate financial losses, taking into account for that the life cycle of the product and not only the early stages as its design or production, as PSS business models imply a major intervention of the firm along the cycle.

Furthermore, the firms must develop action plans in order to increase their readiness for the servitization process, the starting point will depend on the background and situation of each

company, and it should be start from the very beginning as many of the elements such as culture and development and creativity relate to capabilities that could take time to develop; however, awareness, in all the organizational levels, also seems to be a key element to construct the readiness of the firm.

6.2 LIMITATIONS

One of the limitations of this research relates to the inability to conduct interviews with customers to gain insight into their perception toward the value offering as according to the product-service system theory the value proposition is understood from the customers 'perspective. The insight of the customers would contribute to the analysis and results in which they will shed light on the analysis of the current business model of the firm. However, the researchers interviewed firm employees which provided with insights from what they argued it was the customers' perspective.

Another limitation is the lack of enough previous research related to servitization, as this is a novel topic, but even more so when analyzed from a product service system business model perspective. Thus, when the researchers were searching for the articles that are connected to the keywords, and to relate the term servitization to the product-service system business model they found out that there are no sufficient articles that meet the requirements and serve the purpose. The researchers believe that the enrichment in the theory would contribute better to the literature review and also to the analysis and the conclusion of the research.

6.3 FUTURE RESEARCH

During the development of this research, it has been identified different areas for the development of future research. In this regard, the information that relates to describe the theoretical and practical information about product-service system business model is limited. Moreover, the specific field of costs and revenues within the business model has a very reduced analysis, especially regarding the analysis of life cycle costs implications in PSS, as one of the features, the ownership of the product, plays an important differentiation role between these type of business models and the traditional ones.

Likewise, for firms that operates with PSS BM that provides a heterogenous typologies of PSS in parallel, and the transition carried out in the different stages there is still a research gap and constitutes another important area to address as the theory considers businesses as a one-offering-solution entity.

Moreover, the service continuum of PSS shows that it is possible to see different levels of service content, also the level of maturity in the implementation of PSS could vary from firm to firm, thus, it is recommended to apply a multiple case and/or cross-sectional study that could analyze the variety of conditions and the possible differences and challenges that firms face during the servitization journey.

Likewise, as this research lacks a comprehensive examination of the product-service system business models from the perspectives of customers as a primary source. Therefore, it is recommended for future research in this area to interview customers in order to gain their insights about the topic.

Finally, there has been little research into the elements that contribute to a company's readiness for servitization; the most solid theoretical framework related to the topic was a dissertation that covers the nine dimensions of readiness. In that sense, it is recommended to expand the research regarding the readiness for servitization to allow researchers to gain more knowledge on this topic.

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7. APPENDIX

7.1 INTERVIEW GUIDE

Introduction:

- Por favor, ¿podrías describir tu puesto de trabajo? (*Could you briefly describe your job position?*)

Business Model:

Value Proposition

- ¿Cuáles son las principales fuentes de valor para los clientes?, ¿Cómo se comunica la propuesta de valor a los clientes? (*What are the main sources of value for the customers? How is this value communicated to the customers?*)
- ¿Cómo se diseña la propuesta de valor? (*How do you design your value proposition?*)
- ¿Qué nuevas soluciones le gustaría a su compañía desarrollar a futuro? ¿Existe el interés de continuar desarrollando servicios? (*Which new solutions does your company would like to deliver in the future? Is there any interest to develop services?*)

Customers and Channels

- ¿Cómo se incluyen o consideran las necesidades o retroalimentación de los clientes en el mejora de productos o servicios? (*How do you include/consider customers feedback/needs on the product/service improvement?*)
- ¿Qué criterio se aplica para segmentar la base de consumidores y como se canaliza la propuesta de valor a cada uno de ellos? (*What criteria do you apply to segment your customer base and how do you deliver value to each of them?*)
- ¿Cómo se asegura de que los canales de venta sean los ideales para alcanzar a los consumidores? (*How do you ensure that sales channels are suitable to reach customers?*)

Key Resources:

- ¿Qué tipo de habilidades o capacidades en la organización son importantes para sostener el modelo de negocio? (*What kind of skills/capabilities in the organization are important to sustain your business model?*)
- ¿Qué tipo de tecnologías digitales soportan su negocio y cuáles se encuentran en desarrollo? (*Which digital technologies support your business and which ones are in development?*)

Key Activities:

- ¿Cómo se desarrollan nuevos productos y servicios y cómo se orientan los recursos hacia la creación de estos? (*How do you develop new product/services and how do you orient your resources towards the creation of those new product/service?*)
- ¿Qué características de los productos o servicios se procuran realizar más? (Ej.: confiabilidad, durabilidad, modularidad, uso, etc) (*What features of your products/services are prioritized to enhance? (e.g., reliability, durability, modularity, usage, etc.)*)

Partnerships:

- ¿Qué tipo de socios tiene la compañía? ¿Cómo se relacionan con ellos? ¿Son relaciones de corto o largo plazo? (*Which type of partners does your company have? How are the relationships with the partners? Are they long-term or short-term?*)
- ¿Qué tan solida es el intercambio de información y el soporte con sus socios? (*How solid is the information sharing and support with your partnership?*)

Costs and Revenues:

- ¿Cuáles son los mecanismos de ingreso para su compañía? (*How does your company gain revenues per product/service type under your current BM? Which are your main revenues mechanisms*)
- ¿Cuál es la principal estrategia que persigue la compañía? (Ej. Competir por precio, diferenciarse, segmentarse) (*What is the main strategy your company pursue, cost competition, differentiation, or segmentation?*)

Service Readiness:

Effectiveness:

