LUISS

Department
of Business and Management

Course of Digital Economy and Innovation

Servitization Business Model: The case of Tesla

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Academic Year 2021/2022

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Introduction

The dissertation is a literature review of the servitization business model and an analysis of how Tesla overcame all the challenges of implementing such a business model and using it to achieve both high efficiency and productivity. The thesis is thus also a case study of Tesla and their business model and how they were able to enter a market that many others failed at entering, and how they have changed the entire industry.

This thesis will start with a thorough literature review on the servitization business model. The literature review has been done on many articles regarding the servitization business model and some of its aspects that I think can enhance the concepts of my thesis and are connected with my argument. All the articles have been found both on google scholar or on the Scopus website, many other articles were present but not all of them were, in my opinion, completely related to my dissertation. This will be very important to understand how servitization is used by many firms, to enhance their efficiency and productivity and at the same time allow them to move from the classical retail business model to a new model that allows them to sell their data as a service to their customers. I will also go over some of the challenges that firms have to face when moving from classical product creation to servitization. The literature will cover different aspects of the servitization, from a classical point of view to a new digital servitization moving at the end to a close look at how in general this servitization model can be applied in the automotive industry so to give a later comparison between Tesla and the rest of the industry.

I will then focus on Tesla's case; the first step will be to fit tesla into the automotive industry, giving the reader a quick view of its history and why it became the giant firm we know today. I will then try to define their business model and explain why it is so innovative and disruptive in the industry. This means that we will take a deep look at how Tesla has been able to implement servitization by overcoming all the challenges that I have explained in the literature, and also, we will look at how servitization helped Tesla become one of the biggest cars, and tech, power in today's world. I will then, compare their business model with the servitization model explained previously in the literature review, trying to see what Tesla has done differently from its competitors, but also trying to see if what we have seen in the literature can be applied in a real-world case scenario.

Lastly, I will move to the conclusion by trying to understand what tesla has changed in the automotive industry and why tech firms like Google, Facebook, and Apple will benefit from servitization and use it to join the car industry.

The thesis tries thus to answer the question of how Tesla was able to implement the servitization business model, what benefits it brought to the firm, and why it disrupted the entire automotive industry.

1. Servitization Business model

The first step of my thesis will be to give a broader definition of the servitization business model, trying to capture all the main and general aspects of these new business models that are more and more expanding in each industry in the market. This will be done following the definition obtained from all the papers reviewed trying to capture the most important aspects from all of them and summarizing them to give a good definition; we will also take a deep look at the main challenges that manufacturers face in implementing servitization. Then I will move to a more specific approach to servitization, looking at the definition and application of digital servitization, which is the evolution of the classic servitization business model, and which is also the model used by most the firms today; this will be done following the model described by Kohtamäki (2019). Linking with a digital servitization, I will show how thanks to Industry 4.0 servitization expanded and enhanced and how it is possible to achieve better results by combining of Industry 4.0 Business model with the Servitization business model. Lastly, I will move to a more specific application of servitization, trying to capture all the benefits that it has brought into the automotive industry, and how it has completely reshaped the industry; in this section, we will also look at a Green servitization model that tries not only to capture high performance but also tries to reduce the carbon footprint of a firm.

1.1. Servitization Business Model: Definition and challenges

Servitization can be defined as the process of manufacturers adding services to their product portfolio. The firms that decide to adopt servitization must shift their focus from creating value through product selling to creating value by delivering services through a

product. This strategy allows the manufacturers to make money not only because of the product itself but also by providing the product's service.

Following the report of Ayyaswamy (2019), Vice President of Tata Consultancy services, we can define some of the opportunities that servitization creates for the manufacturers:

Enhancing reliability and uptime, meaning the ability to embed monitoring services in their products and thus act before product failure occurs. This will add customer value by raising reliability and reducing maintenance costs.

Customer operational improvement, embedding services that optimize the value customers get from a product. It can be very useful for automakers to advise customers on how to maximize fuel economy.

Selling new product capabilities, Manufacturers can use software updates and downloads to introduce subscriptions and streaming (or more) services to their products.

New revenue-generating businesses, it is probably the most valuable opportunity, since it allows manufacturers to generate entirely new businesses, this can be done with the use of smart, connected products that can gain deep information on customer experience.

Servitization allows the manufacturers to create a closed-loop between them, the distribution, and the customers. This closed-loop allows the manufacturer to access information on how their customers are using the product and what kind of problems they find with it. Manufacturers can receive real-time information about their products even when the product is at the end of the customer. Without servitization, we would fall into int open-loop system, where manufacturers do not have a direct link with their end-users and once the product is out of their end, they do not know anything about it and how it is performing for their customers. Studies have also shown that servitization increases marketing performance given the fact that it increases customer relationships through the closed-loop described before.

Like all good things, also servitization has some downsides and challenges that it has to face. The first and main problem is the resistance to servitization; all manufacturers that are willing to take all the opportunities stated before must be ready to face the internal and external resistance that appears when a change of the business model is undertaken. Following the same report as above I found four main resistances that emerge when undertaking a complete change of business model:

Core business dominance: The managers responsible for operating the core business model of a well-established firm, find it difficult to reimagine it, and thus change can be

challenging, especially when we involve new technologies. This resistance is probably the hardest one to solve and can last very long, even after proof of success has been shown to managers.

The silo trap: Many of the large established manufacturers, are organized in silos, meaning that there are sectors that do not cooperate with the others. This can reduce the benefits of servitization and delay the full acceptance in all the sectors.

Channel resistance: It is the resistance that manufacturers face from their sales and service partners. This is created because there is fear of disintermediation and thus dealers and partners, that want to protect their relationships, try to resist servitization business models.

Customer Inertia: Sometimes customers do not recognize the value of service-embedded products and thus try to resist this shift. Companies need to show, through effective marketing that the new offer they are presenting is better than the one without services.

Besides resistance to the undertaking of a new business model, in the paper from Zhang and Banerji (2017), they defined five more constructs of servitization challenges, and they are Organizational *structure, Business model, Development Process, Customer management, and Risk management.*

Organizational structure refers to the change of internal structures to support the new business model. The entire organization must change from a product-oriented mindset to a service-centric organization. This will lead to a change in communication inside the firm creating a potential obstacle to efficiency given the fact that manufacturers may not fully understand the concept of integrated service offering. This may reduce the performance of service offerings because it is fully based on the service personnel.

Business model: Many changes are required to shift the business model from product-oriented to service-centric. Value proposition changes to a value-co-creation, where employees must create value with their customers and must look at customers' interests to increase the value proposition. Also, Resource utilization is a potential challenge since it requires the acquisition of new resources. Another challenge that can be faced in changing the business model is supplier collaboration since the supply for a service-centric firm is different from a product-oriented one.

Development Process: It refers to all the processes needed to turn an intangible idea into something that can be delivered to the final customers. In business applying servitization, it is fundamental to work on the integrated development processes to

integrate services into a product. Many scholars think that this is a top priority for firms that want to integrate services. Another change regards tools, methods, and techniques needed to support development processes. Lastly, customer integration is fundamental to make sure that what is developed is what customers desire.

