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Recebido: 26 set. 2022

Aprovado: 25 abr. 2023

Versão do autor aceita publicada online: 25 abr. 2023

Publicado online: 04 maio 2023

Como citar esse artigo - American Psychological Association (APA)

Silveira, R. I. M., Torres, N. Jr., Teixeira, R., & Simões, A. C. (jan./mar. 2025). Servitization on the primary sector – coffee plantations case. *Exacta*, 23(1), p. 193-222.

<https://doi.org/10.5585/2023.22990>

Submeta seu artigo para este periódico

Processo de Avaliação: *Double Blind Review*

Editor: Dr. Luiz Fernando Rodrigues Pinto



Dados Crossmark



Servitization on the primary sector – coffee plantations case

Servitização no setor primário - casos em lavouras de café

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Nota dos Autores

Autores declaram que não há conflitos de interesses.

Financiamento: Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG)

Abstract

This paper analyzes the servitization process of different suppliers in the coffee production chain in Brazil. A literature review on product-service systems (PSS) was performed to develop a framework to identify the typology of services in the agriculture sector. The results highlighted that the provision of "less advanced" services is not a necessary condition for the company to offer "more advanced" services. However, the characteristics of rural properties seem to affect the number of services associated with machine suppliers. The results support managers in this sector to identify service offerings and widen the discussion about servitization by covering a barely explored sector.

Keywords: servitization, product-service systems, agriculture, coffee plantation, after-sales service



Resumo

Servitização no setor primário - casos em lavouras de café

Este trabalho analisa o processo de servitização de diferentes fornecedores na cadeia produtiva do café no Brasil. Foi realizada uma revisão da literatura sobre sistemas produto-serviço (SPS) para estabelecer uma estrutura para identificar a tipologia de serviços no setor agrícola. Os resultados destacaram que a prestação de serviços "menos avançados" não é uma condição necessária para que a empresa ofereça serviços "mais avançados". Entretanto, as características das propriedades rurais parecem afetar o número de serviços associados aos fornecedores de máquinas. Os resultados ajudam os gerentes desse setor a identificar as ofertas de serviços e ampliam a discussão sobre servitização, ao abranger um setor pouco explorado.

Palavras-chave: servitização, sistemas produto-serviço, agricultura, plantação de café, serviço pós-venda

Introduction

Despite the authors Vandermerwe and Rada (1988) launched the concept of servitization in the late 1980s, the interest in this topic continues to gain momentum in modern manufacturing and in the academic field (Raddats et al., 2019). In this context, business models based on increasing the product and service offerings that shift from product to service orientation are perceived as essential to industrial success in the 21st century (Baines & W. Lightfoot, 2013; Falk & Peng, 2013; Visnjic Kastalli et al., 2013). During this process, products and services would find the necessary structure to build a joint system called Product-Service System (PSS) (Mont, 2002).

Visnjic Kastalli et al. (2013) state that the servitization can be viewed as a result of developing the organization's innovative capacity by changing the offer of products to the offer PSS to meet the customers' needs. The concept of servitization has been studied from various angles, such as its characteristics, drivers, implications, and challenges (Hakanen et al., 2017).

Several authors (Chase, 1981; Dimache & Roche, 2013; Oliva & Kallenberg, 2003; Reim et al., 2015) advocate that a PSS continuum can envisage the transition from a product-centric company to a "servitized" one. In this continuum, several combinations of PSS are possible, from the less advanced (with a greater appeal for products and services as coadjutants) to those more advanced (with greater



importance of the services, including the possibility to suppress the physical product possession by the customer).

Although the first steps in service manufacturing date back more than 200 years, when International Harvester used service to supply its new harvesting equipment to local farmers (Kaňovská & Tomášková, 2018), the servitization research in agriculture is still minimal (Vidickiene & Gedminaite-Raudone, 2019). Manufacturers in the agriculture sector (such as tractors, trailers, harvesters) face several challenges due to increased product commoditization and greater competition in terms of cost and technological leadership. Thus, numerous companies have responded to these challenges through servitization. Considerations about the services in the agricultural sector are being induced by the IoT (Internet of Things) (Yan et al., 2016). Several changes in technologies are shaping the so-called "precision farming" or "smart farming." This context promotes the incorporation of services in the primary sector that will support crop yields, allowing the production of sustainable products and services (Kaňovská & Tomášková, 2018).

Literature considering the PSS and servitization in first-tier suppliers in the primary sector, namely in agriculture, although recognized as relevant, is scarce. The agriculture sector is responsible for the food supply chain, and, today, this supply chain has had numerous challenges because of the problems related to food traceability, quality, and contamination (Auler et al., 2017; Rodrigues et al., 2019). For example, the agriculture sector is characterized by a fragmented supply of fruits, grains, meat, milk, and other products. Servitization can help manufacturers and farmers to share information and improve data gathering to cope with these challenges and improve food safety. To fill this gap, this work analyses the servitization process of the suppliers of machineries, seedlings, pesticides, and agricultural fertilizers (inputs) in the coffee production chain in Brazil. This analysis has been carried out, considering two research questions emerging from some specific characteristics of this sector (Subsection 2.2).

Reflecting about the responses to the two research questions established in this work, the present study offers three contributions to servitization literature: first, it presents a new



comprehensive framework to identify the typology of services offered in this sector based on three dimensions: i) orientation (oriented to the physical product, to the use, or the results), ii) moment when it can be offered (before purchasing, during purchase and post-purchase) and iii) group of services (Basic, Maintenance, Professional and Operational); second, the study found that the provision of less advanced services such as maintenance services in the typology of Oliva & Kallenberg (2003) in the PSS continuum is not a necessary condition for the company offer more advanced services; and finally, contradicting the theory set out by Oliva & Kallenberg (2003), the findings also revealed that some of the services categorized as professional and oriented to the end-user process might occur in stages before the purchase of the product.

This paper is structured as follows: the next section offers the literature review on the research topic and ends by presenting the framework to identify the typology of services in the coffee production chain. The third section presents the research methodology used. The fourth section contains the results. Finally, the fifth section brings the discussion and conclusion of the research and the limitations and opportunities for future research.

Literature review

Manufacturing companies in various industries are providing advanced services to their customers. Several factors are driving this movement: the possibility of differentiating their products, increasing revenue streams, and boosting profitability. In practice, however, this transition also brings challenges (Lenka et al., 2018).

