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Preparing for Smart Product-Service System (PSS) Implementation: An investigation into the Daimler Group

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This paper aims at investigating the main factors behind advancing the integration of products and services in the Brazilian subsidiary of Mercedes-Benz (MBB), and how Smart PSS has been perceived by other business units of the Daimler Group. We conducted an in-depth qualitative single-case study research to investigate the critical steps preceding the implementation of a smart PSS. The study was based on the main tactical areas of a PSS business model which was applied to MBB's possible integration of their equipment (called Fleetboard) in a smart PSS solution. The findings demonstrate that the internal culture of a product-centric automotive manufacturing firm can prohibit the sales of services, even when service technologies are available. On the other hand, financial pressures can create the sense of urgency required for the firm to appreciate the necessity of change. The process of change is too complex, since it requires capabilities in key areas such as the law, marketing, networking/partnerships, design, sustainability, and organization and human resources management. Our study shows how the company considers alternative options in order to reduce organizational barriers, develop partnerships and legal competence to offer PSS contracts, as well as seeking alignment between design, marketing and sustainability requirements.

Keywords: Smart PSS, PSS, Servitization, Business Model, Operations Strategy.

INTRODUCTION

The emergence of information and communication technologies (ICT), such as the Internet of things (IoT) and Cyber-Physical Systems (CPS), has created the possibility of an IT-driven business paradigm (Zheng *et al*., 2019). This new business paradigm derives

from conventional product-service systems. The transformation of a product-oriented business model towards a service-dominant logic is, however, complex and carries risk. Both researchers and practitioners have extensively discussed the benefits, motivations, enablers and barriers for such a transformation.

Santamaría et al. (2011) reported that one in five companies surveyed reported the integration of PSS products and services. In China, this increased from 1% in 2002 to almost 20% in 2011 (Neely et al., 2011). The convergence of digitalization and servitization offers the opportunity to take advantage of the concepts of the industry 4.0 and the IoT, in order to meet the demands of the new reality of the consumer market (Zheng et al., 2019; Chang et al., 2019), with potentially increased sustainability (Pacheco et al., 2019). The concept of 'Smart PSS' was coined by Valencia-Cardona et al. (2015), defined as the integration of smart products and e-services into novel service solutions to meet individual customer needs. The integration of digital technologies is as a key aspect to consider when introducing advance services and maximizing the value creation and capture in business transactions (Naik et al, 2020; Dmitrijeva et al., 2019).

The benefits of introducing advanced services include revenue growth and greater economic profitability (Eggert et al., 2014), improved product innovation, quick responses to customers, creating new revenue streams (Baines and Lightfoot, 2013), increased customer loyalty (Saccani et al., 2016), and support to exceed barriers toward the competitive advantage (Oliva; Kallenberg, 2003). However, how to provide such services has challenged many companies (Baines et al., 2017).

The literature has shown that the fundamental concepts of PSS are well-established. However, the practices that will promote a shift towards a PSS business model remain an open topic (Baines et al., 2017). The change to a service-led business model requires a transformation of organizational values, structures, and culture (Weeks and Plessis, 2011). Thus, there is still a gap in understanding how companies can prepare to move from a product-oriented to a result-oriented perspective through a Smart PSS business model. Indeed, Zheng et al. (2019) argue that most existing Smart PSS are still product-oriented in nature, while little concern is given to the result-oriented business model. Moreover, Chang et al. (2019) state the necessity of analyzing the roles of OEM and providers in this process.

This paper seeks to investigate the main factors that advance the integration of Smart PSS in an automotive company. A case study in the Daimler Group was carried out with a significant focus on the Brazilian truck unit of Mercedes-Benz (MBB).

The objectives of this paper are: (1) to understand – through a real case study of an OEM – how Smart PSS has been viewed as a new business model. As a result, the paper proposes a conceptual framework that not only includes tactical areas, but also their respective key aspects, which can be used as a guide for the implementation of Smart PSS. The key aspects for each tactical area were compiled and investigated in order to fulfil a gap in the literature. In doing so, this paper addresses the issues raised by Zheng et al. (2019) and Chang et al. (2019), i.e. the need for further studies on the role of an OEM in the implementation of Smart PSS, and the preparation for organizational transformation when adopting new IT-driven business models under a service logic.

2 Literature Review

This section presents the literature on Smart PSS and business model development.

2.1 Integration of PSS and IoT/Big Data

Manufacturing companies are, in general, product-oriented (PO) organizations focused on the tangible attributes of their production processes and key features of their products. According to Baines et al. (2017), simple service strategies aggregated to products have been practiced since the 1980s, and no longer represent a competitive advantage. Many authors (Chang et al., 2019; Resegni et al., 2016; Al Fuqaha et al., 2015) argue that one way to achieve a competitive advantage in manufacturing services is through the use of IoT and Big Data.

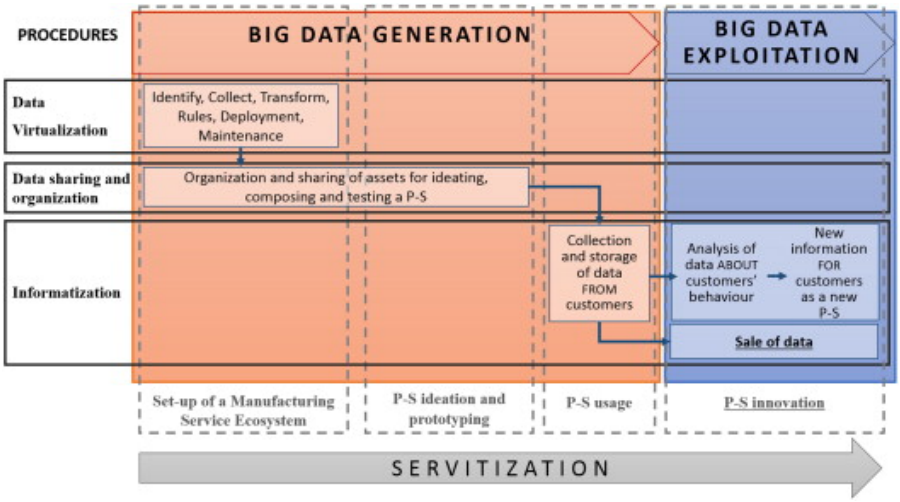
Zheng et al. (2019) state that, although lacking a unified definition, it is accepted that Smart Connected Products (SCPs) and their generated digital services are the fundamental composition of the Smart PSS. Opresnik and Taisch (2015) present the strategic use of Big Data in servitization, including data generation, exploration, and sales use. These comprise? the three blocks in their framework. The blocks consider the conception, configuration and use of product and service in the generation of data. It must be supported by information and communication technology solutions (ICT) and of the Big Data stored neatly, so that they can be shared and even sold.

These blocks represent the adoption of IoT as the key technology to drive the digital transformation. According to Zheng et al. (2019), IoT-enabled PSS was first introduced to exploit RFID devices.