Customer management: It refers to creating and maintaining relationships with customers to increase interactions and communications. Firms need to explain carefully to their customers what they are offering to understand their needs and make sure that they match the offering. Many scholars showed that usually, customers perceive a value that is not always the same as the designed one because of a lack of understanding of customers' needs. Supplier personnel needs to be in close relationship with the customers since in servitization we mainly focus on value co-creation rather than unilateral value creation. The problem is that the integration of personnel into the customer's operating system may damage credibility.

Risk Management: Researchers have found that manufacturers who move to servitization are exposed to various types of risks. The financial risk caused by the many transformations in the business is high and could lead also to bankruptcy if not managed correctly. Operational risk is created because of many uncertainties and changes. Lastly, there are also external risks caused by factors outside the firm that may cause some challenges to the business. We could conclude by saying that all the challenges shown before lead to high risk because of the uncertainties in the different parts of the business.

1.2. The transition from goods-oriented to service-oriented production

When looking at the possible challenges of servitization, it sticks out the problem of transitioning from a good-oriented production to a product-service-oriented production. This transition is what makes the entire process of servitization very complex, but it is also the step that, if overcome, can increment exponentially the financial, and production efficiency of the firm. The product service strategies can help strengthen the customer relationship, but also increase the satisfaction of the clients, thus making a service-based strategy very attractive both for the producer and the customer. From Salonen's paper (2011), we can identify different types of service transition strategies based on the form that the service takes. There are two main categories of services, those that support the products and those that support the clients. The first ones are services designed for better functioning of the product, while the second ones are services sold as products. The last

definition of services is probably the hardest to understand since an intangible service can be sold to customers without having them purchase tangible goods (examples are financing or business-oriented consulting). The transition to these services has to be seen as a movement along a line where the most advanced phase happens when the focus of the value proposition shifts away from the tangible product toward the service offered to the end-users that make the product effective.

Salonen (2011) continues his paper by stating that the transition phase implies facing many organizational challenges that firms have to overcome to achieve the best from the service sold. First of all, since new capabilities are needed for the transition, manufacturers' traditional advantages are set to diminish rapidly when they shift towards a more complicated product service relationship. Firms that want to stick out from the competition must provide superior value through customization and proactive sensing of client expectations. Firms must transition towards services that are tied to the customer's process. Moreover, another big challenge that firms have to face regards the cultures and mindsets of the managers. A goods dominant logic implies a view where goods are the primary focus of value in exchange and services are just add-ons that enhance the value; the new service-dominant logic should instead imply a process of doing something for another party, thus the offering is co-produced with the customer during an interactive process of needs definition and refinement. Firms must thus assist their customer in the value co-creation process and use tangible goods only as appliances for service provision rather than as ends in themselves. Moreover, another big issue resides in the shifting of mindsets of the managers that have been tied up in a classic product-based organization; the process of shifting their mindsets and making them develop the needed capabilities to function under service-based logic is probably one of the hardest challenges.

When instead we look at the structural issues, it has been found that firms must change their organizational structures to accommodate for integrated solutions. There are some particular forms of organization that are appropriate for each system of production, for example, large batch and mass production systems tend to have mechanistic types of management structure, while unit and small-batch systems have organic structures. If we try to conceptualize solutions as individualized offers for complex customer problems, it seems that project-based organizations are the best way of organizing firms around solutions and thus necessitating organizational separation.

Lastly, Salonen (2011) states that solutions providers tend to prefer the development of customized solutions tailored to each customer's needs since the

uniqueness of a solution is at the core of solution thinking and the basis for value proposition. This creates a very expensive situation that does not always guarantee long-term growth and profitability; solution providers must thus learn to provide solutions that are scalable with the use of modularization and standardization to develop unique solutions that are composed of fairly standardized modules and components.

The shift in cultures and mindsets requires the recognition that goods are not the focal point of exchange, but they are rather a service-delivery tool. The challenge rests on the notion that manufacturers must adopt some integrated solutions along the already established business based on goods and support services.

Firms, to support the relational orientation for the enabling of value co-creation must take customer requirements as a starting point for a process of co-creation of the solution. This will require the openness and willingness of the customers to support the firm and understand that they are a fundamental step in creating a successful product. This will help the manufacturer build internal efficiency of operations.

Firms must understand that the shifting to a solution orientation is slow and requires many resources and new mindsets, capabilities, and structures. The change process must start from a power position of the firm so that there can be enough organizational slack to support the redirection.

Following the ideas of Xing and Ness (2016), we can further implement the concept of transitioning towards product-service systems and analyze the principles and business model of this transition. In the paper, PSS (product-service system) is defined as “a mix of tangible products and intangible services designed and combined so they are jointly capable of fulfilling final customer needs”. (Xing and Ness, 2016). There is a basic form of PSS which is defined mostly as leasing or renting but the more sophisticated form of PSS involves a partnership between provider and customer where both have a fundamental role in the co-creation of value. A new set of skills and changes in the relationship between customer and producer are therefore needed for the transition from procuring products to services; the transition from product-oriented to service-oriented business requires the firm to identify what particular *value* has to be *offered* to the customers, how to *create* such *value*, how to *deliver* it in a *bundle* that contains both the *product and the service*, how to *create* such *bundles* of product-service and how to *interact* with the *client* and other *partners* in the co-creation of value and its delivery.

Products should be seen as key resources used to generate and convey desired results, while service processes are part of the key activities in this business model and are used to support production operations internally, and customer engagement eternally.

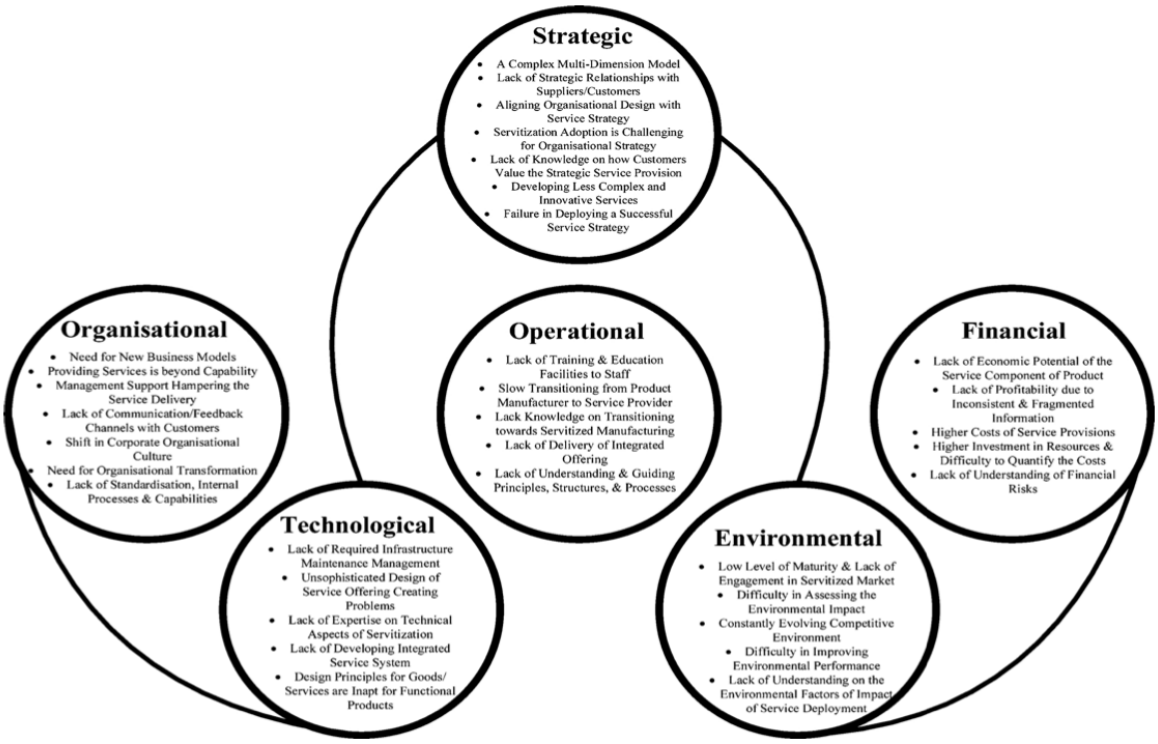
Servitization is the best way for achieving high-value cocreation and competency in a market and represents the highest step of integration between products and services. To achieve servitization we must understand that there needs to be a change from the traditional sell/buy model to the new PSS model where services are more central with lower costs of production and lower carbon footprint since services are immaterial.

