

# **Dilemmas and Strategies of Digital Servitization: A Multiple Case Comparative Study**

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## **Abstract**

Both servitization and digitization are mainstream types of business model innovation. In recent years, there have been an increasing number of studies integrating these two research topics to develop a series of research on digital servitization. Facing the impact of the COVID-19 pandemic, the development of digital servitization capabilities in the manufacturing industry can help companies provide smart product-service systems (PSSs) to address uncertainties and shocks in the external environment. This study aims to explore "the dilemmas and response strategies of digital servitization" using a qualitative multiple case study comparative analysis. Through in-depth interviews, we identified the difficulties and bottlenecks that small and medium-sized manufacturing enterprises (SMEs) may encounter in the process of digital servitization and proposed corresponding response strategies. The results of this study contribute to the literature on digital servitization by accumulating and extending upon existing research.

**JEL classification numbers:** C83, M15, O31.

**Keywords:** Small and medium-sized manufacturing enterprises, Digital servitization, Multiple case studies, Action research.

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## 1. Introduction

Small and medium-sized enterprises (SMEs) are the epitome of an ‘economic miracle’, and because they possess the flexibility required to adjust to and enter markets, their contribution to economic growth is evident to all. Nowadays, the competition among SMEs is undeniably fierce due to the accession to the World Trade Organization, internationalization, and globalization. Nevertheless, the change of the global economic structure has led to unprecedented changes and challenges for SMEs in Taiwan. Moreover, facing environmental changes and the devastation of the pandemic, SMEs, which account for nearly 98.93% of all enterprises in Taiwan, have been particularly affected. In response, the industries and academia have suggested pursuing digital transformation or transitioning to a servitization business model to improve their business resilience.

The concept of servitization was first proposed by Vandermerwe and Rada (1988), and emphasizes the concepts of customer-focus and service bundling, and often incorporates technological elements (Rabetino et al., 2018) to shape strategies, processes, and structures. For example, the adoption of technologies such as the Internet of Things (IoT) or artificial intelligence analysis can fully contribute to the development of delivery services (Holler, Tsiatsis, and Mulligan, 2017; Ardolino et al., 2018) as well as the development of new service-oriented business models (Adrodegari and Saccani, 2017), and can even reshape the competitive landscape of the industry (Porter and Heppelmann, 2014). The manufacturing and service industries are becoming more and more intertwined. In the past, servitization and digital technology were usually discussed separately. The integration of these two themes into the topic of digital servitization is a recent and now mainstream research trend (Kowalkowski et al., 2013; Bustinza, et al., 2018; Grubic and Jennions, 2018) that highlights the importance and value of in-depth exploration, which is one of the motivations of this study.

Previous literature has extensively discussed servitization capability, e.g., Parida et al. (2015), Gebauer et al. (2017), Hasselblatt et al. (2018), and Jovanovic et al. (2019). It is evident that empirical studies have been conducted on the capability of manufacturing servitization, and those on digital servitization continue to emerge, e.g., Lenka et al. (2017), Hasselblatt et al. (2018), and Huikkola et al. (2020). There are some researchers who claim that manufacturing organizations that offer services should be embedded within high-level network systems (Raddats et al., 2019). However, studies discussing digital servitization from a B2B perspective are relatively scarce (Paschou et al., 2020; Gebauer et al., 2021). Thus, exploring digital servitization capability from such a perspective is an important and worthy focus of research. That is the second motivation of this study.

Based on the aforementioned background research, research motivations, and theoretical foundations of digital servitization, this study focuses on the following issues:

- a. Exploring the connotations, analytical framework, and models of digital servitization through literature and relevant theories;
- b. Analyzing the possible dilemmas that may be encountered in digital servitization through multiple case studies;
- c. Proposing response strategies based on the above possible dilemmas of digital servitization;
- d. Proposing recommendations to academia and the industry based on the above findings.

## **2. Literature Review**

### **2.1 Digital servitization**

Servitization is commonly defined by international researchers using the terms "servitization" or "servicization." Although there are differences in the concept, the basic ideas remain the same. The content, nature, characteristics, and role of servitization have been described in terms of its evolutionary process as well as its dynamics, the role of enterprises, internal efficiency, and their relationship and functions, respectively. Apart from the differences in the focus of these studies, these studies all emphasize that manufacturing companies should sell the functions and services of their products, rather than the products alone, and that they must go through a specific development process from product-based to service-based sales. Digital servitization not only adds digital elements, but also emphasizes the collaboration between digital elements, services, and products. In addition, service delivery emphasizes cross-company network collaboration (Frey et al., 2019; Marx et al., 2020). In this view, digital servitization emphasizes that the value creation of systems in an organization must interact positively with suppliers and customers, and collaborate and compete in a complex relationship (Kohtamäki and Rajala, 2016).