Since the term servitization was disseminated in the academic field, the number of publications on this topic has increased, especially after the 2000s. However, servitization is most studied in manufacturing and companies based on products (Hou & Neely, 2013; Lightfoot et al., 2013), and most of the work on this topic is in the Industrial Marketing area (Zhang & Banerji, 2017). Even though the significant growth of services offers in companies that manufacture traditional physical products, this growth is also relevant to other sectors. Therefore, expanding field research beyond manufacturing can improve our understanding of the existing servitization growth strategies



(Kowalkowski et al., 2017). In order to explore the issue of servitization besides the industrial sector, the following sections did a literature review based on i) the servitization in the primary sector, focusing on in the agriculture context, and ii) the several dimensions in which servitization occurs in general contexts. Based on the literature review, a proposed framework to identify the typology of services that could assist the agriculture context, particularly the coffee plantations, is presented.

Services in the Primary Sector – Agriculture

The primary sector comprises a set of economic activities responsible for the extraction and/or modification of the raw material, which can be transformed into primary products. This sector is constituted by the segments of agriculture, livestock, agro-business (which includes all operations up to the commercialization of agricultural products), fishing, forestry (extraction of forest material), mining, and the extraction of non-renewable resources (Oda, E.; Marques et al., 2008).

Agriculture is characterized by the production of commodities, whose characteristics include the low added value in production and the firm reliance on the market (domestic and international) to establish prices (Ferraz et al., 1995). The production cycle is more prolonged, often dependent on several factors that cannot be monitored/controlled by the company. This sector faces the risk of production or yield. This risk occurs because the agriculture fields are exposed to many uncontrollable weather-related events (e.g., excessive or insufficient rainfall, extreme temperatures). Technology can also introduce risks because the rapid implementation of new crop varieties and production techniques can occasionally produce adverse results (Harwood et al., 1999). Moreover, in such perennial crops as coffee, the capital invested remains fixed for a relatively long time, making new investments in production more difficult (Costa et al., 2012).

In the Brazilian context, farmers rely on cooperatives and representative entities (e.g., producer associations and government agencies) for accessing new technologies and funding. Cooperatives play an essential role in supplying products and services to farmers and act as dealers for the machinery and agricultural implements, and fertilizer industries (Rollo, 2009).



Servitization in the agricultural industry is being boosted by IoT (Internet of Things). This trend has been called "precision farming" or "smart farming." The IoT brings radical changes in farms management since it enables access to crucial information that improves decision-making skills. For example, manufacturer John Deere has announced that his products will be able to report, monitor, and control machines' operations (John Deere, 2019). Servitization can achieve several benefits: more efficient logistics, reduced maintenance, and higher cost control. In this context, although the agriculture sector is at the beginning of this digital transition, it must respond to this challenge by building and managing intelligent systems that enable the acquisition and exploitation of adequate digital capabilities to compete in this new digital environment (Kaňovská & Tomášková, 2018).

The coffee production chain in Brazil

The coffee sector has significant characteristics that differentiate it from those sectors of the economy that produce higher value-added manufactured goods that extensively use the servitization strategy. In contrast to durable goods, coffee is a perishable good that presents a long production cycle (Matiello, 1991).

Servitization in agriculture is the process taken by product-centered manufacturers, such as suppliers of machineries, seedlings, pesticides, and agricultural fertilizers, to offer services (e.g., plantation consulting, efficient usage of resources, resources optimization) that add value to farmers in the food supply chain.

More specifically, the coffee supply chain is composed of suppliers of machinery, seedlings, pesticides, and agricultural fertilizers. There are wholesalers, retailers, specialized stores, and individual consumers going downstream in this supply chain.

It is essential to highlight some characteristics of the agriculture sector of emerging countries, like Brazil, that imply significant challenges in this productive chain's servitization. These characteristics are outlined in the following paragraphs.



Agricultural products are perishable, single-use, and low-value/cost. For these reasons, some farmers may not see value in educating themselves to make better product selection and usage decisions. Therefore, they can be understood as products with limited support patterns if we consider their suppliers' operational responsibilities (Brax & Visintin, 2017). Products framed in this kind only provide lower advanced services in the PSS continuum (Oliva & Kallenberg, 2003). This characteristic and the lack of knowledge and ability of some farmers create a condition not commonly found in other sectors.

Coffee production in Brazil takes place on farms of different dimensions and in locations with different topographies (CONAB, 2020). Regarding the size of the farms, the larger cultivated areas are, the more prominent in the adoption of machines that allow greater mechanization of the sowing and harvest and increase the possibility of using services associated with these machines. On the other hand, a rural property with a rugged terrain makes it difficult to use machinery to perform the seeding and harvesting in a predominantly manual mode (de Oliveira & Zylbersztajn, 2017), negatively affecting the servitization possibilities. These characteristics of farmers are distinct from producers in other industries because agricultural production is made under environmental conditions that cannot be adjusted or controlled for. Other sectors can build facilities to adjust and control the production environment.

Finally, cultural aspects of agriculture in countries like Brazil can play an essential role in how farmers adopt certain operational practices. Brazil is considered the world's largest producer and exporter of coffee, commercializing 36% of the volume of grain sold in the international market and can produce all types of coffee demanded by the markets (CONAB, 2020; Volsi et al., 2019). Therefore, the country has a great tradition in its production, having its first cultivations formed almost 200 years ago. However, the more significant tradition in coffee-growing implies a greater conservatism in the producer's attitudes, consequently, a lower propensity to change production processes and business management due to the dependence on investments made in the past. This dependence and conservatism tend to inhibit the adoption of innovative practices stemming from the servitization



process (Bara, 2015). On the other hand, since the 1980s, Brazilian agricultural chains have undergone profound transformations, particularly with the deregulation of the domestic market, forcing the sector to experience essential changes driven by new consumer markets increasingly focused on production processes and product quality. These changes forced the sector to be modernized by adopting new management practices (Saes & Silveira, 2014; Volsi et al., 2019).

These coffee sector specificities denote the pertinence of describing and understanding the servitization process for management literature.

Decoding the Servitization

According to Morelli (2003), servitization can be seen as an evolution of the product idea of an entity (that is reducible to its material part) to another entity whose material part is inseparable from its immaterial part (the system of services in which the product is consumed). This evolution does not take place in a short period, and this is a process that involves both the customer and the PSS provider. In this sense, an enhanced understanding of the current level of servitization in an organization requires recognizing a continuum type and dimension of the services that can be offered (Martín-Peña & Bigdeli, 2016). In the following sections, a brief explanation of the dimensions of the service will be given.