Zhu and Madnick (2009) argue that there are two ways by which companies can use the data to create added value: first, by selling such information privately – as they are not yet publicly accessible – and, secondly, by starting to reuse available data for the sale of new products or services added to the product (e.g. predictive maintenance).

Opresnik and Taisch (2015) propose a two-block big data strategy model that includes big data generation and exploitation in the servitization (Figure 1).

Figure 1-Opresnik and Taisch's Big Data Strategy within the context of servitization



First, the conceptual design needs define the service and product elements and their level of integration. Then, it is important to evaluate the current business model, especially understanding the necessary efforts that should be taken to change from a product-oriented (PO) firm to a Smart PSS business model.

2.2 PSS Business Model Development

Reim et al. (2015) defined 'business model' as the design or architecture of the mechanisms of creation, capture and supply of value. They conducted a systematic literature review to understand how companies adopt and implement PSS, using the seminal classification from Tukker (2004): product-oriented (PO), use-oriented (UO) and result-oriented (RO). As a result, the key literature suggests that PSS business models and implications for implementation use five distinct sets of tactics: contracts, marketing, network, product and service design, and sustainability.

Contracts refer to how rights and duties are distributed between the supplier and customer. A PSS contract must be developed by clearly addressing all aspects of the service provided, involving the obligations, any failures and all legal considerations. These contracts have a complexity far beyond the simple sale of a product, and the terms and

agreements must be adapted according to the negotiated context of PSS (Reim et al., 2015). This is also supported by other authors (Xie et al., 2014; Rodríguez et al., 2020).

The second tactic describes how PSS providers interact, communicate and use customer and market insights to implement their business model in PSS. First, the extent of customer interaction increases when the company shifts to a service-oriented business model; second, communicating the value of the service with transparency and no ambiguity, as well as showing how it differentiates from competitors, and seeking to gain new customers; and finally, the use of customer and market insights, considering the collection of product data or service in use through interaction with them. In fact, it is imperative that manufacturing firms create close relationships and establish routines and communications (Fain et al., 2018); these relationships require high levels of engagement, focusing on customer processes and problems (Lightfoot et al., 2013).

The third tactic describes how PSS providers use their networks and relationships with partners to ensure that the PSS business model is successfully implemented. This tactic refers not only to those with whom partnerships are forged, but also to the type of partnership, shaping the sharing and coordination of the activities (Reim et al., 2015). According to Mastrogiacomo et al. (2018), the relationship with customers covers the entire life cycle of the PSS, from its design to its disposal, and it is constant and enduring. Similarly, Klimanov and Tretvak (2019) contend that a business model represents the architecture of a value creation process by a complex set of relationships between various network participants.

Brambila-Macias et al. (2018) found that organizational configurations of a PSS can range from collaboration with individual customers and their suppliers to entire networks, which can include competitors, as part of providing solutions to the customer.

Product and service design tactics describe how PSS providers structure their products and services to meet the needs of customers, and thus achieve success in implementing the PSS business model. To meet the new design requirements of products and services, it is necessary to place emphasis on the alignment of the physical characteristics of the product with the characteristics of the service offered and vice versa (Reim et al., 2015). A closer and long-term relationship requires a product and service design perfectly adapted to the needs of the customer. Kuijken et al. (2017) argue that the client perceives the benefits of PSS if it creates more value-added than when the product and service are sold separately on the market. The added value may also be created for the customer

through being supplied by a single organization, instead of having to buy the product from one organization and receiving a service from another.

Most of the studies show that Smart PSS implementation results in sustainability benefits and avoids rebound effects. PSS business models may facilitate the extension of a product's life cycle, collection of end-of-life products, as well as remanufacturing or recycling. Despite the large number of studies detailing the environmental benefits of PSS implementation, Pacheco et al. (2019) have found this issue remains controversial. Vezzoli et al. (2015) corroborate this view and suggest that PSS need to be regarded as socio-technical elements rather than corporate ones.

The tactics presented by Reim et al. (2015) involve several aspects in terms of the implementation of a new business model. However, they leave out the human aspect approach. In this sense, Weeks and Plessis (2011) emphasized the significance of organizational culture and human resources policies in the implementation of PSS. They observed that organizational culture and shared business values, from executives to employees, demonstrate the importance of a unique identity, common understanding and shared, company-wide attitudes in the development of a new business model. Other characteristics, such as individual autonomy and support in decision-making, risk tolerance, and high performance, in the form of conflict management, also constitute determinants for the implementation of the new PSS business model (Weeks and Plessis, 2011).

Similarly, through a systematic review of literature, Brax and Visintin (2017) found eight stages to advance a PSS model: production, business analysis, solution design, supply network design, implementation, operation, support and disposal (though not necessarily all of them being used sequentially). In addition, these stages, also three-value elements, are identified: the financing of the capital good investment, system ownership and payment model. The system ownership and payment model are considered to be revenue model elements, while financing is considered a supplementary value element.

Ulaga (2013) supports the need for transition planning to a PSS business model. The involvement of the company's board of directors is crucial. Owing to the complexity of the change, a large number of companies decided to split the business and created a separate business unit, or even a new company, to quickly develop the new PSS business model (Ulaga, 2013; Baines et al., 2017).

Reinartz and Ulaga (2008) highlight the need to develop ways of service charging (pay-for-use, pay-per-hour). In the customer service, the back-office processes should be

monitored and must be agile. Moreover, it is necessary to create an experienced sales force for the handling of complex services solutions. However, it requires long sales cycles, with decisions made by high-ranking customers, which demand an experienced and prepared team for such negotiations.

Foote et al. (2001) state that, in terms of reorganization, it will be important to hire trained and specialized technicians to engage in ICT, as well as in performing new services, such as consultancy and customer training. A definition for an organizational structure to meet this new demand also becomes necessary (Baines et al., 2017).

An analysis of the economic feasibility, considering the servitization paradox and the U-Curve effect, may be required, since the investments for such implementation may have their return in a period whereby the levels of risk can hinder this process (Eggert et al., 2014; Kwak; Kim, 2016). Despite complex economic analysis, companies should recognize the importance of integrating services as a proactive and conscious strategy that enables growth and increased profitability (Kwak; Kim, 2016).

Previous studies have reinforced the importance of the current organizational structure and the adaptations needed for the implementation of PSS, in addition to the human management and internal behaviors of the company. Individual autonomy, structure, support, identity, performance, conflict tolerance and risk tolerance - these characteristics of the organizational culture and its attributes, added to the internal behaviors, are also determinants for the implementation of the new business model PSS (Weeks and Plessis, 2011).

Gebauer et al. (2005) argue the main aspects concerning the organizational culture was the necessary motivation for the managers and the opposition behavior, thereby limiting the changes to the business model.

2.3 Conceptual framework for Smart PSS implementation

Based on the gap identified in the literature, the authors chose to expand the tactics of Reim et al. (2015), in order to investigate the process of change within the business model from PO to RO (Table 1). Human characteristics pointed out by Weeks and Plessis (2011) were added, as well as the stages of change and the three contractual value elements identified by Brax and Visintin (2017). The literature paid special attention to empirical studies that described the experiences of companies which have already implemented PSS business models (Foote et al., 2001; Oliva and Kallenberg, 2003; Gebauer et al. 2005;

Gebauer and Friedli, 2005; Reinartz and Ulaga, 2008; Zhu and Madnick, 2009; Baines and Shi, 2015; Opresnik and Taisch, 2015; Kwak and Kim, 2016; Baines et al., 2017).