The main difficulties lie in the fact that firms do not understand easily the changes required to their business model and how they should undertake the changes without having a huge loss. A pathway has to be established so to assist firms in making the shift and taking step by step understanding risks and benefits of all the changes made.

Kamal et al. (2020) in their papers evidence some other challenges that are faced when transitioning to servitization. They state that the main problem is that servitization is still considered a "black box" and thus still seen as averse by some manufacturers. Moreover, the lack of service culture and support from decision-makers are among the central challenges when transitioning from a product-centric to a service-centric approach. They also state that the adoption of servitization presents challenges mostly for the service design, the organizational strategy, and the organizational transformation. This is because the implementation of servitization requires top to bottom changes like the alignment of servitization strategy with corporate culture, production, and high investment resources. Moreover, the value of co-creation increases the human resources needed to interact with the customers. As stated also before, organizations need to evaluate the stream of challenges in line with their performance objectives and the challenges addressed, both in short term and long term to achieve the desired servitization outcomes.

The following chart represents a classification, based on the field of operation, of the challenges for the transitioning toward servitization given by Kamal et al. (2020) in their papers. They split the challenges into six different categories: Strategic (e.g. Aligning organizational design with service strategy), Environmental (e.g. Lack of understanding of the environmental factors of impact of service deployment), Financial (e.g. Higher costs of service provision), Organizational (e.g. Lac of standardization, internal processes, and capabilities), Technological (e.g. Lack of developing integrated

service system), and Operational (e.g. Slow transition from product manufacturer to service provider). Moreover, in each category, there are several challenges that a firm has to face. This chart represents opportunities for researchers and practitioners to implement their research on servitization challenges and try to solve their different issues.



1.3. Digital servitization

In the last decade, many companies are starting to have a more digitalized approach to business modeling. Collection of data and data analysis, autonomous systems based on Artificial intelligence, and new Machine Learning techniques, are allowing many businesses to shift from a classical servitization model to a new and advanced Digital servitization where digitalization and servitization merge to allow for new smart solutions but at the same time creating new challenges for the business.

Digitalization can help manufacturing companies improve their implementation of servitization in their businesses. Many are the cases that have been reported to start moving towards a digital servitization where the focus is more on the digitalization of services using software and data analytics. This shift is not easy at all and requires many changes based on the business model. Digitalization can help not only prevent maintenance and speed up its process but can also make the entire business more effective and efficient thanks to new software components.

Digital servitization is still in its early stages of life and thus an actual definition does not yet exist; I fully agree with *Kohtamäki* (2019) when he defines it as the transition towards smart product-service-software systems that enable value creation and capture through monitoring, control, optimization, and autonomous function.

Digital servitization requires collaboration between different parties inside the firm and across firm boundaries to achieve a smart autonomous ecosystem. Value-co-creation remains still a fundamental pillar of servitization, and it requires companies to operate not for their customers but with their customers.

Following the idea given by *Kohtamäki, et al (2019).* in their paper, in the next paragraph, I will try to explain how a business model is reshaped once digitalization meets servitization and how a firm can capture the maximize the potential from it to expand beyond its boundaries.

Successful implementation of digital servitization will reshape the entire business model of a company, shifting its focus from an in-house approach to an out-of-firm boundary approach. The main goal is to create a value system based on an ecosystem that can increase the value created between firms. Examples of successful business ecosystems are firms like Apple and Google where the value of the firm is created thanks to a combination of values from multiple firms.

Building an ecosystem is the starting point for achieving success through digital servitization since the development of the solution is based on relationships beyond the firm boundary. Platforms can be seen as enablers of the connections between actors in an ecosystem. To fully achieve value from an ecosystem, a firm that is moving towards digital servitization should reshape their business based on the business configurations of the other participants in the ecosystem, in this way they will increase the possibilities of collaboration and reduce knowledge discrepancies.

We can say that there is no single path that a firm has to follow to obtain success through digital servitization, but the main goal is to find a configuration that can make you achieve optimal outcomes. *Kohtamäk (2019)* finds three main dimensions in which a firm should focus to create a good offering with digital servitization, and they are: Solution Customization, Solution Pricing, and Solution Digitalization.

Solution Customization allows the firm to create and capture value thanks to the creation of tailored products-service-software based on each customer's need.

Solution Pricing refers to the ability of the firm to capture the value of a product-service-software offering based on the pricing strategy adopted. The logic of the pricing

follows the one used also in classical servitization models, making it product-oriented, agreement-oriented, availability-oriented, or outcome-oriented.

Solution Digitalization refers instead to the strong interrelation between technology and business model. Software gains a fundamental role in the product-service-software system by enabling the bundling of products and services. IoT and Software can help monitor, control, and optimize different functions in the business.

The combination of different degrees of these three solutions can shape a version of a digital servitization model, allowing firms to focus more on the dimension that they prefer to create a typology of digital servitization that can also differ from one of the competitors.

When we take into consideration Digital servitization, the concept of the business model has to be seen as a dynamic concept that is continuously changing. This happens because in a working ecosystem, since the collaboration between firms is very high, the shape of the business model is redefined in terms of the business models of the other firms in the ecosystem, and thus a change in one business will reshape all the others too. In The paper "Digital Servitization Business Models in Ecosystems: A theory of the firm", (*Kohtamäki et al.,* 2019) define four theories to study the optimal business model configurations considering their dynamic and volatile aspect. They have also found four theoretical perspectives to analyze how digitalization affects servitization in platforms and ecosystems.

The first business theory is the Resource-Based view. It studies how unique and valuable resources can create competitive advantages for a firm. Digitalization can help create new processes and capabilities for better value creation and capture, with higher customization efficiency and more effective resource reconfiguration. The advantages are created because the reconfiguration of resources can be used to create new value in the firms.

Organizational Identity is the second theory; it concerns the real identity of an organization, highlighting the culture of the organization. The culture and identity of the firm shape how actors perceive the organization and how they can see the new change in the business model. The shift to the digital servitization model is challenging more the identity than a classical servitization model.