Service orientation

The types of services orientation, proposed by Oliva and Kallenberg (2003), is defined in terms of the company's position in the continuum between products and services. This continuum starts at one extreme with various basic services and finishes with operational services (Oliva & Kallenberg, 2003). At the end of the other extreme of this continuum, services are more crucial, the focus is on customer interactions, and the nature of relationships is inherently relational. Service orientation can be understood by the number of services offered, the number of customers to which these services are offered, and how they are provided. A service orientation also implies the occurrence of intangible and personalized outputs, customer involvement, and simultaneous production and consumption



(Lenka et al., 2018). The development of service orientation can be seen as vital for companies to benefit from the increased sales performance and profits from the enhanced service offer (Kohtamäki et al., 2015). Therefore, this classification is crucial to compose the continuum of PSS.

Oliva & Kallenberg (2003) identified two types of service orientation: Product-oriented services and End-user's process-oriented services. However, other studies that measure servitization, such as (Dimache & Roche, 2013; Gebauer, 2008; Reim et al., 2015; Saccani et al., 2014; Tukker, 2004) classify services in PSS according to three types of orientation which are superimposed on Oliva & Kallenberg (2003) model:

- a) Services oriented to the physical product - their primary purpose is to ensure its functionality over time. Examples of such services are installation and activation of the product, repair services, provision of spare parts and consumables, deactivation and disposal services;
- b) Services oriented to service use - these services aim to facilitate daily interactions of end-users with the product and their complete satisfaction. Examples of such services are provision and updating of technical documentation, helpdesk/remote support system, on-line forum related to product issues, customer attendance service;
- c) Service-oriented to service results - These services aim to assist customers in redesigning, managing, and optimizing processes related to the product supplied. Examples of such services are consulting and professional services for engineering processes, testing, simulation, design, construction, and process-driven training services.

Type of Services

According to Oliva and Kallenberg (2003), the services can be distributed into four groups, as follow:

- Basic installed base services: Documentation, updates/upgrades, Transport to the customer, Product-oriented training, Hotline/help desk, Inspection/ diagnosis, Installation/commissioning, Repairs/spare parts, Product Refurbishing, and Recycling/machine brokering.

- Maintenance Services: Condition monitoring, Preventive maintenance, Spare parts management, and Full maintenance.
- Professional Services: Engineering-oriented process (testing, optimization, and simulation), Research and Development (R&D), spare parts management, business, and process-oriented training, and consulting.
- Operational Services: Involving operation and maintenance management.

In the literature exhibits several types of services can be found. Based on the literature review on PSS and servitization, it was possible to identify 25 different types of services used by the companies in their servitization process (See Table 1).

Services integration

Bettencourt (2010) discussed the importance of adding services that complement the product portfolio in product-dominant companies. Added services should be understood as solutions to customer needs. In this sense, services provide the ability to get a job/task well done, in a convenient, efficient, reliable, and affordable way, or help them get more jobs done. They help the customer to get the desired results with the product (ownership and consumption) (Christensen et al., 2007). Bettencourt (2010) argued that an essential point for servitization practices in organizations is to recognize the best opportunities to integrate services according to different time points (moments) of interaction between the company and its customers (e.g., pre-purchase, purchase, post-purchase). The identification of such services/opportunities can be made during the stages of pre-purchase, purchase, post-purchase by asking questions about the opportunities to help the customer with Product Selection; Purchasing of the product; Installation and/or deployment of the product; Instructing how to use the product; Product usage; Moving and/ or storing the product; Product maintenance; Upgrading and/or updating the product; and product disposing of.



Conceptual Framework - Identifying the services in the servitization process along three dimensions: purchase time, type of service and orientation

In this subsection, the authors made a theoretical effort to integrate three main services dimensions presented in the previous subsections. Thus, the framework proposed to classify the services (Table 1) founded in the literature according to their: i) moment when it can be offered (before purchasing, during purchase and post-purchase); ii) type of service (Basic, Maintenance, Professional and Operational) and iii) orientation (oriented to the physical product, to the use, or the results).

Table 1 shows a concentration of service opportunities in the after-sales stage because it is in this stage that the customer has already acquired the product or the right of using it, and the PSS provider can show all the capacities to guarantee the full functioning of the PSS. The greater range of services available at this purchase stage can be crucial for the customer's decision to select the company where to buy the product (due to the inherent advantages of superior support).

A better understanding of what are the moments of interaction to offer the services tends to favor the effectiveness of initiatives to restructure the business through servitization (Bettencourt, 2010). This aspect is relevant since it assists managers in allocating the servitization efforts. Additionally, the identification of service offer opportunities can decrease the downtime of the current resources since the capital remains immobilized for a relatively long period, impeding new investments (Costa et al., 2012).