Table 1- Conceptual framework for Smart PSS implementation and supporting authors

Tactical Areas Expanded from Reim et al. (2015)	Key aspects	Authors
CONTRACTS Responsibility and agreement Standardization and complexity Risk Level	1. Understanding of the new business model with embedded sale of services 2. Evaluate adaptations of contracts according to proposed services 3. Definition of the form of payment for services (pay-for-use) 4. Duration of long-term contracts 5. Constant Risk Management 6. Management of partnerships with core functions 7. Assessment of the financing of capital goods and investments	Zhu and Madnick (2009) Baines and Shi (2015) Foote et al. (2001) Brax and Visintin (2017)
MARKETING Communication of added value to the customer Extension of customer interaction Customer and market insights	1. Charge for current simple but unbilled services 2. Definition of shared worksheet for Total cost of ownership (*TCO)* calculation 3. Creating Customer Relationship Marketing 4. Creation of proposal that adds value to the client 5. Creation of indicator monitoring system 6. Definition of new potential customers	Reinartz and Ulaga (2008) Saccani et al. (2016) Gebauer et al. (2005) Foote et al. (2001) Oliva and Kallenberg (2003)
RELATIONSHIP NETWORK Types of partners Relationship Type Sharing and coordination activities	1. Establish a clear market-oriented service process 2. Create agile and bureaucratized *BackOffice* 3. Direct and agile customer contact 4. Sharing of data 5. with business partners 6. Create a sales force specializing in services 7. Service-oriented team training - including language 8. Improved efficiency, quality and customer service time 9. Sales focus on customer processes 10. Contracting of service partnerships	Gebauer et al. (2005) Reinartz and Ulaga (2008) Foote et al. (2001) Baines et al.(2009b) Oliva and Kallenberg (2003) Baines and Shi (2015)
DESIGN OF PRODUCTS AND SERVICES Functionality Customization	1. Extract knowledge of equipment to generate services (Extended use of the *Fleetboard*). 2. Organized data storage (*Big Data* and *IoT*) 3. Use of tele-diagnosis data for the sale of new services	Al-Fuqaha et al. (2015) Opresnik and Taisch (2015)
SUSTAINABILITY Better utilization of resources Extension of innovation	1. Definition of property of the property 2. Increase the life cycle of products and services offered 3. Emphasis on intangible and non-measurable characteristics 4. Elaboration of sustainable integrated solution 5. Definition of the final destination of the product 6. Product reuse 7. Reduction of product volume and reuse of material in production	Brax and Visintin (2017) Saccani et al. (2016) Gebauer et al. (2005) Tukker (2004)
ORGANIZATIONAL AND HUMAN MANAGEMENT Individual autonomy, structure, support, identity, performance, tolerance to conflict and risk management, internal training.	1. Creation of an independent business unit in services, focused on innovation 2. Selection of qualified executives for services 3. Hiring technicians specialized in *Big Data* and *IoT* 4. Cultural change (service minded) 5. Executive body motivation for the new business model 6. Motivational Campaign 7. Release product quality employees and add service capacity	Foote et al. (2001) and Oliva and Kallenberg (2003) Baines et al. (2017) Foote et al. (2001) Ulaga (2013) Gebauer et al. (2005) Gebauer and Friedli (2005) Kwak and Kim (2016)

The following section will present the methodology used in this study.

3 Methodology

This study is based on a qualitative methodology and employs a case study research method. Changes in the firms' strategy and business model, especially those regarding the inclusion of services into products, can prove challenging to investigate, because this involves a multifaceted phenomenon that is difficult to shape. Thus, conventional data gathering techniques, whereby respondents complete questionnaires remotely, do not seem sufficient in order to secure and generate practical insights (Baines and Shi, 2015). The gap in the literature led us to propose the following research questions:

- How can we assess the preparation for implementing a Smart PSS business model at MBB?
- How does the senior management at the Daimler Group perceive the opportunities presented by transitioning Fleetboard to a Smart PSS system?

Based on the characteristics of the subject, this paper cast light on in-depth, single-case qualitative empirical research, analyzed from the adaptation of the tactics introduced by Reim et al. (2015). The case study shows a reality that is worth knowing in order to build theory (Yin, 2017). This research is 'exploratory' in the specific context of a Brazilian subsidiary of a multinational car manufacturer located in Sao Paulo.

Despite its limited use for theory-testing, case-study research has been used in the field of operations management to test complex issues, such as business strategy implementation (Voss et al., 2002, Yin, 2017).

3.1 Respondents and data sources

The scope of the research for PSS implementation was the Daimler truck division in Brazil. This division was chosen because of the current market pressures (e.g. price reductions), the availability of a technology (Fleetboard), and the consequent need to move towards a service-led strategy. The Fleeboard is an advanced telematic system that facilitates the integration of information technology, data from the Internet and mobile telephony to provide modern fleet and driver management solutions. It is considered the key element of our original research on Smart PSS implementation.

Having a clear scope for the research allowed us to proceed to inviting and selecting key respondents to participate in personal interviews.

One of the most important aspects in the definition of the respondent is the level of knowledge about the subject being investigated (Baines and Shi, 2015).

Although the proposed transformation was meant to happen in the Brazilian subsidiary (MBB), the research included other Daimler companies to collect the insights from a more senior and strategic level, which helped us to better understand the S-PSS business model implementation that was seen across the whole group. So, in addition to MBB, the following subsidiaries participate in the research: **Daimler AG** (Germany), Detroit Diesel Corporation (**DDC**), Daimler Trucks North America (**DTNA**), Mitsubishi **Fuso** Truck and Bus Corporation (Japan) and Daimler India Commercial Vehicles - **DICV** (India).
Respondents were selected following a set of predetermined criteria: firstly, they were required to be a person from the service supply side and personally involved in the provision of services or related activities; secondly, they needed to have knowledge of, and experience in, the function and preferably have authority on the subject. In addition, to avoid the risk of inhibitory factors by the function performed by respondents, the theoretical sample favored those with executive positions of different levels in the group's hierarchy (sequentially, in ascending hierarchical order: managers, senior managers, director, COO and CFO). The areas with a closer relationship to S-PSS implementation and key tactics presented in our conceptual framework were also taken into consideration. Thus, the respondents were selected from the following areas: operations, sales, after sales, human resources, quality control, industrial planning, purchasing and information systems IT. The list of respondents in their respective positions is shown in Table 2.