The third theory is the Power approach which studies the impact of position on bargaining power, competitive advantage, and performance. The theory is used to understand how a firm can fit itself into an optimal position within the industry.

Servitization may require repositioning and direct engagement with the operator to sell and deliver integrated solutions; power position play thus an important role in shaping the entire ecosystem for autonomous operations. Unfortunately, not many studies have been done on the impact that digitalization brings to power positions, and thus further research is needed on these topics.

The last theory focuses on the Transaction cost approach that has been used to develop a theory on make-or-buy decisions. Looking at the theory, environmental uncertainty, relationship-specific investments, and a large number of transactions can increase the transaction costs; for this reason, in case of the presence of such conditions, a firm should make rather than buy a product or service. In the case of product-service software, transaction costs can be high because of the sales and delivery of complex smart solutions and upstream interactions with the service supply chain. Digitalization can decrease transaction costs by increasing visibility.

In conclusion, Digitalization can help with expanding firm boundaries and solving some of the challenges of classic servitization. Still, on the other side, it creates other new challenges that the firm has to face, like the reshaping of the business model and the possible repositioning in the market to increase its power position. However, the shift towards digital servitization is necessary and the firms struggling to succeed in the shifting towards a more digital model may be left out of the big picture of the market-facing not only higher costs but also not achieving the higher efficiency and effectiveness promised with this new business model.

1.4. Servitization and Industry 4.0

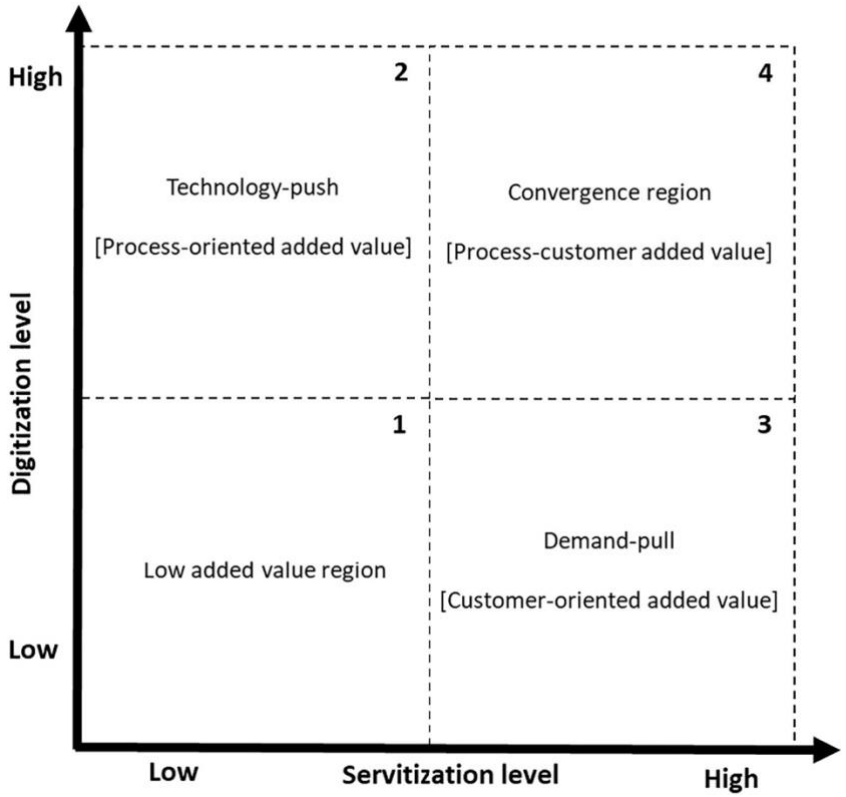
In the last decade, businesses had to face many transformations. The two that probably are the most facing ones are the Servitization transformation and the industry 4.0. The former has already been discussed thoroughly in the previous paragraphs, therefore in this section, I would like to focus firstly on how Industry 4.0 has reshaped the business model and then on how Servitization can merge with industry 4.0 to achieve its maximum potential. To do so, I will follow the ideas published in the literature by *Frank et al. (2019).*

Industry 4.0 can be defined as a new industrial phenomenon that uses the new technologies of the Internet of Things to create a new cyber-physical system that can create new value for the firms. This means that firms are moving towards a new

digitalization era where devices and products are interconnected and creating value for the firm and the users together. We could see Internet 4.0 as an establishment of intelligent products and production processes that integrate modern information and communication technologies emphasizing the new industrial challenges.

Frank (2019) states that We cannot compare digital servitization to the merge of servitization and industry 4.0, because the former only focuses on the value created for servitization thanks to the application of IoT solutions; emphasizing only the value that digital technologies can provide for the service value delivery to the customers. He instead wants to look internally at the firm, at what happens at the manufacturing level where the concept of Industry 4.0 is stronger.

To analyze the impact of servitization and industry 4.0 on the business, *Frank* (2019) developed a framework built on two levels: servitization and Digitization. The first regards the relevance of servitization in the company, based on a different level of service offering and thus following a demand-pull trajectory. The second level is instead the digitization level considering the level of implementation of Industry 4.0 related technologies and following a technology push innovation. The graph below shows the framework proposed in the literature.

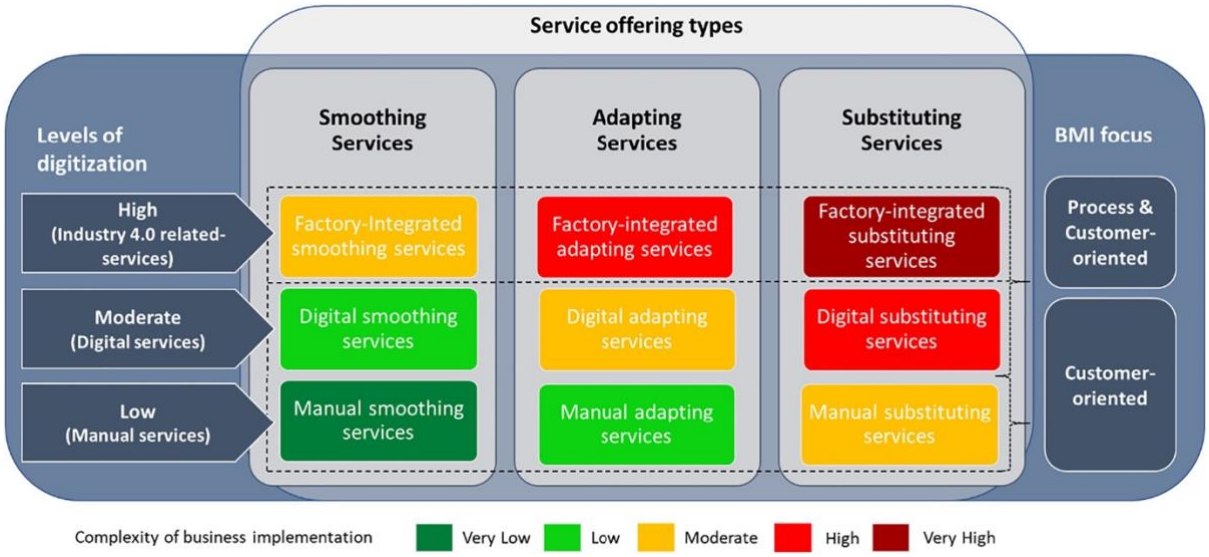


Basing themselves on the above theoretical framework they were also able to develop a more conceptual one where the two dimensions, servitization type, and digitization type, interact and can help clarify three different concepts: the difference