Table 1

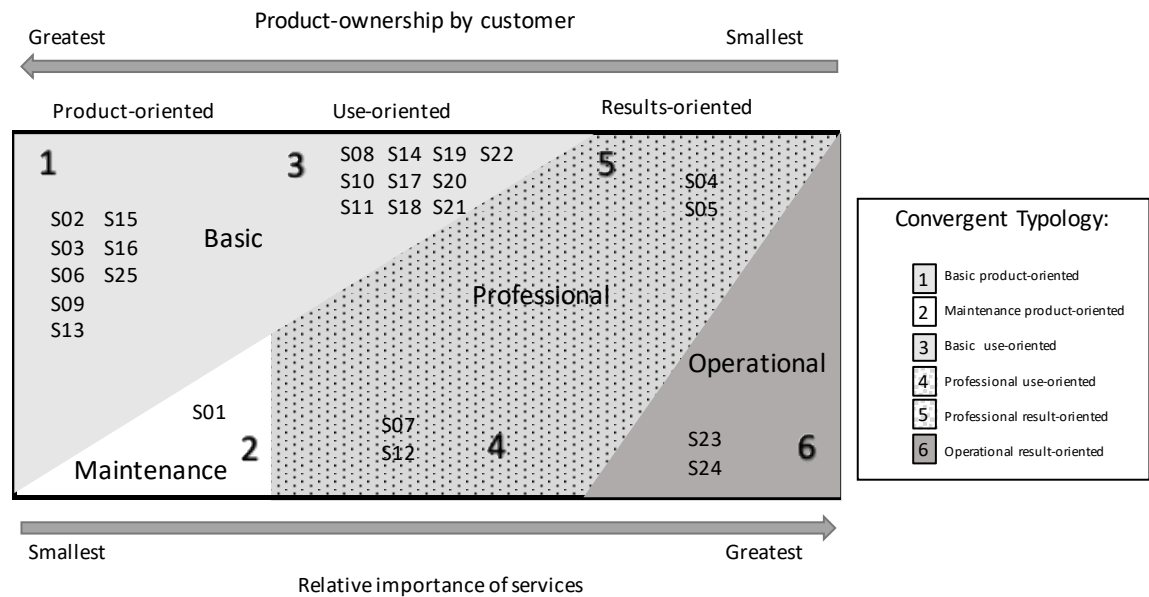
Conceptual framework

Point of interaction/ Purchase point of time		Code/Service Description	Type of service	Orientation
Pre-Purchase	Product Selection	- S14 - Demonstration	Basics	Use
		- S22 - Cost-benefit calculation	Basics	Use
		- S16 - Technical assistance	Basics	Product
		- S19 - Warranties	Basics	Use
		- S24 - Customer Process Operation	Operational	Result
Purchase	Purchasing of the product	- S02- Deliveries and logistics	Basics	Product
		- S18 - Revenues	Basics	Use
		- S20 - Lease of products	Basics	Use
		- S21 - Orders	Basics	Use
		- S08- Customer support	Basics	Use
Purchase or Post-purchase	Instructing how to use the product	- S04 - Training / seminars / lectures	Professional	Result
		- S11 - Help Desk	Basics	Use
		- S16- Technical assistance	Basics	Product
		- S10 - Documentation / information material	Basics	Use
Post-purchase	Installation and/or deployment of the product	- S13 - Installation / commissioning	Basics	Product
		- S16- Technical assistance	Basics	Product
		- S11 - Help Desk	Basics	Use
		- S02 -Deliveries and logistics	Basics	Product
		- S10 - Documentation / information material	Basics	Use
	Product usage	- S05 -Consulting / auditing / advice	Professional	Result
		- S06 - Inspection / Monitoring / Diagnosis	Basics	Product
		- S17 - Recruitment of staff	Basics	Use
	Moving and/or storing the product	- S04 - Training / seminars / lectures	Professional	Result
		- S10 -Documentation / information material	Basics	Use
		- S02 - Deliveries and logistics	Basics	Product
		- S16 -Technical assistance	Basics	Product
		- S11- Help Desk	Basics	Use
	Product Maintenance	- S01 Maintenance	Maintenance	Product
		- S03 - Troubleshooting / problem-solving	Basics	Product
		- S07 - Replacement management	Professional	Use
		- S15 - Supply of utility items/consumption items	Basics	Product
		- S25 Reconditioning	Basics	Product
	Upgrading and/or updating the product	- S09 - Updates and Upgrades	Basics	Product
		- S12 - R&D	Professional	Use
		- S23 - Analysis of manufacturability and viability of products	Operational	Result
		- S16 - Technical assistance	Basics	Product
	Product disposing	- S02 - Deliveries and logistics	Basics	Product
		- S04- Training / seminars / lectures	Professional	Result
		- S10 - Documentation / information material	Basics	Use
		- S16 - Technical assistance	Basics	Product

Source: Authors' elaboration.

Taking into account the service dimensions type of service and their orientation exposed in Table 1, the authors classified the services according to six groups: i) basic product-oriented services; ii) maintenance product-oriented services; iii) basic use-oriented services; iv) professional use-oriented services; v) professional result-oriented services; and vi) operational result-oriented services (Figure 1).

Figure 1
Services classification according to Convergent Typology framework



Source: Authors' elaboration.

The framework exposed in Figure 1 enables visualization of the services offered in a PSS continuum using two dimensions: product-ownership by the customer and relative importance of the services. This framework has some distinguishing features:

- As the company moves from the left side to the right side of a continuum in PSS, the services become more relevant to the company. The dimension “relative importance of the services” can be interpreted as the result of more or less ownership of the product as the company evolves to servitization practices where the tangible products are only accessories or add-ons to the services.
- Basic services have two types of orientation: for products or for use. The theory evidences this since the effort necessary to offer use-oriented services is more

significant, although they are considered basic (Brax & Visintin, 2017). As such, basic use-oriented services are more advanced than product-oriented services but less advanced than professional services user-oriented.

- Product-oriented services require less effort/resource expenditure by the customer (e.g., deliveries and logistics, Installation/commissioning) since the services are designed to focus on the tangible products not being executed by the customer's employees.
- When basic services become use-oriented, they become more susceptible to being evaluated by the customer, the direct user of the services. Thus, these services are positioned more on the right side of the PSS continuum.
- The maintenance services are solely oriented to the product and are on the left side of the PSS continuum.
- Professional services can be less advanced (use-oriented) or more advanced (result-oriented). This differentiation can be understood by the presence of sales efforts (still in pre-purchase) that occur in consulting services, demonstrations, and extra support focused on improving the product performance and their production management.
- Operational result-oriented services are characterized by a higher degree of interactions (relationship) between the PSS provider and its customers. The PSS provider can become the manager of the customer's production process.
- This framework emphasizes an evolution process of the servitization, stratifying the evolution levels that were not perceived in previously studied classifications. Also, it shows that advanced services can be offered even if less advanced services were not offered (e.g., it is possible to offer professional result-oriented services in the purchase phase).

Research methodology

The coffee sector specificities in Brazil outlined in section 2.2 imply significant challenges in this productive chain's servitization. Thus, describing and understanding the servitization process in this sector can be seen as relevant to management's literature. For this purpose, the present research considers two main questions which drove this work:

- RQ1. What are the services related to the product offered by the leading suppliers of inputs in the coffee production chain?
- RQ2. What are the main types of service orientation offered by those suppliers?



These two main questions aim to be appropriately addressed with the methodological design offered in this section.