Table 2 - Respondents profile

RESPONDENT	**COMPANY**	**AREA OF RESPONSIBILITY**	**POSITION**
R1	Mercedes-Benz	Operations Bus	Director
R2	Mercedes-Benz	Human resources	Director
R3	Mercedes-Benz	Operations	COO
R4	Mercedes-Benz	Sales	Manager
R5	Mercedes-Benz	Sales	Senior Manager
R6	Mercedes-Benz	Purchase	Director
R7	Mercedes-Benz	Purchase	Manager
R8	Mercedes-Benz	Controlling	CFO
R9	Mercedes-Benz	Strategic Quality	Senior Manager
R10	Mercedes-Benz	Controlling	Director
R11	Mercedes-Benz	Strategy	Director
R12	Mercedes-Benz	Operations Powertrain	Director
R13	Mercedes-Benz	Purchase	Manager

RESPONDENT	COMPANY	AREA OF RESPONSIBILITY	POSITION
R14	Mercedes-Benz	IT	Manager
R15	Mercedes-Benz	Controlling	Senior Manager
R16	Mercedes-Benz	Purchase	Senior Manager
R17	Mercedes-Benz	Strategy	Senior Manager
R18	Mercedes-Benz	IT	Director
R19	Daimler AG	Strategy	Manager
R20	Daimler AG	Services	Director
R21	Daimler AG	Strategy	Manager
R22	DICV	Purchase	Senior Manager
R23	Fuso	Services	Senior Manager
R24	DDC	Strategy	Director
R25	DTNA	Services	Director

Furthermore, the research also counts for a participant's observation, since one of the authors has been working for 35 years in the Daimler Group, and currently at the Global Procurement department of the Brazilian subsidiary of Mercedes Benz. He has also gained experience in cost and value engineering, truck product planning, product cost calculation & investment analysis departments.

Participant observation is commonly linked to the data collection phase, but in this research it can be defined as a longitudinal observation process of a community or social group, where the researcher has a role in this unit of analysis in order to share experiences (Bernard, 2017). According to Jorgesen (2015), the researcher interacts with people in everyday life while collecting information. It is a single method for investigating complexity, conflictual and diverse experiences, and thoughts.

3.2 Data collection and analysis

A systematic literature review informed the development of a conceptual framework (Table 1), from which the key constructs were identified and considered when composing the research protocol.

Data collection was performed with the use of a semi-structured questionnaire (see appendix) in personal interviews with 25 company experts at senior management level during the months of June to September 2017. The interviews lasted about two hours each, and were all audio recorded and later transcribed.

The most appropriate participant was asked to answer the questions pertinent to their respective area of expertise, in alignment with the expanded tactical areas and their key aspects, as shown in our conceptual framework. For example, questions relating to

contracts were directed to the areas of procurement, the law, control and services. Issues associated with 'Marketing' were directed to sales, marketing, accounting and business strategy; and the questions referring to the 'Network of relationships' were answered by employees in the areas of sales, business strategy, quality, human resources and operations. 'Design of products and services' were directed to the areas of IT, sales and product development and sustainability, while 'sustainability' issues were addressed by personnel in operations, sales and controllership. Finally, 'organizational and human management', based on Weeks and Plessis (2011), was addressed by participants in the areas of human resources, business strategy, quality and operations. All participants were asked about their overall views on the integration of technologies and PSS business development prior to focusing on key areas of expertise.

Data were also gathered from company websites, internal documents, and by direct observation, since one of the researchers works on the Brazilian site. The documents analyzed included procurement contracts for the production's parts and services, a spreadsheet and software for TCO calculation, pamphlets and a manual regarding Fleetboard, performance indicator tables and corporate goals, and, finally, reports from previous motivational campaigns for changes to business culture. This information enabled data triangulation for tabulation, combination and analysis of the findings (Eisenhardt, 1989; Yin, 2017).

Finally, data analysis was conducted by deepening and examining the sets of evidence, and following the use technique of thematic analysis. Spreadsheet software was used to store and structure the raw data, and development of findings. Then, the relationship among the several sources of evidence and the research constructs were established through thematic analysis.

4 *Background on the case study*

The decision to analyze the case of Mercedes-Benz is mainly due to its representativeness in the Brazilian and worldwide markets. Other factors behind the choice were the prospects of the truck sector that currently presents with sales in decline: approximately 4.7 million trucks were sold in 2011 compared to 3.0 million in 2019, strongly driven by the reduction in international trade and recent signs of recession in some countries with a mature economy; the loss of the relative representativeness of trucks compared to other Daimler businesses also had an impact.

In 2019, Daimler sold more than 3 million vehicles, which made it the third largest producer of cars in the world and the world's largest producer of trucks, with approximately 300,000 employees and a total revenue of 173 billion euros and EBIT of 10 billion euros (Table 3).

Table 3 - Main results of the Daimler Group (*)

TOTAL	2019	2018
Revenue	172,7	167,4
EBIT	10,3	11,1
Investment in property, plant and equipment	7,2	7,5
Research and development expenditure	9,7	9,1
Total Employees	290.000	298.683
Net profit	(a)	7,6
Earnings per share (in euros)	(a)	6,78

*Values in billions of euros. (a) Not yet officially released

Source: Daimler AG FY Disclosure 2019- Investors and Analysts Conference (February 11, 2020).

The Table 4 presents the results of the different divisions:

Table 4 – Results of divisions (*)

DIVISIONS	INDICATORS											
	Revenue		EBIT		Investment in property, plant and equipment		R&D expenditure		Total Employees		Contract Volume (31st dec)	
	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018
MERCEDES BENZ CARS	93,9	93,1	3,4	7,2	5,9	6,2	8,1	7,6	(a)	145.436		
DAIMLER TRUCKS	40,2	38,3	2,5	2,8	1,1	1,2	1,7	1,5	(a)	82.953		
MERCEDES BENZ VANS	14,8	13,6	-3,0	0,3	(b)	(b)	(b)	(b)	(a)	26.210		
DAIMLER BUSES	4,7	4,5	0,3	0,3	(c)	(c)	(c)	(c)	(a)	18.770		
DAIMLER MOBILITY	28,6	26,3	2,1	1,4	0,09	0,06	0	0	(a)	14.070	162,8	154,1

*Values in billions of euros

(a) Not yet officially released (b) included in Mercedes-Benz Cars (c) Included in Daimler Trucks

Source: Daimler AG FY Disclosure 2019- Investors and Analysts Conference (February 11, 2020).

In 2019, the company's total revenue was 173 billion euros, of which 63% was generated from the segment of cars and vans. Forty billion, that is 23%, had its origin in the segment of trucks. By way of comparison, the mobility (financial) division has generated 29 billion (17%) alone. With respect to the total manpower, 50% (about 150,000) work in the car

segment, while more than 27% (83,000) in trucks, and only 5% in the mobility division (14,000). From the company's overall EBIT (10 billion euros), 4 billion (40%) has its origin in passenger cars and 2 billion (20%) in trucks; the total invested in property, plant and equipment was 7 billion euros, cars represent 85% (6 billion euros), trucks 14% (1 billion euros), while the mobility segment is lower than 1% (0.1 billion euros).

From a comparative analysis of the results, one can surmise, through the internal discussions related to the businesses' balancing, that generating 23% of the company's revenue includes 28% of employees and 16% of assets, while the car segment, with 50% of employees, generates 62% of revenue occupying 85% of the fixed assets. In addition, the mobility business, with only 5% of employees, generates 16% of revenue with only 1% invested in fixed assets.