- ¿Qué tan seguido el éxito de un producto o servicio se traduce en una mejora o upgrade o en una compra repetida por los clientes? (*How often is a successful product translated into repeated purchase or upgrades?*)
- ¿Cuál considera que ha sido la principal razón por la cual su compañía ha sido exitosa en el pasado? (*Which do you think is the primary reason for success? (eg. good design, teamwork, commitment, environment, market, etc.)*)

Experience:

- ¿Qué lecciones de éxito o fracaso ha aprendido su compañía en el pasado? (*What are the lessons learnt from past success or failure of your company?*)
- ¿Cuál consideras que han sido los principales impulsores del cambio en la organización? (*Which do you consider the main drivers that lead changed in your organization? (Market, technology, demand or personal drivers)*)

External Engagement:

- ¿Hasta que punto su red de clientes, proveedores, distribuidores, etc puede influenciar o participar en la forma en la que usted idea, desarrolla o entrega una solución o una propuesta de valor? ¿Qué tanto usted tiene coordinaciones con estas partes para dicho fin? (*To what extent your network (suppliers, distributors, customers, competitors, etc.) can influence or participate in the way you ideate/develop/deliver a solution? how often do you discuss those things with them?*)

Culture and Development:

- ¿Cómo se promueve u ocurre el proceso de aprendizaje en su organización? (*How does the learning process occur and/or is promoted in your organization?*)
- ¿Qué tanto se involucran los diferentes empleados en el diseño o desarrollo de productos o servicios? (*How does the different employees are involved in the product/service design/development?*)

Creativity:

- ¿Cómo se motivan o alientan a los empleados a expresar sus ideas? ¿ Los empleados toman la iniciativa para discutir con la gerencia algún cambio o solución? (*How do you encourage and motivate your employees to express their ideas? Do your employees take initiative to discuss with management about improvements and solutions?*)
- ¿Cómo describirías tu espacio de trabajo, la colaboración, y la promoción de la innovación? (*How would you describe the working space, collaboration, innovation promotion in your working environment?*)

Risk Propensity:

- ¿Cómo se gestiona la novedad y la incertidumbre? ¿Consideras que son barreras para desarrollar nuevas soluciones? (*How do you manage novelty and uncertainty? Which do you consider are barriers to develop a solution?*)
- ¿Qué tan dispuestos están los empleados a aceptar nuevos proyectos o enfrentar cambios? ¿Cómo reaccionan las diferentes áreas al cambio? (*How willing are the employees to accept new projects or face changes? How do the different departments react to change?*)

Communication:

- ¿Qué tan buena es la comunicación entre las áreas? ¿Cómo ocurre el intercambio de información dentro de la organización? (*How well all the departments communicate with each other? How is the information exchanged within the firm?*)

Awareness:

- ¿Qué tan involucrados están los clientes en la ideación, desarrollo, etc de nuevos productos o servicios? (*How involved are customers in product/service design phases such as ideation, prototyping, development, follow-up, etc.?*)

7.2 BUSINESS MODEL SUMMARY OF FINDINGS

<i>Element</i>	<i>Main Findings</i>
<i>Value proposition</i>	Source of customer value (Products): Reliability, technology incorporated, training. Source of customer value (Service): Responsiveness, guarantee, availability, commitment of agreements, constant support during life project, technical advice, and after-sale services.
<i>Customers & Channels</i>	Consideration of Customer's needs: Surveys, periodic meetings, studies to make the proposal. Value proposition design: Starts with the definition of the customer's needs and then developed by a multidisciplinary team. Channel's choice: different strategies to address the different customer' segments. Direct contact mainly for mining, and digital means for construction.
<i>Key Resources</i>	Financial Backs: To support operations. Human resources: Enough personnel with hard skills such as technical knowledge, and soft skills such as empathy, work under pressure, resilience, and awareness of urgency. Installed capacity: To attend all service demands on time. IT Systems Inventory: To support the demands on time.
<i>Key Activities</i>	Safety Efficiency in: Supply, Inventory Planning, Service Center. In order to provide a good level of availability, and response time without financial drawbacks. Technology development
<i>Partnerships</i>	Long-term and good relationship with factories. Factories might directly influence the offering. Provide innovation and design, availability, and restriction to competitors because of exclusivity contracts.
<i>Costs & Revenues</i>	Costs: trained departments for service support, but troubles in the interaction with other departments nonspecialized in financial matters. Problems in inventory management related to service contracts. Revenue: Awareness of longer times for the returns of financial flows.

7.3 READINESS SUMMARY OF FINDINGS

<i>Readiness Element</i>	<i>Main findings</i>
<i>Effectiveness</i>	<i>Previous successes because of responsiveness, quality, hot line products, technological improvements.</i>
<i>Experience</i>	<i>The firm has developed new capabilities over time such as improving information systems, purchasing processes, and training programs.</i>
<i>Service History</i>	<i>Shareholders, and Top management have changed the strategic vision of the company towards services.</i>
<i>External Engagement</i>	<i>Long term relationship with the factories, listening to the customer needs.</i>
<i>Culture and Development</i>	<i>Mechanism for training under career development programs, safety conditions in every action, and informal learning from daily work experience.</i>
<i>Creativity</i>	<i>Periodic meetings with top management, promotion of innovative projects in all the departments towards value creation</i>
<i>Risk Propensity</i>	<i>The firms take care in unpredictable environments. Risky investments when high expectations about a new business appear. Employees willing to assume new projects but should be provided with enough time.</i>
<i>Communication</i>	<i>Communication flows for daily operations. Some operations departments not very well communicated and clear about their impact in the business. Meetings with top management. Pauses to discuss relevant issues. Confusions in terminology concepts departments.</i>
<i>Awareness</i>	<i>Services can create barriers for the entrance of competitors and position the brand. Service contracts improve the planning of services. Services could provide a high profit to the firm</i>