Research design

Considering the exploratory nature of this research, the use of a case study approach allows more in-depth research (Meredith, 1998) and the documentation of concrete practices, more understanding of the complexity and nature of the studied phenomenon (Voss et al., 2002). This approach is appropriate when particular behavior cannot be manipulated, and the boundaries for the phenomenon of interest and its context are not clear (Yin, 2018). The authors used a qualitative multiple case study. The multiple case study approach enables extracting evidence from more than one unit of analysis, adding depth and breadth to the collected data (Yin, 2018). Following Flick (2006) suggestions, given the exploratory nature of this research, different forms of data collection were used such as an in-depth interviewing method, using a semi-structured interview guide, as data collection instrument. These interviews were used to collect information from those directly or indirectly involved in the servitization process: PSS suppliers, cooperative managers, and organizations/entities that provide technical and financial support to coffee farms. Documentation analysis through institutional websites information, companies' technical documents, and artifacts noticed during the interviews were also used to collect information. Finally, field observations in PSS suppliers' companies were also conducted.

Sample frame

The selection of case companies was critical for the results of this study. A sequential approach was used to choose the case sample. Firstly, to select the primary sector to approach in this study, the coffee sector, an analysis based on the cultural and economic importance for the country was made. Therefore, companies/farms in coffee production were used as cases. In the second stage, two prominent regions in the largest coffee-producing state in Brazil were selected: Zona da Mata (Region 1) and Cerrado (Region 2). Region 1 accounts for 15% of national coffee production and has a



rugged terrain that makes it difficult for machinery to access. Thus, sowing and harvesting are predominantly manual. The properties are small and characterized by family-run enterprises. Producers of this region have opted for trademark registration to identify and distinguish the coffee produced in this region from the others on the market. This trademark registration highlights the artisanal profile of this product for the consumer market. Region 2 accounts for 11% of national coffee production and is characterized by an environment with high mechanization of the farming with a plateau's topography characterized by a flat landform. The properties are of medium and large sizes and are characterized by professionalized management (CONAB, 2018).

Subsequently, based on literature review and websites searches on representative associations in the sector, areas of activity in the coffee sector (which could provide more possibilities of PSS) were selected. A more detailed analysis of companies that offer farming machinery, equipment, and accessories and companies that worked in the coffee sector was conducted. Similarly, companies of farming inputs and fertilizers (an industry in which products have little differentiation and lower added value) were also selected. Based on this analysis, three types of organizations were identified to be used for this paper: PSS suppliers (farming machinery, equipment, and accessories suppliers and farming inputs and fertilizers suppliers), coffee cooperatives (organization run by the people who work for them or owned by the people who use it) and support organizations (organizations that support the coffee agriculture sector).

All the organizations of the three types previously defined and located in the two regions (R1 and R2) were contacted by e-mail or phone to assess their intent to participate in the study (in a total of 25 PSS suppliers were contacted). At the end of this process, 7 PSS suppliers (R1_M1, R1_I2, R1_I3, R2_M1, R2_M2, R2_M3, and R2_I4), three cooperatives (R1_C4, R2_C5, and R2_C6), and one support organization (R2_E7) agreed to participate.

Data collection and data analysis



All interviews were conducted with the company manager or the manager responsible for the service area. In total, the interviews lasted nearly 10 hours of speaking time. A total of 11 interviews were conducted in these three types of organizations.

During the interviews, the authors also collected some printed data, such as event folders, fieldwork days spreadsheets, user manuals, procedures for technical delivery, and sales brochures.

Three research protocols were designed to collect data: one for PSS suppliers, a second for cooperatives, and a third for organizations/entities that provide technical and financial support. Table 2 shows the data collection instruments used and the corresponding objectives.

Table 2
Data collection instruments used and corresponding objectives

Data collection instrument	Object	Objective
Semi-structured interview	PSS suppliers	To understand how services are incorporated into the products portfolio, what PSS levels are offered, and how customer-supplier interaction occurs.
	Cooperatives	To understand how services are incorporated into the products portfolio, what levels of PSS are offered, and how customer-supplier interaction occurs through cooperatives.
	Entities that provide support to the sector	To describe general aspects and peculiarities of the regions that may foster differences in the quantity of the types of services offered.
Field observation	PSS suppliers	To identify the types of products and services that form the PSS, their characteristics, and ways of offering PSS to customers.
Websites, companies' and technical documents	PSS suppliers	To identify the types of products and services that form the PSS, their characteristics, and ways of offering PSS to customers.
	Cooperatives	To understand the peculiarities and forms of operation of cooperatives when acting as a distribution channel of products/services of several suppliers.
	An entity that provides support to the sector	To understand each region's fundamental aspects and collect technical and profiling data for each region.

Source: Authors' elaboration.

To ensure a complete data set, the interview guide was based on the conceptual framework presented in Table 1 and Figure 1, with questions related to the type of service and the aspects related to its offers, such as the description of the service linked to the product, the time and intensity of occurrence, and other more specific aspects. To ensure analytical validity, some interviews were



audio-recorded. However, some interviewees did not allow audio recordings. In such cases, the authors took notes of the relevant points raised during interviews and made a brief after each one. Exchanging e-mails with interviewees to confirm, clarify, and improve the collected data was used to validate the analysis. All data (written-up field notes, interview transcripts, and documents) were condensate, displayed, and analyzed (Miles, Huberman, & Saldanã, 2014). The data followed a thematic and theory-driven analysis. A coding scheme was developed based on the conceptual framework and was used as an input to the coding scheme, informing about essential themes to be included in such a scheme (Namey et al., 2008). This coding scheme was discussed with the research team to reach a consensus on which topics to address with the data collected. Once the structural coding process was completed, the authors conducted a more in-depth analysis of the data analyzing the topics predicted and not predicted by the theoretical framework (Namey et al., 2008).

For each interviewee, this framework allowed the identification of the type of service and the aspects related to its offers, such as the description of the service linked to the product, the moment and intensity of occurrence, and others. The information contained in the websites, technical and business documents, and information obtained from the coffee expert and the regional cooperative that trades coffee were used to enhance the analysis and support data triangulation.

Results

Based on the previous analysis, the data gathered from the fieldwork provided the necessary information to detail the services provided by the companies participating in the study — this data allowed us to classify the services provided according to the proposed conceptual framework presented in section 2.3. The services are described in detail in the following sections (4.1 to 4.4), corresponding to the "Type of services" dimension. Cooperatives were not included in this analysis since they work as resellers of PSS suppliers in the coffee sector. Table 3 gives an overview of the services offered by the companies analyzed in this study and the number of services offered by each category of service.