In short, the truck business, which is no longer the main generator of revenue in Daimler due to market pressures, increasing competitiveness and price reductions. And, it is likely to see its results deteriorate further, which may even make it unfeasible if no new strategy for the trucks business is developed.

It must be concluded, therefore, that for Mercedes-Benz's truck segment, a change in its business model is not only desired, but a necessity, in order to maintain the viability of its business. This was not only one of the key motivations that underpinned the research in this division, but also makes this study highly relevant.

4.1 The current context for Smart PSS implementation

In the preliminary meetings with the sales department of Mercedes-Benz, a PSS model was found to be currently in development alongside new data equipment (Fleetboard). This equipment is among the most advanced telematics systems and uses the facilities of integrating information technology with the resources of the Internet and mobile telephony to provide modern fleet and driver management (Mercedez Benz, 2020). For the carrier and those responsible for fleet management, it provides important data on the use of their vehicles. For example, an analysis of driving (driving style) may be undertaken, checking habits and vices in the steering wheel, or monitoring routes with verification of stopped time and in movement. The diagnosis allows for an evaluation of the operation of the engine and vehicle equipment in general, including a digital map, geographical position, driving patterns in different road conditions, and prognostic maintenance.

The Fleetboard is currently offered separately as an ‘add-on’ product to support customers in the management of their fleet, rather than used as an opportunity to sell fleet management services. From the point of view of smart PSS implementation, the critical question this raises is how the company can capture value created by Fleetboard.
In this paper, the sale of data will not be discussed. The purpose of the current plan is to use the data to generate a new type of product sales, in which embedded services are included and thus advance the development of a PSS business model.

5. FINDINGS & DISCUSSION

This section presents our research findings, covering the perceptions of the adoption of a new PSS business model, and all six tactical areas included in our conceptual framework. The key focus is on the preparation of an effective implementation of PSS in the MBB truck division.

5.1 Development of the new business model at MBB

All respondents agreed on the need for a change to improve the company's profitability, but it is interesting to note that several of them highlighted the necessity of technically improving current products to meet the needs of the market, confirming the internal culture’s focus on products (PO), according to Tukker’s typology (2004). For example, R9 underscored the necessity of quality improvement in all products in the search for a competitive advantage, while R17 and R15 agreed that many product simplification initiatives have been made over time to reduce costs, and can be harmful to product quality and sales.
With respect to the integration of services to trucks, the respondents agreed that it should improve profitability, but they also advocated the integration of basic and intermediate services as opposed to fully advanced services – opposing the logic of a Smart PSS. R24 supported the truck rentals, R4 cited the sale of maintenance services, and R5 the extended warranty and driver training sold together with the product. The respondents agreed, however, that the integration of product services should be a matter of survival, which reinforces the findings of Reim et al. (2015).
Most of the respondents considered that it would be very difficult for the case company to enact the new business model, owing to cultural issues. However, these cultural issues

should be managed by company executives, corroborating the findings of Weeks and Plessis (2011). The training of employees is also vital, particularly technical staff such as product engineers, as the company is dedicated to the development of new products instead of service-oriented solutions. R3 commented on the previous initiatives for cultural change, and their related challenges.

Fourteen respondents stated that creating a business unit separate from the current company to foster the development of the new PSS business model may be the most viable alternative, reinforcing the studies of Ulaga (2013) and Baines et al. (2017), which argue that the only way to speed up and facilitate the development of the new business model for PSS.

Four respondents also cited the use of startups and one cited the company's current project, Leadership 2020*,* which uses ideas incubators, especially for the lower investment needed.

Table 5 provides further evidence of how the interviewees perceived the need for changing the business model towards a more service-oriented one.

Table 5 – Examples of respondents' statements related to changes in the business model

CHANGES IN BUSINESS MODEL
R9 ... the company, in the interests of cost reduction, has left the quality of the products in the background ... but we will finally pay the guarantee for the lack of quality ... the services must always look at the product with quality eyes.
R17 ... we have taken items that we consider not adding value to the customer [...] we are cannibalizing our products [...] we need to increase profitability by increasing our margins.
R24 [...] here in the USA several companies rent trucks [...] seems to be a positive business .
R4 ... we already have some practices [...] when the fleet buys the trucks, they already have the extended maintenance.
R5 [...] within this, I have already presented a suggestion [...] that seems to be in the direction of the new business model ... to train drivers in a safe and economical direction.
R3 [...] since I got here we have done 3 campaigns of cultural change ... different rejections and many explanations ... the internal culture is very strong.
R3 ... I tried to change some things ... there are a lot of people to say that in the past we have tried nothing against, but it will be difficult [...] many negative words.
R6 ... I see the cultural issue very complicated ... the company from which I came 3 years ago also had difficulties [...] it seems that here the employees have been in the company for a long time [...] the internal culture is complicated. [...] my suggestion is to start outside the company [...] also with open-minded people ... as the investment can complicate, I suggest using startups in this process.
R17 [...] I agree that it's complicated here ... the Leadership 2020 project works with incubators.
R2 ... the culture is stuck in the majority [...] staff with more than 20 years of company [...] can not change from one moment to another [...] encourage employee exchanges [...] really think it should be something outside the company [...].

5.2 Contracts

The company neither purchases nor sells PSS with advanced services included. This is seen as hindering the critical analysis of contracts, which leads to a lack of internal legal competence in analyzing and producing sales contracts of PSS.

As evidence of the above finding, we have analyzed different types of existing contracts, from those related to the sale of trucks and Fleetboard, as well as contracts of machine and equipment purchases. Our findings suggest that all contracts are legally designed to meet the legislation of each location. The focus is primarily product and basic services compliance, guaranteeing the rights and duties of both the company and the consumer. This is in line with one of the important aspects cited by Reim et al. (2015).

Our findings suggest that partnerships were rarely established. R7, R13 and R14 presented the parts and tools contracts used in the company and reinforced the fact that they are always related to the supply of a physical product and not services. In the case of services, the scope is usually defined as the payment with a fixed amount according to a worksheet accompanying the tasks, as highlighted by R14 and R6, with a form of turnkey payment, that is, full payment when the task is executed and finally delivered.

Long-term contracts cover a maximum of five years, but most of the contracts analyzed cover one year. According to Baines and Shi (2015), companies with a PSS model must have long-term contracts and managed risks. All the contracts examined were standardized, and any change should be approved through the legal department, having developed an internal system for this purpose.

The contracts are managed and monitored by the contract manager and no risk management instruments have been observed. R10 clarified that it will use investment analysis spreadsheets on the acquisition of capital goods, given by the controlling department of the company, since the investments that generate returns in a maximum of two years are regarded as viable. This is in line with one of the important aspects cited by Brax and Visintin (2017) for the implementation of a new PSS business model.

Table 6 provides further evidence of how the interviewees perceived the need for a shift towards more service-oriented contracts.