between types of servitization, the understanding of possible combinations pursuable by strategy makers and their BMI implementation, and lastly the challenges and implications of this innovation trajectory. The framework is presented in the figure below, with servitization type being on the horizontal axis with three levels, smoothing adapting and substituting services, while digitization being on the vertical axis with other three levels representing the level of digital technologies embedded into service offering, being High (Industry 4.0 related services), Medium (Digital services) and Low (manual services). The interaction between the two dimensions creates nine different configurations and levels of complexity. We go from Manual smoothing services where services are at the non-digital level and are mostly basic services provided in product firms; to the Factory-Integrated substituting services where the interaction between servitization and digitization is at its highest and it regards all the feedback gained from services that not only help increase customer service quality but are also very useful at manufacturing level for their processes trying to deliver value for the internal processes.

The colors in the framework below represent the different levels of complexity of the twofold BMI implementations. We can then understand servitization complexity as breadth and depth, respectively the value of architecture involved and the degree to which each element of the business model should change; we can also understand digitization complexity as to how advanced the technology is going to be implemented is. The more advanced the more specialized knowledge will be a need for implementing and using it.

Following the proposed propositions offered by the literature, we could conclude by saying that Industry 4.0 is not only increasing the value offered with servitization to customers but also for internal processes; there are some challenges that the business must face, as seen in previous paragraphs but they can be removed thanks to the help offered by digitization. Moreover, industry 4.0 and servitization would not give their maximum potential without some digital support offered by new technologies like IoT, cloud computing, and data analysis that help bridge the two dimensions. Therefore, as also expressed in other works of literature, a business that is not able to move towards a new digitalization may have some problems overcoming the difficulties of servitization.



1.5. Servitization in the automotive industry

In this section of the literature review, I would like to narrow down on servitization and start giving a broad look at what servitization application means in the automotive industry. This will help set up the stage for the next section of my thesis which will be regarding Tesla's application of the servitization business model thus an introduction to the world of automotive is fundamental to further understanding why Tesla's model is so disruptive in the market.

To give a better look at this application of the servitization business model, I used two papers found in the google scholar database, the first will be a literature review of the servitization in the automotive industry in general, and the second one will be regarding a green application of digital servitization in the automotive industry, so to not only be more efficient but also try to be more climate sustainable since it is becoming more and more a huge aspect of a firm's success in the markets.

In the automotive industry, the search for new ways to increase both sustainability and competitiveness led them to introduce new service capabilities and increasingly embrace servitization.

We can say that there are two different points of view on how servitization can be applied in the automotive industry. From the point of view of the customers, the most common use of services is targeting a "usage service" with the possibility to lease and rent cars but also with the new implementations of car-sharing that have been recently seen as a Product-service system.

From the manufacturer's point of view instead, many of the services regard the implementation of software able to increase the value of the product after the sale. Most

of the innovation is brought into the maintenance service, allowing companies to monitor car status after the sale, with remote diagnostic, like GM, BMW, and Toyota already do. Other services may regard embedded entertainment in the vehicle with the introduction of services such as the Deezer music service integrated into the BMW offer. Probably, the most extreme case of service integration can be seen with Tesla's cars where any service can be added at any time after the sale with just a single software update allowing customers to constantly upgrade their vehicles.

In the first paper, the authors discuss that some characteristics and requirements in the automotive industry are fundamental for the adoption of a product-service system. They identify three main requirements:

Requirement 1: Change the business model towards a product-service offer rather than a mere product offer. This requirement can be achieved by using the servitization-applicable methodologies, like Product service Lifecycle Management to manage information in the lifecycle of a product-service system; or Property-Driven Design which is an approach for modeling the product-service system in the development phase, and many other approaches discussed in the literature but that I did not evaluate as relevant for my thesis purposes.

Requirement 2: Management of cross-implication of service through organizations. It can be seen as cooperation between a firm's boundaries for retrieving new expertise and skills to allow collaboration between traditional product activities and survival activities.

Requirement 3: Manage information to achieve higher efficiency in the company's activities and achieve higher personalization for each client. In the automotive industry where the uses are various, foreseeing the conditions of a product is very hard. Achieving good information regarding the use state of a product, through new information systems, like IoT and Big Data, might be fundamental for increasing customer value and firm efficiency. The main problem is the need for an infrastructure to support the amount of data and transform it into valuable information.

The second paper empirically discusses the effects that digital and green servitization has on the automotive industry. They think that applying sustainable initiatives in the automotive industry, can bring automakers different benefits, such as enhanced resource optimization, lower production costs, and better utilization of by-products in new product development. These benefits must add with the ones related to adding digital servitization and thus higher efficiency, reliability, and cost-efficient

operations. They came up with three hypotheses one for application of only digital servitization, one for green servitization, and one where firms use a digital-green servitization stating that in this case, they will have a higher productivity gain than manufacturers having only one type of servitization.

The selected different firms apply solely digital servitization nor green servitization neither. They found out that firms using digital servitization are much more productive than non-digitalized firms, as I also explained in the paragraph on digital servitization, but they found out that green servitization is not relevant for productivity gains from those firms not being green. Lastly, they tried to test Servitization in both servitization in place and they discovered that firms having both are more productive than firms with only green servitization or digital servitization, demonstrating that digital servitization is a primary requisite for green servitization implementation.

Their results are very important showing that green servitization by itself does not help an automaker, but if taken into consideration with digital servitization it can enhance by a lot of productivity of a car manufacturer because digital services can enhance resource management in operations, moreover, green servitization can have a positive effect in upgrading resources through sustainable initiatives and thus promote circularity of resources. If both strategies are in place, there is a superior optimization of the pool of resources that enhances both performance and competitiveness of the firm.

This introduction to servitization in the automotive industry will work as a starting point for my thesis. It was useful to understand how automakers use servitization for their gains and what things could be done to improve their performance and some clue challenges that the firms have to face to fully implement servitization.
In the next section of the thesis, I will show how Tesla was able to fully maximize its potential through servitization and overcome the main challenges and why I think that it disrupted the automotive industry.

2. Tesla servitization approach

In this section of my thesis, I will try to analyze Tesla's History, its business model, and how they were able to overcome servitization issues and use its business model to disrupt the entire industry, creating a not so certain future for the entire automotive sector.

In the first paragraph, I will go through some key points of tesla's history to understand how they decided to use servitization, but more importantly, why such a choice for their business model was so disruptive in the market.

The second paragraph will go deeper into their business model trying to analyze all aspects of their servitization; we will see some of the fundamental aspects of their business model and show how it can distinguish itself from all the other competitors in the market and how also Data is a fundamental point of its entire business.

The third paragraph will be a conclusion for this section of the thesis with comparisons between what I defined in the servitization literature and what I found regarding Tesla's business model. Moreover, I will try to show why Tesla is so important for the automotive industry and how its business model may inspire other non-automotive firms to join the market.