Table 3

Service offered by the analyzed companies classified according to the conceptual framework

Categorization	Types of services	PSS suppliers							Subtotal	Total
		Region 02 - Cerrado				Region 01 - Zona da Mata				
		Machinery, equipment, and accessories			Farming inputs and fertilizers	Machinery and equipment	Farming inputs and fertilizers			
		R2_M1	R2_M2	R2_M3	R2_I4	R1_M1	R1_I2	R1_I3		
Basic Product-oriented	- Deliveries and logistics	2	1	1	1	1			6	13
	- Troubleshooting / problem-solving								0	
	- Inspection / Monitoring / Diagnosis								0	
	- Updates and Upgrades		1	1		1			3	
	- Installation / commissioning	2	1	1					4	
	- Supply of utility items/consumption items								0	
	- Technical assistance								0	
Basic Use-oriented	- Customer support	1							1	34
	- Documentation / information material		3	1	1	1	1	1	8	
	- Help Desk	1							1	
	- Demonstration	1	2	2	2		1	1	9	
	- Recruitment of staff								0	
	- Revenues	1	2	1	2	1	1	1	9	
	- Warranties								0	
	- Lease of products								0	
	- Orders								0	
	- Cost-benefit calculation	1	1	1	1	1	1		6	
Maintenance Product-oriented	- Maintenance (various)	1	1	3		1			6	6
Professional Use-oriented	- Replacement management		1						1	1
	- R&D								0	
Professional Result-oriented	- Training / seminars / lectures	2	1	1	1	1	1	2	9	13
	- Consulting / auditing / advice	1	1	1	1				4	
Operational Result-oriented	- Analysis of manufacturability and viability of products								0	0
	- Customer Process Operation								0	
Total		13	15	13	9	7	5	5		67

Source: Authors' elaboration.

Basic services

The majority of services delivered by the analyzed organizations are basic services, with the predominance of basic use-oriented services. It is possible to distinguish between the services offered by companies in the two types of industry: Suppliers of agricultural machinery, equipment, and accessories (R1_M1, R2_M1, R2_M2, and R2_M3) and Suppliers of agricultural inputs and fertilizers (R1_I2, R1_I3 and R2_I4). Suppliers of agricultural machinery, equipment, and accessories offer 12 basic product-oriented services, while suppliers of agricultural inputs and fertilizers offer only one such service (deliveries and logistics). This difference can be explained by the fact that suppliers of



agricultural inputs and fertilizers work only in the planning and preparation of soil, planting, and the maintenance of crops through pest control. So, services related to delivery and logistics have high relevance. The supplier companies offer a scheduled delivery service, which avoids improper storage by farms.

Basic use-oriented services are the basic services widely offered by suppliers of agricultural inputs and fertilizers. This is justified because of the intrinsic characteristics of the products, such as low differentiation, low technological input, single-use, that benefit the demand for these kinds of services as a differentiation strategy. Thus, farmers can easily find suppliers of these inputs that do not have significant differentiation in their formula and manufacturing technology. Given this situation, suppliers concentrate their efforts on offering basic use-oriented services that encourage higher customer loyalty.

Maintenance services

Maintenance product-oriented services were found only in suppliers of agricultural machinery, equipment, and accessories. Most maintenance services (e.g., scheduled exchange of parts, preventive maintenance) are performed on machines of higher value and technologically advanced. Maintenance services for smaller machines are usually carried out by mechanical workshops that offer lower price items and a less skilled workforce.

Professional services

Professional results-oriented services were found in both types of companies, almost in the same proportion. All companies investigated carry out training and seminars (individual/group) to explain the appropriate use of the product. These services are not directly related to the product (post-purchase phase), and they can be offered to the customer during the purchase phase. However, given their limitations in providing basic and product-oriented maintenance services, these services can be seen as differentiating factors for suppliers of agricultural inputs and fertilizers.

Professional use-oriented services are scarce in both types of companies. Only one service of this type exists in a company of agricultural machinery, equipment, and accessories (Supplier R2_M2)



that provides a scheduled part replacement system that is reinforced during harvest periods where there is greater use of the product.

Operational Services

The PSS providers participating in this study do not offer any services that fit the classification of operational results-oriented services. Indeed suppliers of agricultural inputs and fertilizers cannot include the provision of these services since services such as analysis of manufacturability and management of the customer's process operation are suitable for companies that manufacture agricultural machinery, equipment, and accessories. On the other hand, these suppliers have not yet contemplated the possibility of offering these services.

Discussion and Conclusions

This study aimed to understand and identify the typology of services offered in the primary sector based on its orientation, moment when it can be offered, and the group of services it belongs to. This paper was based on the analysis of PSS relationships existing in the supplier-customer dyad in two relevant regions of coffee sector production in the country. For this purpose, considering the opportunities of services offered in the pre-purchase, purchase, and after-purchase stages, the study developed a conceptual framework to classify the services offered in the primary sector. This framework seeks to integrate three recognized models present in the literature studied.

Additionally, this paper proposes an additional framework that enables the classification of services according to a range of categories within a continuum from basic products-oriented services to operational results-oriented services. The Convergent Typology (Figure 1) should be used to evaluate the services offered. In particular, this typology was used to assess the suppliers of agricultural inputs and fertilizers that have not yet been considered in studies on servitization. This study also showed that when advances in servitization are made, the importance of product ownership is reduced, and the importance of services is highlighted. This paper also intends to stimulate discussion on servitization in the primary sector, which is scarcely explored in the literature.



The majority of services delivered by the companies participating in this study are basic services. This fact diverges from that reported by Parida et al. (2014) for the manufacturing sector, whose services are mainly based on maintenance services. However, we should consider that the business-to-business relationship prevails in the primary sector, in which aspects related to the product are generally overcome by those related to the relationship between the parties (Bastl et al., 2012). However, this study also concluded that similarities exist between the PSS in manufacturing and the suppliers of machinery, equipment, and agricultural inputs and fertilizers in the coffee plantation farmers. The services offered and how the customers are assisted are similar to the manufacturing sector since the offer is product-oriented.