Table 6 – Statements of the interviewees related to contracts

CONTRACTS
R7... you can check all types of current contracts ... the contracts are directly related to purchased products [...] we have contracts for parts and tools [...].

R14 [...] in the case of services, the scope of the work is usually defined [...] as payment with a fixed amount according to a worksheet accompanying the tasks [...] and we do not use the form of *pay-for-use* payment, but *turnkey* [...] definitions that come from years ago [...].
R7… contracts are usually of short duration - 1 to 5 years at the most [...].
R14 ... contracts are practically 100% standardized ... any need for change must be formally approved by the legal area of the company ... where the contract manager must request approval for the change in the legal area from the company.
R15... we do not have major partnerships [...] and we should have instruments for risk management of contracts.
R10... in the case of new investments ... use of investment analysis sheets ... but only in cases of acquisition of capital goods ... regardless of their value, are considered viable investments that generate maximum return in 2 years.

5.3 Marketing

According to the experience of companies with a PSS business model, we investigated some services that the company already provides. R4, R5 and R24 have argued that the sales area has a software to calculate the Total Cost of Ownership (TCO), as recommended by Roda and Garetti (2014). This software is used by technical sales assistants to suggest, according to the customer needs, the most viable products from the point of view of total cost. We found that this same worksheet is used by the after-sales staff as a guidance tool for large fleet owners to optimize costs (Reinartz and Ulaga, 2008). This service is currently offered, but not charged, in MBB.

The relationship of the sales staff with the dealers of trucks is very close, including using sales performance indicators and comparisons of them, and even distributing awards. However, R24 and R21 emphasized that there is little interaction with final customers, e.g. logistics companies. Thus, the development and preparation of the employees do not focus on serving the public directly, but only the dealers. Thus, only part of the value chain understands the value creation process, resulting in greater engagement with customers (Lightfoot et al., 2013; Klimanov; Tretvak, 2019). Moreover, Bambrila-Macias et al. (2018) state that for a successful PSS offering, both customer and provider may need to make necessary adjustments to their tangible and intangible capabilities in order to specify, communicate and capture value.

R1, R3, R4, R5 stated that they consider the company with advanced technology to be always ahead of the competition by presenting new products to customers. Nevertheless, the participants stressed that Mercedes-Benz is a genuine product development company - very focused on its production, but not offering solutions for demand needs.

The company uses a balanced-score card approach, i.e. an annual definition of corporate goals being cascaded into specific indicators which are monitored monthly. The business strategy area, directly linked to the CEO, is responsible for the control and monthly reporting of the results of the indicators. R3, R19, R21 and R24 indicated that the main performance indicator used by the company is the return on sales (ROS), not only by the Brazilian subsidiary but by all those within the Daimler Group.

Challenges were also observed when reflecting on possible future clients in the PSS model, due to the culture of products and the current relationship with dealers.

Table 7 provides further evidence of how the interviewees perceived the need for changes in marketing towards a more service-oriented model.

Table 7 – Statements of the interviewees related to marketing

MARKETING
R24 [...] and we also have software for the calculation of *TCO* [...] used by technical sales assistants [...] always integrating with customers [...] an important tool that determines [...] according to their needs ... offering the most economical products. This same software is provided [...] also according to customers' demands [...] releasing its use and we even teach its use. R21 [...] interaction with other customers [...] small direct interaction with final customers, only with concessionaires. R5... there is even little preparation to meet the public directly ... our company still has many difficulties to meet the needs of customers. R19 ... one even forgets customers' needs ... trying to suggest what is best for them [...] in a context of pushing the market and not being pulled by it. R24 [...] we have several, [...] but the main indicator used by the company is the *ROS* (Return on Sales) [...] monthly reports are produced [...] using the indicator structure *BSC* (*Balanced Score Card*), with clear definition of goals [...] annually discussed and cascaded

5.4. Networking

In general, the respondents understand that this issue is a significant challenge for the whole Daimler Group, because the company does not present a culture of partnerships and networking. As quoted by R18, the company has a customer-supplier relationship based on standardized, clear, objective, but not flexible, contracts.

According to interviews with the controlling area (R8, R10, R15), Mercedes-Benz has never used the concept, for example, of open-book, an open structure and shared costs with its business partners. Neither does it share internal information, since it is characterized as confidential information, which makes it difficult to use the PSS business model, as discussed by Foote et al. (2001) and more recently by Fain et al. (2018).

Respondents considered that a large majority of internal processes were bureaucratic and non-agile. The rigid compliance rules and regulatory standards that need to be followed by all employees are considered the main reasons for excessive bureaucracy and a lack of agility. According to R13, this directly influences the training and skills required for

purchasing personnel who need to spend a significant amount of time learning how to uphold standards, instead of developing the commercial and non-technical skills to build necessary business partnerships. In the view of participants, a new PSS business model should be developed in a separate organization, or possibly a business unit or even a startup. R2 considers that several factors make it difficult to change the business model for PSS; in particular, the very close corporate culture, which is not based on partnership and trust with key PSS stakeholders – an essential aspect of PSS development as pointed out by Baines and Shi (2015). In order to integrate Fleetboard into a smart PSS and successfully position it in the market, the company will need to rethink the current rigid contracts and communication procedures in place.

Table 8 provides further evidence of how the interviewees perceived the need for changing the networking towards a more service-oriented one.

Table 8 – Statements of the interviewees related to networking

NETWORKING
R18 ... this is a huge challenge ... the company does not have a culture of partnerships ... only customer-supplier relationships ... always with clear and objective contracts [..] with a high degree of standardization [...].
R8 [...] we do not even think of *open-book-accounting* [...] nor do we know well [...] nor think of any kind of internal information sharing [...] are confidential.
R13... over the years [...] molded buyers with rigid skills ... do not facilitate partnerships ... nor do the training in this regard happen.
R8... because of our corporate culture ... we are out of date [...] we cannot trust [...] we have to follow rigid contracts and mostly official communication. [...] always through letters and controlled emails.

5.5 Design of Product and Services

The product development department appears to be focused on the technology of new products with little customization. Customization is carried out particularly by companies that complement the trucks with items to meet the specific use of the products. Most of the product development activities are carried out in the headquarters, which in turn reduce flexibility and would be a major disadvantage for the implementation of the PSS business model (Baines et al., 2007). Brambila-Macias et al. (2018) argue that in order to offer a PSS, the provider should supply temporary teams during different stages of the design process and improve flexibility as required by customers.

We examined further the characteristics and information provided by Fleetboard with the sales area. They mentioned the difficulty in using it as a new service. R5 mentioned that the company is currently extracting the technical data needed to support the customers' fleet. Similarly, R3 considers that the difficulties of developing customized products are numerous, as the processes are rigid and hinder flexibility, which demonstrates that the

manufacturer should rethink the customer solutions from products to relational processes, with clients managing the transition from a product-oriented firm to product-service firm (Oliva and Kallenberg, 2003; Tuli et al., 2007). Although when offering a PSS, hidden costs may arise in the form of resistance to change or re-training, for example, when creating relational, rather than transactional, relationships with customers (Brambila-Macias et al., 2018).