2.1. Tesla's History

Tesla was founded in July 2003 by Martin Eberhard and Marc Tarpenning; the name is a tribute to Nikola Tesla, one of the greatest scientists in the world. In 2004, Elon Musk, after selling his quotas of PayPal, decided to invest $6.5 million and became the largest shareholder and the chairman of Tesla. He leased a warehouse in Silicon Valley so to start assembling the prototype vehicles.

Tesla's vision has always been to manufacture mass-market electric vehicles (EV) that could offer its customers a long-range, high performance, and low cost of ownership.

The first car that was developed by Tesla is a Roadster, a premium EV based on the Lotus Platform. Tesla decided to replace the combustion engine in those vehicles and substitute it with an electric one. This step took a very long time and we had to wait until 2008 to get the first 2,450 Roadsters on the market.

In 2012, after being able to step into the market and create a sort of fidelizaiton with the customers, Tesla started producing a much cheaper car that was possible to mass-market: the Model S. To do so, it had to hire not only automotive engineers but also software developers and manufacturing specialists.

One of the darkest periods for tesla was the years 2008 and 2009. It had a near-bankruptcy experience but thanks to its vision and its cars Tesla was able to rise and become now one of the largest and most profitable firms in the automotive industry.

After the model S Tesla produced other three Models for its cars: the Model 3 sedan in 2017, the Model X SUV in 2015, and the latest Model Y crossover in 2020. The model 3 is probably, as of today, their most sold vehicle and is exactly what Tesla always wanted to do, create an affordable EV that can guarantee high performance to all its customers and can also attract new ones in the EV world.

By the end of 2021, Tesla became one of the few firms to reach the $1 trillion goals of Market capitalization.

Its entrance into the market in 2008 suggests that the barriers to entry into the automotive industry are coming down. Before Tesla, not many manufacturers were successful in entering such a market, because they had to face competition from some of the biggest companies in the entire world. Tesla's strategy, to enter the market with a luxurious car, that was not possible to mass market, but that gave an idea of the capabilities of such a firm, and then move down to a cheaper model and a more affordable one, was probably one of the key points to their success in the industry.

2.2. How Tesla achieved Servitization and how it profits from it

In this chapter I will go through the business model that Tesla decided to use and the approach it had to the automotive industry; its business model will also be useful to understand how the automotive industry has been completely disrupted and why it will never be the same. Many aspects of Tesla's business model, resemble those described by the literature review of servitization business, trying not only to sell the customers a product but a product service. In this way, the real power of Tesla does not come only from the car itself but from all the services that the firm can offer its customers both before the sale and more importantly after the car has left the factory.

As I have explained in the previous section of my thesis, achieving full servitization is quite hard especially for a new business trying to enter a market full of competition. The automotive sector is an industry in which servitization was never really seen as a real possibility, but Tesla showed us all how to fully implement this business model and how to overcome the main challenges that servitization brings to the company.

To understand how Tesla was able to achieve efficient servitization and disrupt the automotive industry I think we first need to look at some of the basic characteristics of Tesla's business model.

The first thing we must say regarding Tesla's business model and why it is completely different from the competitors is that they vertically integrated mostly every step of their production line; from the running of the plants where cars are manufactured to Gigafactories where batteries for the EV are produced. Also, the retail step has been integrated by the company so to create a solid direct channel between them and their customers to create a strong bond and fidelizaiton. Tesla created a sort of network of stores where people can directly interact with a Tesla employee, receive the vehicle, and all the information needed, without having to go to third-party resellers. This direct selling allowed Tesla to gain an advantage over the competitors because it allowed for a better customer experience and a faster and more efficient retail process. This is probably one of the most important characteristics of Tesla's model that allowed them to overcome the Customer management challenge that Servitization can bring to firms adopting such a model. As seen in the literature review, it is fundamental for a servitizing firm to create and maintain a strong relationship with customers to increase interaction and communications.

Tesla's decision to vertically integrate every step, without having to rely on Third-parties, allowed them to have a much more deep and direct connection with its customers at every step of the sale, but also after-sales. Customers can learn almost anything on their vehicle at the store, or on Tesla's website, and just like with Apple if they have any issues with the products, they can just go to the nearest Tesla dealership and talk with a professional about their problems. Moreover, after the car leaves the store, Tesla and the customer are still in strict contact since everything happening with the car is reported to tesla in the form of data, which then can be used to enhance some aspects of the vehicle that result insufficient for customer satisfaction. This enhances the value co-creation of Tesla since both parties, tesla and the customer, work towards a better performance of the vehicle.

Another challenge that firms moving towards servitization have to face is the *development process.* From the literature, we know that these are the step required for a manufacturer to move from an intangible idea to something that could be sold to customers. Scholars think that this is probably the most important step for firms that want to integrate services. Tesla's choice to vertically integrate every step of the production chain, allows it to fully monitor everything that happens from the ideation of a service/product to the real production of such an idea. In this way, Tesla can decide at each step what could be a good idea to sell to customers and what instead needs to be

discarded. Moreover, the large amount of Data that Tesla collects from their vehicles after the sale, allows them to fully comprehend what customers need and want and thus decide which idea to bring forward or not. The other issue with the development process is how to produce such an idea; the tools, methods, and techniques needed to turn something intangible into something tangible are various and completely new and extraneous to the automotive industry. Tesla, as we have seen in its history, decided to hire not only experts in the automotive sector, but also engineers, software developers, and more in general people that are funded with all the knowledge needed to turn an idea into a digital software, which in case of Tesla is their primary way of distributing services.

With the majority of OEMs Test and Learn, ends as the car is sold to their customers. This means that the manufacturers do not learn once they sell their vehicles but the testing and the learning stop. Tesla's huge disruption in the industry can mostly be attributed to how they designed and developed their car's software.

Tesla's cars offer their customers constant "Over the air" updates to their vehicle software to constantly update some of the functionalities that might be fundamental in the car itself; it also offers customers the possibility to add new software, like the full self-driving capability, that can upgrade the vehicle making it better than it was when it left the production center.

This is possible thanks to the data-driven development effort that Tesla put into the design of their EV. The car is built like a platform, where software and hardware work separately, like modules, but once together, they express the maximum potentiality of the Texan vehicle. The hardware is what creates a sort of short-term revenue, while the software allows for long-term steady revenues thanks to the value-added services that the manufacturer gives to their customers. This way of producing cars like platforms is probably what allowed Tesla to overcome most of the challenges of servitization regarding production. From the literature we know that there is a challenge called "The silo trap", this refers to the problem of many manufacturers that are not able to make different sectors of their firm cooperate to create a higher value for the final product. Tesla was able to overcome this issue thanks to how it built the car and the firm itself; The car is not something that is done in different sectors but is a platform where many participants can work together and cooperate so to create a product of much bigger value. Mechanical engineers work on the frame and the engine of the car, IT and software developers work on the AI of the car and the software offered to customers,

Data scientists work on the analysis of data collected from the users to enhance the value offered; different sectors work on different aspects of the vehicle but at the end, they put together all the modules so to create a single final product.

The updates are not free, Tesla charges their customers for receiving specific software updates and upgrades to their cars. This is one of the main expressions of servitization that Tesla has and probably the one that generates the highest value possible, for example, the automatic pilot, an extra service, that works with data and machine learning algorithms, is offered, at around $12,000.