The findings of the research show some disagreements with the theory about the transition in the service offering continuum in service-oriented firms (PSS continuum) proposed by Oliva & Kallenberg (2003):

- The findings show that the provision of less advanced services in the PSS continuum is not a necessary condition for the firm to be more servitized. That is, the company can offer more advanced services without necessarily offering also less advanced services. This fact is evident when observing that all the companies surveyed offered at least one service termed as professional, which also occurred in companies R1_I2 and R1_I3, which did not offer maintenance (Maintenance Services in the typology of Oliva & Kallenberg (2003)).
- The findings also revealed that some of the services categorized by Oliva & Kallenberg (2003) as professional and oriented to the end-user process might occur in stages before the purchase of the product (e.g., R2_I4, R1_I2 and R1_I3) For some suppliers, the pre-purchased services are decisive for the purchase accomplishment and to the consolidation of the relationship with the customer.

The results of this paper have an important as a meaningful impact on agribusiness managers. The results show servitization practices used in coffee farming and also discussed some possibilities for differentiation through servitization. Furthermore, the authors believe that the frameworks presented will support managers in identifying opportunities for service offerings that best suit their business.



Although the positive impact of these results, this study also presents some limitations. The small number of companies that agreed to participate in this study and the area they belong to can be considered a limitation of the study. More companies in other agriculture areas may complete and enlarge the results of this study.

The article identified the services in the Servitization process along three dimensions: point of interaction/purchase point of time, type of service, and orientation. Although the three dimensions were appropriate to address the Servitization process in the coffee sector, the literature review uncovers other dimensions not explored in this framework.

The installed customer base and related data are the main features that support the servitization. Therefore, the provider needs to collect and manage data related to services, products, processes, and data related to the use of the product by the customers to support the development of a broad knowledge of the technical system involved. In this context, the growing opportunities offered by new technologies, such as the Internet of Things and Big Data, can drive the journey of transformation towards servitization (Adrodegari & Saccani, 2017).

The impact Precision Agriculture tools adoption in this coffee sector is expected to be relevant and challenging the servitization process. Thus, the authors suggest exploring the servitization practices related to "precision farming" or "smart farming" to analyze its viability in the coffee plantation context. These studies could identify which services should be maintained, modified, or introduced using new technologies from the 4.0 Industry. Finally, to enrich the findings of this study, a quantitative approach to assess service offerings in the primary sector, namely in the agriculture area, is recommended.

References

Adrodegari, F., & Saccani, N. (2017). Business models for the service transformation of industrial firms. *Service Industries Journal*, 37(1), 57–83.

<https://doi.org/10.1080/02642069.2017.1289514>



- Auler, D. P., Teixeira, R., & Nardi, V. (2017). Food safety as a field in supply chain management studies: a systematic literature review. *International Food and Agribusiness Management Review*, 20(1), 99–112. <https://doi.org/10.22434/IFAMR2016.0003>
- Baines, T., & W. Lightfoot, H. (2013). Servitization of the manufacturing firm. *International Journal of Operations & Production Management*, 34(1), 2–35. <https://doi.org/10.1108/IJOPM-02-2012-0086>
- Bara, J. G. (2015). *Conhecendo os valores pessoais do produtor rural de café na compra de insumos agrícolas*. Universidade de São Paulo.
- Bastl, M., Johnson, M., Lightfoot, H., & Evans, S. (2012). Buyer-supplier relationships in a servitized environment. *International Journal of Operations & Production Management*, 32(6), 650–675. <https://doi.org/10.1108/01443571211230916>
- Bettencourt, L. A. (2010). *Service Innovation: How to go from customer needs to breakthrough services*. McGraw Hill.
- Brax, S. A., & Visintin, F. (2017). Meta-model of servitization: The integrative profiling approach. *Industrial Marketing Management*, 60, 17–32. <https://doi.org/10.1016/j.indmarman.2016.04.014>
- Chase, R. B. (1981). The customer contact approach to services: theoretical bases and practical extensions. *Operations Research*, 29(4), 698–706.
- Christensen, C. M., Anthony, S. D., Berstell, G., & Nitterhouse, D. (2007). Finding the Right Job For Your Product. *MIT Sloan Management Review*, 48(3), 38–47.



- CONAB. (2018). 2º Levantamento da Safra de Café de 2018 - maio 2018. In *Acompanhamento da safra brasileira de café* (Vol. 5, Issue 1). <https://doi.org/ISSN 2318-6852>
- CONAB. (2020). Acompanhamento da safra brasileira 2019/2020. *Acompanhamento Da Safra Brasileira de Grãos 2019/2020*, 6(3), 1–29. <https://www.conab.gov.br/info-agro/safras>
- Costa, C. H. G., Teixeira, F., & Junior, L. G. de C. (2012). Análise da viabilidade econômico-financeira da cafeicultura : um estudo nas principais regiões produtoras de café do Brasil. *ABCustos Associação Brasileira de Custos*, VII(1), 21.
- de Oliveira, G. M., & Zylbersztajn, D. (2017). Determinants of Outsourcing Contracts in Agricultural Mechanization Services: the Brazilian Coffee Agribusiness Case. *Proceedings in System Dynamics and Innovation in Food Networks 2017*, 33788–391. <https://doi.org/10.18461/pfsd.2017.1739>
- Dimache, A., & Roche, T. (2013). A decision methodology to support servitisation of manufacturing. *International Journal of Operations & Production Management*, 33(11/12), 1435–1457. <https://doi.org/10.1108/IJOPM-07-2010-0186>
- Falk, M., & Peng, F. (2013). The increasing service intensity of European manufacturing. *Service Industries Journal*, 33(15–16), 1686–1706. <https://doi.org/10.1080/02642069.2011.639872>
- Ferraz, J. C., Kupfer, D., & Haguenauer, L. (1995). *Made in Brazil: Desafios competitivos para a indústria* (1st ed.). Editora Campus.
- Flick, U. (2006). *An Introduction to qualitative Research* (3rd ed.). SAGE Publications.

Gebauer, H. (2008). Identifying service strategies in product manufacturing companies by exploring environment–strategy configurations. *Industrial Marketing Management*, 37(3), 278–291.