Regarding the concepts of Big Data, R14 and R18 cited the implementation of the concepts of industry 4.0 in production but regarding the use of Big Data in products, this is still outside the current reality of the company in Brazil. R20, R23 and R24 asserted that such concepts have already been developed in products across Europe, the USA and Japan.

Table 9 provides further evidence of how the interviewees perceived the need for changing the design of products and services towards one that is more service-oriented.

Table 9 – Statements of the interviewees related to design of products and services

DESIGN OF PRODUCTS AND SERVICES
R5 [...] in addition to *fleetboard* [...] by several fleet ... we have extracted all the technical data ... we are looking for new data [...] I believe we are at or near the limit [...].
R18 [...] we worked hard on *Big Data* [...] when we implemented changes in the production system [...] concepts of industry 4.0 [...] having difficulties in interconnecting all equipment [...].
R20 [...] furthermore, the stand-alone vehicle [...] Germany [...] *Big Data* is a reality [...].
R23 [...] both in production with industry concepts 4.0 [...] electrical products in Japan fully customized [...].
R24 [...] in everything in the company here in the *USA* [...] more and more *Big Data* [...] in all our activities.
R3 [...] I perceive difficulties in the development of customized products [...] even the customers paying [...] for example are the buses [...].

5.6 Sustainability

Managers have shown themselves to be concerned with sustainability. R3 highlighted sustainability in their production processes, by reusing material such as waste, burrs, and lost parts used in production. In relation to sustainable products, R17 mentioned the use of alternative materials, such as the development of trucks using coconut fiber instead of foam.

According to R12, Mercedes-Benz has developed a facility for motor reconditioning and the sale of used products, but aims at meeting the legislation instead of capturing the value of end-of-life products. These findings give further empirical validation to the

opportunities that the PSS business model may create to increase recycling rates (Brax and Visintin, 2017), particularly at the point of disposal.

The company controls (through indicators) the conservation of environmental and natural resources of their direct and indirect suppliers, including having an annual award for actions to help the environment, as quoted by R6.

Little evidence was found on fostering a more advanced type of relationship between PSS and sustainability (Tukker, 2015), namely: feedback for eco-design, and the advanced integration of circular economy principles. This can be explained by the economic motivation that triggered the company to consider a Smart PSS model, which is strongly supported by the literature.

Table 10 provides further evidence of how the interviewees perceived the need for changing sustainability.

Table 10 – Statements of the interviewees related to sustainability

SUSTAINABILITY
R3 ... a fundamental issue for this company [...] and a constant concern for the environment. Also, in the new production lines [...] in all processes [...] especially in the production processes [...] besides the re-use of most of the material used in the production [...] including the scrap and machine waste ... without forgetting burrs and strips [...]. R17 I cite the use of alternative materials [...] and I also remember coconut fiber [...] in Mercedes-Benz car seats and head restraint [...] in a self-sustaining company. R12 [...] we have developed an engine reconditioning area [...] with the operation of reselling used products [...] and we began to study the final destination of the product [...]. R6 [...] controls through BSC- based indicators ... the issues of preservation of the environment [...] beyond the natural resources of its direct and material suppliers [...] support for production. [...] and the annual awards of suppliers for differentiated actions [...] sustainability and the environment.

5.7 Organisational and Human Management

This tactical area was stressed as a crucial issue by all respondents. R1 realized that the development of the current team could be an alternative. Instead, R2 argued that it would be too costly in terms of investment and time, and creating the risk of not reaching the appropriate level of qualified staff. A common agreement was reached regarding the need to hire qualified personnel for the new PSS business. According to R16, the skills and competences required to work with services were not found in the current employees. An example of this was that few respondents demonstrated knowledge of PSS and constantly returned to product focus. The Mercedes-Benz Chief Operating Officer (R3), in particular, believes it is a challenge to achieve full executive motivation and an awareness of the need for change.

The timing of the new PSS development is also critical. The respondents also considered that internal motivational campaigns would not have positive effects because of the current (negative) market situation and consequent ongoing staff reductions. They believe the right company atmosphere for a campaign of this type does not exist at the present time.

Another finding revealed that interviewees of the quality department did not agree that the personnel of this area should add service offerings, since, in the opinion of R9, the "quality of product must come first". Likewise, R25 considered that both the technical training and the psychological profile of the staff were focused on technology and new products, not services. However, R22 stated that since the company is relatively new in India, the staff who recruited had prioritized qualifications in the service area.

During the interviews, executives have often cited the question of economic viability and risks in changing the business model, which reinforces the internal product culture.

Some previous attempts at internal changes were carried out without agility and it was very difficult to involve all the executives. This was probably because of the size of the company and problems related to internal communication, or even for motivational reasons. It has also been pointed out that several years of crisis and the constant reduction of personnel generate a degree of pessimism and lack of motivation when change is considered.

Table 11 provides further evidence of how the interviewees perceived the need for changing the organizational and human management towards a more service-oriented one in nature.

Table 11 – Statements of the interviewees related to organizational and human management

ORGANISATIONAL AND HUMAN MANAGEMENT
R1 [...] for the quality of today's [...] staff can and should be developed [...] always as the first alternative.
R2 ... of course ... could be an alternative [...], but I think it would be very expensive for investment and time ... not to mention the risk of not reaching the appropriate level of staff qualified [...] would be disastrous.
R16 ... I do not see these skills in today's professionals [...], but I do not know everyone ... I see that culture is not present.
R3 ... I see as very difficult full motivation ... as well as executives [...]; there must be prior awareness of the need for change.
R9 ... quality must be a priority ... I do not see that a release of staff from the area [...] to a service capacity [...] would be a good solution. It is not a viable idea.
R22 [...] plant here in India is recent and we have already set up the staff [...] glimpsing the aggregation of services.
R25 [...] technical profile of product [...] engineers for product developments [...] here in the *USA*

As a result of using our conceptual framework as a guide to assess the preparation and implementation of a Smart PSS business model, we advanced Opresnik and Taisch's (2015) model, with a third block going beyond the sales of data (Figure 2). Instead, a company should use the data to create new services that, when incorporated into products, will generate new business opportunities.