As of today, Tesla does not focus only on selling their vehicles, and updates for them, but we could say that there is a three-stage approach, from selling to servicing and charging their Electric vehicle.

One of the most important, and crucial, aspects of Tesla's success come from the network of charging stations that they were able to create all around the world. Charing an EV is the biggest obstacle to the mass adoption of such vehicles; if people are not able to charge them, then no one will ever buy them. Their network of charging stations allows customers to freely charge their vehicles, which helped speed up the rate of adoption of EVs. This network can also be implemented with the possibility of charging your vehicle in the driveway of your own home; they are called power walls and they allow you to store energy at home or your business. But Tesla does not stop here because it offers clients also the possibility to implement solar panels that can generate the energy for your power walls directly at home to be green and also at producing the electricity for the battery of your car. This ecosystem that Tesla was able to create not only attracts many more clients but also makes the current customers stick with Tesla's product because you become part of the ecosystem itself. All these products are nothing but Services that are sold to customers in form of products, that in reality are just add-ons to the vehicle and thus Services that make the life of the customers better and that increase both revenues and customer value for Tesla. This is what in the literature has been called a "New Revenue-generating business", a way in which the manufacturers can generate entirely new businesses that are distant, but close, to the main business offered by the firm.

When Tesla released the Roadster, they approached the market in a very different and unusual way. Instead of offering people an affordable and mass-marketable car, they decided to step in with a luxury sports car that not many people could afford. This was done so to start validating the market gradually. Sports cars have usually a high price,

this allowed them to get in with a competitive price and settle with a temporary business model. In 2012 when the Model S started rolling out, Tesla modified its business model basing it on the mass adoption of its Electric vehicles. This was probably the riskiest step in Tesla's history, which also brought them to a close default situation; the ability of the managers to understand the main issues with the business model they chose and immediately change it was the event that gave Tesla a completely new life. From the moment in which they started mass-marketing with the Model S, they also started to implement servitization. Risk Management is one of the challenges that firms have to face to achieve servitization and if not done correctly this may also lead to bankruptcy. Tesla was able to understand that by selling only an EV, they would have failed very soon, they thus needed to move towards a new business model that allowed them to not only sell customers a car but also sell them services that could distinguish tesla from the other car manufacturers in the market. Its success is probably derived from the fact that they were able to distinguish itself from the others by offering customers something more than the others in the market offered.

2.3. Tesla's servitization compared to the literature

In this last paragraph of my thesis, I would like to make a comparison between Tesla's Servitization and how the literature describes such a business model.

The first step would be to look at the classic way of applying servitization in the automotive industry and then compare it with tesla. From the literature, we know that there are three main requirements that each manufacturer has to achieve to adopt a product-service system. The first one is to change the business model towards a product-service offer rather than a mere product offer. Tesla was born as a manufacturer mainly focused on offering customers services with the product they are selling, thus the change in the business model is not so evident as it may be with OEM that had to switch from classical product chain to product-service. I could say that Tesla's real business change happened with the decision to start mass-marketing its products and the release of the Model S. Moreover, Tesla over the years has updated the services offered to its customers, it started with just software updates and a network of charging stations, and now it also offers customers the possibility of implementing a solar panel in their house to charge their electric vehicle from home with self-generated green electricity.

The second requirement for a manufacturer is the management of cross-

implication of service through the organization. This regards the cooperation between the firm's boundaries to retrieve new expertise and skills. Tesla's decision to vertically integrate every step of the production allowed them to control mostly every step from the production of the vehicle to the distribution and the "over-the-air" update and upgrade of such vehicles. This decision forced them to employ not only mechanical engineers for the creation of the car but also other workers that have skills both in software development but also in data analysis. They decided not to cooperate with firms outside of the boundaries, but mostly to have all the skills and expertise inside the firm to have more control and efficiency but at a slightly higher cost. This decision also allowed them to have much more direct contact with customers, allowing the firm to both communicate with them directly in the stores but also to understand passively what each customer thinks should be modified in the car, and in its software, to make it better with data analysis.

The third and last requirement for a manufacturer in the automotive industry should be to manage information to achieve higher efficiency in the company's activities and higher personalization for each client. In the literature, this has been defined as the ability of manufacturers to foresee the conditions of a product and achieve good information on its state with information systems. Tesla was probably one of the first car manufacturers to adopt Artificial intelligence, Big Data, and IoT in a car. Thanks to the numerous sensors that are present in tesla's vehicles, the firm can capture a myriad of data regarding the status of the car, the software that the customers use more, the performance of the vehicle, and much more. All this data is then processed by a data scientist and is transformed into meaningful information that can be used by software developers, engineers, and other employees to increase both customer value and firm efficiency. The main problem, as stated in the literature, is that to analyze this huge amount of data, the manufacturer needs an infrastructure that can support and transform data into information. Tesla was able to build a vehicle that not only creates data but can also store and analyze it through machine learning techniques implemented in the vehicle; this can improve the life-quality of the customer offered by the services in the vehicle, without the need to bring it to a tesla facility. Moreover, Tesla can request data also remotely so to analyze, for example, what has gone wrong during an accident without the need for a physical database.

After this comparison between tesla and what the other car manufacturers are doing to apply servitization, we should focus on a much broader comparison between

Tesla and digital servitization firms. Two of the most prominent examples of digital servitization firms, are probably Google and Apple; from the literature review, we saw how implementing digital servitization means expanding the value creation from in-house to out-of-firm boundaries, and we saw how an ecosystem should always be the basis for a successful digital servitization. Apple and Google probably offer the two most important and successful ecosystems in the digital world at the moment, and their ecosystem allowed them to make a profit not only from the products they sell but also from the variety of services they offer through the ecosystem of product and software they created. Platforms like iOS or Android are probably what made these two tech giants achieve high servitization efficiency and profits and increase their connections with different actors in the ecosystem.

Tesla was able to emulate what these tech giants created and made it available in a car. The ecosystem of Tesla starts probably in the car, with the software created by Tesla and embedded in the tablet of the car. With such a Tablet, you can not only interact with internal hardware and control the autopilot, or the ventilation system, but you can also communicate with third-party sources like Google Maps APIs, or applications created by developers for people to enjoy while in their cars. The software is a real operative system that allows Tesla to communicate with out-of-firm developers that want to create something special to add to the car to make it much more efficient, but also fun to have. The next big pillar in Tesla's ecosystem is probably the huge network of charging stations that allow drivers to always have a resort to charge their car when they need it. Lastly, the ecosystem is completed by the smartphone application of tesla's car. This app not only controls many of the functionality of the car from the outside, but it also connects to the solar panels and Powerwall that Tesla sold you to charge your vehicle.