<https://doi.org/10.1016/j.indmarman.2007.05.018>

Hakanen, T., Helander, N., & Valkokari, K. (2017). Servitization in global business-to-business distribution: The central activities of manufacturers. *Industrial Marketing Management*, 63, 167–178. <https://doi.org/10.1016/j.indmarman.2016.10.011>

Harwood, J. L., Heifner, R. G., Coble, K. H., Perry, J. E., & Somwaru, A. (1999). Managing Risk in Farming: Concepts, Research, and Analysis. In *Agricultural Economics Report* (Vol. 774, Issue 1). Agricultural Economic Report No. 774. <https://doi.org/10.22004/ag.econ.34081>

Hou, J., & Neely, A. (2013). Barriers of Servitization- Results of a Systematic Literature Review. *Spring Servitization Conference, Aston Business School*, 1–8. papers3://publication/uuid/30EC5B66-E9C6-440D-A139-9F071E901811

John Deere. (2019). “Telematics” [Online]. <https://www.deere.com/en/electronic-solutions/%0Atelematics/>

Kaňovská, L., & Tomášková, E. (2018). *Agris on-line Papers in Economics and Informatics Drivers for Smart Servitization in Manufacturing Companies*. X(3), 57–68. <https://doi.org/10.7160/aol.2018.100305.Introduction>

Kohtamaki, M., Hakala, H., Partanen, J., Parida, V., & Wincent, J. (2015). The performance impact of industrial services and service orientation on manufacturing companies. *Journal of Service Theory and Practice*, 25(4), 463–485. <https://doi.org/10.1108/JSTP-12-2013-0288>



- Kowalkowski, C., Gebauer, H., & Oliva, R. (2017). Service growth in product firms: Past, present, and future. *Industrial Marketing Management*, 60, 82–88.
<https://doi.org/10.1016/j.indmarman.2016.10.015>
- Lenka, S., Parida, V., Sjödin, D. R., & Wincent, J. (2018). Towards a multi-level servitization framework: Conceptualizing ambivalence in manufacturing firms. *International Journal of Operations and Production Management*, 38(3), 810–827. <https://doi.org/10.1108/IJOPM-09-2016-0542>
- Lightfoot, H., Baines, T., & Smart, P. (2013). The servitization of manufacturing. *International Journal of Operations & Production Management*, 33(11/12), 1408–1434.
<https://doi.org/10.1108/IJOPM-07-2010-0196>
- Martín-Peña, M. L., & Bigdeli, A. Z. (2016). Servitization: Academic research and business practice. *Universia Business Review*, 2016(49), 18–31.
- Matiello, J. B. (1991). *O café: do cultivo ao consumo*. Editora Globo.
- Meredith, J. (1998). Building operations management theory through case and field research. *Journal of Operations Management*, 16, 441–454.
- Mont, O. . (2002). Clarifying the concept of product–service system. *Journal of Cleaner Production*, 10(3), 237–245. [https://doi.org/10.1016/S0959-6526\(01\)00039-7](https://doi.org/10.1016/S0959-6526(01)00039-7)
- Morelli, N. (2003). Product-service systems, a perspective shift for designers: A case study: the design of a telecentre. *Design Studies*, 24(1), 73–99. [https://doi.org/10.1016/S0142-694X\(02\)00029-](https://doi.org/10.1016/S0142-694X(02)00029-)

Namey, E., Guest, G., Thairu, L., & Johnson, L. (2008). Data reduction techniques for large qualitative data sets. In G. Guest & K. M. Macqueen (Eds.), *Handbook for team-based qualitative research* (pp. 137–161). Altamira Press.

Oda, E.; Marques, C. F., Oda, C., & Marques, É. (2008). *Gestão das Funções Organizacionais* (2nd ed.). IESDE BRASIL SA.

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160–172.

<https://doi.org/10.1108/09564230310474138>

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*, 83(October 2018), 207–223.

<https://doi.org/10.1016/j.indmarman.2019.03.015>

Reim, W., Parida, V., & Örtqvist, D. (2015). Product–Service Systems (PSS) business models and tactics – a systematic literature review. *Journal of Cleaner Production*, 97, 61–75.

<https://doi.org/10.1016/j.jclepro.2014.07.003>

Rodrigues, D., Teixeira, R., & Shockley, J. (2019). Inspection agency monitoring of food safety in an emerging economy: A multilevel analysis of Brazil’s beef production industry. *International Journal of Production Economics*, 214, 1–16. <https://doi.org/10.1016/j.ijpe.2019.03.024>



- Rollo, M. A. P. (2009). *As novas dinâmicas do território brasileiro no período técnico-científico-informacional: o circuito espacial de produção do café e o respectivo círculo de cooperação no sul de Minas.*
- Saccani, N., Visintin, F., & Rapaccini, M. (2014). Investigating the linkages between service types and supplier relationships in servitized environments. *International Journal of Production Economics*, 149, 226–238. <https://doi.org/10.1016/j.ijpe.2013.10.001>
- Saes, M. S. M., & Silveira, R. L. F. da. (2014). Novas formas de organização nas cadeias agropecuárias brasileiras: tendências recentes. *Estud. Soc. e Agric.*, 22(2), 386–407.
- Tukker, A. (2004). Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment*, 13(4), 246–260. <https://doi.org/10.1002/bse.414>
- Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding services. *European Management Journal*, 6(4), 314–324.
- Vidickiene, D., & Gedminaite-Raudone, Z. (2019). Servitization as A Tool to Increase Vitality of Ageing Rural Community. *European Countryside*, 11(1), 85–97. <https://doi.org/10.2478/euco-2019-0006>
- Visnjic Kastalli, I., Van Looy, B., Kastalli, I. V., Van Looy, B., Visnjic Kastalli, I., & Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management*, 31(4), 169–180. <https://doi.org/10.1016/j.jom.2013.02.001>



Volsi, B., Telles, T. S., Caldarelli, C. E., & Camara, M. R. G. da. (2019). The dynamics of coffee production in Brazil. *PLOS ONE*, 14(7), e0219742.

<https://doi.org/10.1371/journal.pone.0219742>

Voss, C., Tsikriktsis, N., & Frohlich, M. (2002). Case research in operations management. *International Journal of Operations & Production Management*, 22(2), 195–219.

<https://doi.org/10.1108/01443570210414329>

Yan, B., Yan, C., Ke, C., & Tan, X. (2016). Information sharing in supply chain of agricultural products based on the Internet of Things. *Industrial Management & Data Systems*, 116(7), 1397–1416.

<https://doi.org/10.1108/IMDS-12-2015-0512>

Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). SAGE Publications.

Zhang, W., & Banerji, S. (2017). Challenges of servitization: A systematic literature review. *Industrial Marketing Management*, 65(March), 217–227.

<https://doi.org/10.1016/j.indmarman.2017.06.003>