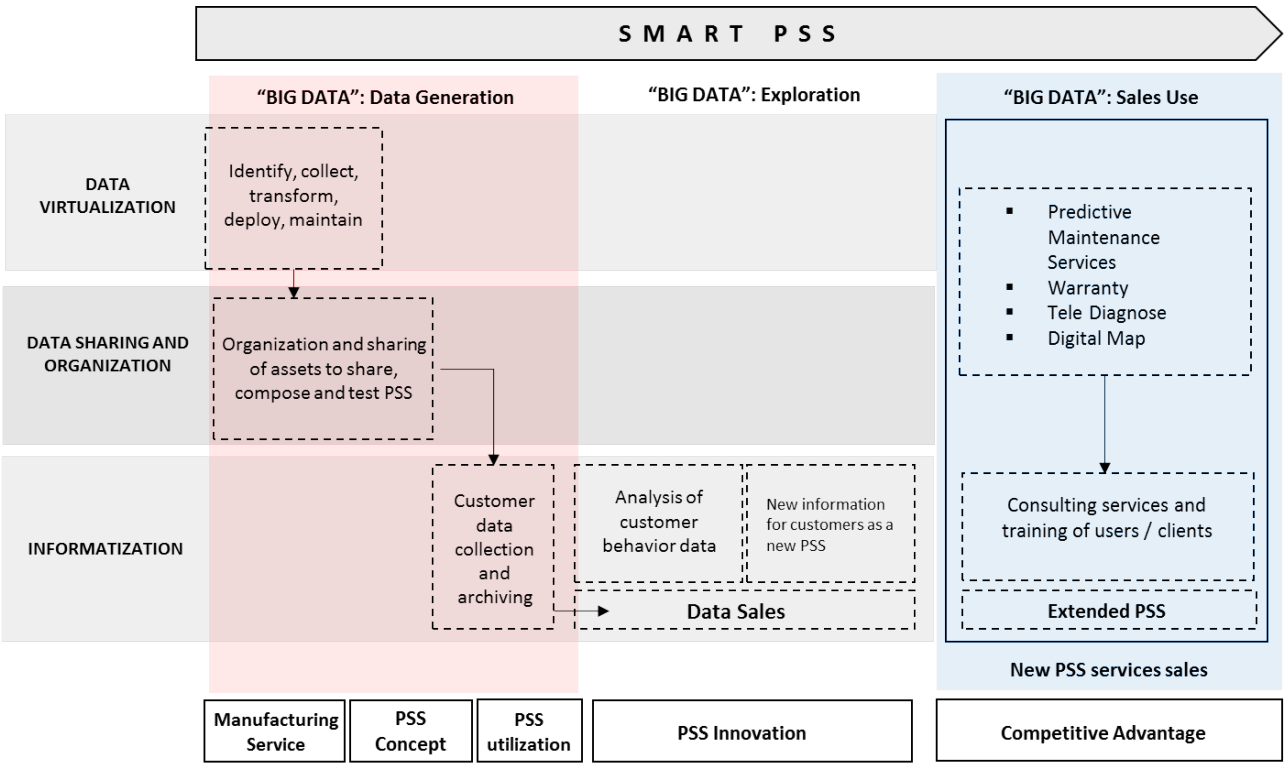


Figure 2 – Beyond data sales in Smart PSS business models

6 Conclusion

Transforming a product-oriented organization to compete with? Smart PSS is a challenge for practitioners. But it is also an opportunity for researchers to understand the transformation towards service-orientation, as well as contribute, in the light of the latest literature, to how the process can be done effectively. In general, the academic research is organized into separate and often disconnected fields of knowledge. As a result, no 'holistic' framework explains how to enact a shift towards the integration of products and services. Thus, this inevitably constitutes a barrier to the adoption of servitization (Baines et al., 2017).

From these fragmented theoretical propositions and best practices of companies that have implemented PSS business models, we built a framework that includes the main dimensions of preparing a company for the implementation of a Smart PSS. The investigation was limited to an in-depth study in one automotive company and one market segment – the truck sector.

Our findings indicate that, although there is a recognition of the importance of shifting to integrated product and service offerings, this requires remodeling the business as a whole. Challenges such as establishing relations between products and service design in a product-service system, organizational culture, and employees' resistance to change, were identified. In terms of practical issues, some obstacles must be overcome, such as service contracts versus product contracts, the economic justification of implementing services, service marketing and communication, and the supply chain and dealers.

For reasons of scope definition, this paper focused on the strategic and behavioral actions of the development of a new PSS business model in an auto manufacturing company. Internal issues of logistics or production processes were not considered. This is certainly an area that should be considered for future research.

In terms of theoretical contribution, this paper expands the PSS model based on Opresnik and Taisch (2015), by proposing the use of Big Data to generate a new business model, i.e. adding services to products and not only selling the available data. An additional contribution was the development of a conceptual framework, which expands the strategic/tactical areas of Reim et al. (2015). and provides further detail in each of them. It can be used to assist the preparation phase of PSS implementation. Our empirical study contributes the following additional insights:

- Motivation (drivers) and organizational climate (timing) for implementation need to be monitored frequently. Organizational barriers may be so high that PSS implementation may need to occur via a spinoff company;
- Procurement activities may provide a route to build legal competence in designing Smart PSS contracts. Companies that do not buy through PSS contracts may face more difficulties to design and sell PSS contracts;
- Despite the predominant economic motivation, companies should use the preparation phase to align marketing tactics with networking and sustainability to capitalize the benefits of Smart PSS beyond the economic dimension. This can lead to smoother implementation because of stakeholder's involvement (networking), improved customer retention (marketing), as well as to advanced integration of circular economy principles (sustainability).

A main limitation of this paper is that it is based on a single case study covering one segment (loads) and a specific product (trucks). It provided, however, an in-depth view of the challenges faced when embarking on a new PSS business model development. The use of multiple respondents from various companies of the Daimler Group from different countries and with access to different sources and internal documentation provided a general view of key aspects around the preparation for PSS implementation. Future research could explore the hierarchy of tactical areas and key aspects during the implementation process. Moreover, expanding the research to other Daimler segments, auto companies, and even other industrial sectors, will have a lasting impact on theory and practice. Furthermore, implications for after-sales teams (Legnani et al., 2009) and the use of new technologies, such as additive manufacturing (Davies et al., 2020), need to be considered in the context of Smart PSS implementation.

In terms of managerial implications, Mercedes-Benz should take advantage of the information provided by Fleetboard and start offering the device as a service. By offering Fleetboard as a service, the company would better position itself to create and capture value on the product use data. That would allow a more robust preparation towards the implementation of a Smart PSS business model to the truck sector. Accurate data on product use will be a valuable input in the transition to supply not only a truck but a complete transport solution, and finally adding new services to their product range.

It is paramount that a Smart PSS offering starts small and via a device, instead of fully moving to transport solutions and fleet management services. This will reduce organizational resistance and financial risk, develop key partnerships and competences (e.g. in contracts mainly), and bring further awareness of sustainability benefits.

The use of Big Data will provide accurate information on the designated driver's behavior, selection of the most appropriate routes, targets for fuel consumption, and other key inputs in customer operations (e.g. tyres) and fleet maintenance. In addition, MBB may offer other advanced services, such as driver training for its customers. The capture of the data will also enable partnerships with upstream suppliers. With tele-diagnosis data, predictive maintenance will be more accurate and impact positively on negotiations with suppliers. For example, if MBB better understands customers' tyre wear information, it can pass it on directly to suppliers of tyres, and build a more agile supply chain.

The transformation of a product-centric manufacturing business towards a service-led model is challenging, risky and it may take years to be implemented. With profit margins being squeezed and competition becoming more intense, the preparation for such transformation is a critical phase that cannot be neglected. This paper has cast greater light on the complexities involved in preparation for Smart PSS implementation, which may not only bring invaluable benefits for businesses, but also prove worthwhile for its own sustainability.

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