From the literature review on digital servitization, we also saw how there exist different paths that a firm can follow to obtain success with digital servitization. There are indeed three dimensions on which a firm should focus to create a good offering of digital services, and they are Solution Customization, Solution Pricing, and Solution Digitalization. Tesla, has a huge focus on all three of the dimensions, starting with Solution customization. From Tesla's website, and with in-store activities, you can customize however you want your future car, both in hardware, but especially on software and thus services implemented. Not only that, but just like any other operating system, the software in the car allows you to customize to your preferences many details

of the car just with a click. The different services offered by Tesla can tailor customers' needs, from those that want a much more innovative car with all services implemented, like full auto-pilot, to those that prefer to stick to a more classic vehicle. Moreover, the software of the car allows you to customize the entire driving experience, you can change the sound of your car horn, and you can download specific applications both to play with the car or to experience some relaxing moments. The customization of the services does not stop at the car because Tesla also offers the customer to charge their cars at home, so it reaches every single need of the customers making it a hugely positive aspect of their servitization. Solution digitalization is also a big focus of Tesla; it refers to the software gaining a fundamental role in the product-service-software system. As we have seen before, the software of the car is what makes the experience with Tesla's vehicle and what makes the customers stay within Tesla's ecosystem. IoT and Software are central in Tesla's vehicle, for example, the thousands of sensors allow for the self-driving service to work perfectly, or the software embedded in the car's tablet allows the user to control the vehicle and optimize the different functionalities. Solution pricing is also fundamental in Tesla's application to digital servitization. They have a very specific pricing strategy, that starts with the idea of Mass marketing an electric vehicle. The Model 3 has a price that is somewhat accessible by many people, but if you want more services that could make your Tesla experience better, you of course will need to pay more. Moreover, the pricing strategy for the charging of the vehicle is exceptional, with free charging at the charging stations spread all around the world, but also allowing drivers to pay something more to get a Powerwall in their houses to charge whenever they want their cars. It also offers, at a higher price the possibility of implementing solar panels in your house to charge in a greener way your vehicle. It thus offers different levels of price for the different levels of servitization that each customer requires, from a simple Electric vehicle with low software services to a full auto-pilot car that can also be charged in a greenway at your habitation.

Looking back at the literature, we can find four business model theories that were expressed by Marko Kohtamaki. These theories study the optimal business model configurations considering all the dynamicity of the servitization business model. They were defined as Resource-based view, Organizational identity, Power approach, and Transaction cost approach. If we look at how Tesla is shaping its business model, we can find many resemblances with what Kohtamaki has defined in its studies.

Starting from the resource-based view, we can see how Tesla can achieve high-value creation through the reconfiguration of resources. The competitive advantage for Tesla has been created thanks to the introduction of Gigafactories. They allow the firm to use a variety of valuable resources to create in-house batteries for the cars. The batteries have always been seen by Elon Musk as the most important component for a Tesla, and thus being able to produce them in-house can for sure help them create an advantage compared to the other competitors that cannot use such resources but have to buy them from third-parties.

Moving on the Organizational identity, Tesla has put a lot of effort into the identity and culture of the firm. As I have also explained before, Tesla was created with the idea of achieving a mass-marketable electric vehicle that could reach the majority of the drivers in the world. This allows the firm to create an emotional connection with the buyers and the direct contact Tesla has with its customers, allowing it to show very clearly what they believe in and what the real identity of the firm is. There has never been in Tesla a change of identity and culture, they have always wanted to empathize with the customers, and this allowed the firm to be perceived as a firm that wants to connect with the mass. Moreover, Elon Musk has also had a huge impact on this aspect thanks to their constant interaction with numerous people on social media platforms to connect even more with the customers and allow them to perceive the real culture and identity of the firm.

The third theory regards the power approach and thus how Tesla can create a position of bargaining power in the automotive industry. This theory studies how a firm can fit into an optimal position within the industry thanks to digital servitization. Tesla was probably one of the first Automakers to introduce servitization into this industry and this allowed them to create a new position in the market. Entering the automotive industry has always been very hard and many other firms failed, but the ability of Tesla to create not a simple car, but a product-service that people wanted, allowed them to enter this very competitive world. The strategy used to enter the market, first with a very expensive and luxurious car, and then with a mass-marketable car, is unique and was probably what allowed them to enter into competition with the giants already present in the industry. Moreover, they revolutionized how people see a vehicle, it is not anymore just a car but is something more than only Tesla, as of today, can realize, thus creating a new position in the market that gives the firm much more power than the competition. Servitization was thus fundamental for Tesla to gain a power position since it is what

made their product unique and completely different from what was already present in the market for centuries.

The last theory regards Transaction cost and why a firm should prefer to make rather than buy. Tesla as I have explained earlier is fully vertically integrated, this means that every process happens inside the firm, without the need for third parties to help them. With the introduction of the Gigafactory, in its ecosystem, Tesla has also started to produce its batteries without having to rely anymore on third parties. This decision has reduced by a lot the transaction costs of the firm, but it has also increased the efficiency. Moreover, Tesla also produces the software of their services in-house thanks to the team of engineers and developers that were employed just to analyze and use the data collected from their vehicles.

This chapter was fundamental to understand if the things shown in the literature review can apply in practice, moreover, it showed how Tesla decided to achieve servitization and what kind of business model it has. I will now try to give a conclusion to my thesis by trying to give a summary of all the findings of both the literature and the Tesla case, moreover, I will try to answer the question made at the beginning of the thesis regarding how Tesla was able to disrupt the industry and lastly I will conclude trying to explain why this disruption has completely reshaped the industry and why it may open a new chapter of the story of the automotive.

3. Conclusion

In this Thesis we have analyzed first, with a literature review, all the aspects of the servitization business model, looking both at the good things that it might bring to a business that decides to apply it, and also at the downsides that it may create and the difficulties that a business may face when it decides to shift their business model. Then we analyzed the specific servitization case of Tesla and we found out that this business model can bring also in practice many improvements to the firm and create a really good position of power in the market; we also looked at how Tesla was able to overcome all the different challenges that servitization brings to the business.

This was only a small study on the possibilities that servitization can bring to different businesses, but it showed how shifting the goal of a business might completely revolutionize the market and bring huge improvements not only to the firm but to the

entire industry. Tesla showed us how servitization can be used today in a market where no one ever tried to use such a model and how thanks to this approach they were able to enter a market in which the competition and the barriers to entry are both very high.

Additional research might be done on other industries trying to understand if servitization can help to lower entry barriers and to understand if this approach can bring also other industries, the same benefits it brought to the car industry. This market has been completely revolutionized thanks to Tesla's entrance, and it will probably have a future that will be completely different from the past. If Tech firms, like Apple, Google, and Meta, will follow the ideas brought by Tesla in the market, we might see a lot of new cars brought to us by these big tech giants, but this is only a possibility and only the future will tell us how the market will reshape. Moreover, already present car manufacturers might decide to implement servitization to create a product-service that simulates Tesla's cars.

We saw how servitization needs huge cooperation with customers to implement a new value-creation and value-proposition in the industry and probably, this cooperation with customers, represents the higher barrier to overcome for car manufacturers because of the way the market is shaped, with third-party car dealers and low level of services offered.

In conclusion, Tesla represents probably one of the biggest examples of how servitization can help a firm gain a position of power in a market, but it is also an example of how to overcome all the challenges of servitization, and it is thus in my opinion a firm that should be studied much more deeply, especially to understand the data usage of the firm and how they treat new technologies such as Artificial Intelligence and Machine Learning. This Thesis tried to focus more on the business model side of the firm rather than the technological side, but also tried to connect the two fields, so to give a starting point for future research in the field.

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