### **2.2 Digital servitization capability**

To further explore digital servitization, it is necessary to develop a conceptual framework of capability, including dynamic capability (Lütjen et al., 2019; Linde et al., 2021), operational capability (Gebauer et al., 2017), and strategic capability (Huikkola and Kohtamäki, 2017). There have been many previous studies that have developed the analytical framework of servitization through inductive reasoning, e.g., Raddats, Burton, and Ashman (2015), Hasselblatt et al. (2018), and Jovanovic et al. (2019).

Münch et al. (2022) analyzed digital servitization capability using the socio-technical systems theory and proposed the analytical framework shown in Table 1, which provided a valuable reference for subsequent research. In this study, we will take into consideration their analytical framework to conduct qualitative research.

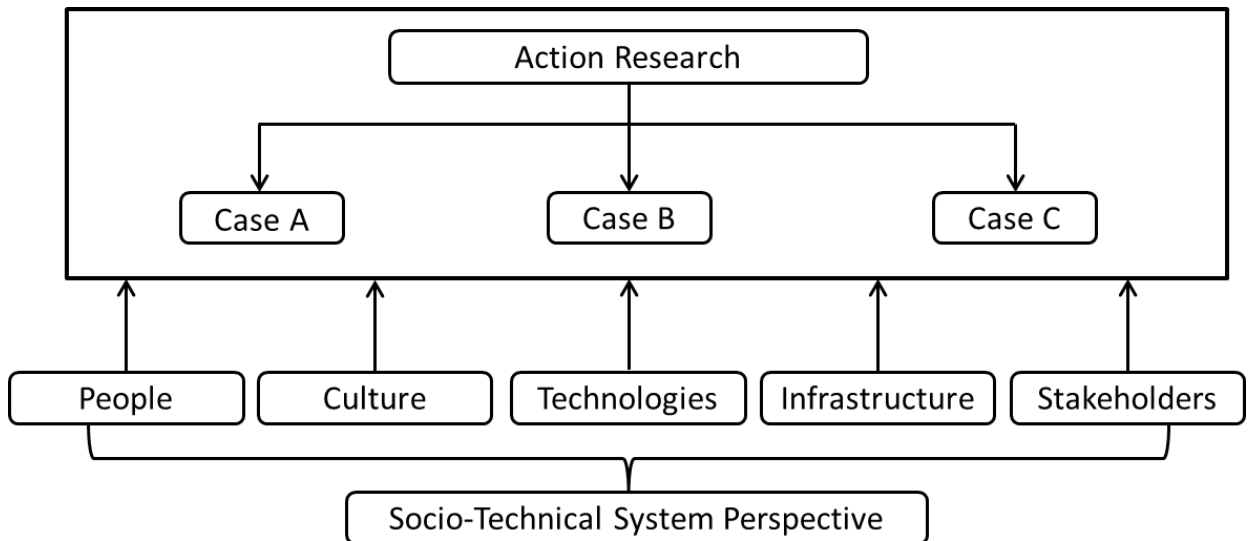
**Table 1: Analysis of digital servitization capability using the socio-technical systems theory**

<b>Socio-technical systems framework</b>	<b>Digital servitization capability</b>
Goals	Key performance indicator (KPI) logic, target system, bonus system, management commitment.
People	Knowledge and skills building, employee training, cross-functional teams, open mindset, digital affinity, competence shift, employee involvement.
Culture	Agility, error culture, open innovation, customer feedback consideration, customer-oriented value, generation alignment, internal communication.
Technologies	Data analytics tools, digital platform, industrial IoT integration, contract management tools.
Infrastructure	Leveraging existing resources, open workspaces, geographical customer proximity.
Processes	Continuous improvement, cost focus, risk management, vendor managed inventory, customer management, data monetization, machinery fleet management, service-oriented pricing and billing, aftermarket, continuous change management.
Stakeholders	Lead user involvement, new customer segments, new key partners, best practice sharing.
Financial/economic circumstances	Pre-financing, machinery operator, shareholder commitment.
Regulatory frameworks	Data security, data ownership, warranty.

Data source: Münch et al. (2022); summarized by this study.

### **3. Analysis of digital servitization dilemmas**

At this stage, we conducted action research with three SMEs in Taiwan, for a duration of six months, four times a week and with each session being two hours long. The interviewees were the heads of the three SMEs, and in-depth interviews and feedback discussions were conducted in accordance with the interview plan. After review, reflection, and repeated confirmation, the results were summarized into the "Analysis of Case Study Backgrounds and Digital Servitization Dilemmas," as described below.



**Figure 1: Research framework**

### **3.1 Introduction to Case A and an analysis of the digital servitization dilemmas**

#### **a. Company profile**

The company was founded in 1977 and initially engaged in the production of baby products. In recent years, the production line has expanded to include kitchenware, tableware, and daily necessities. In addition to operating its own brand, it also accepts OEM and ODM projects. Ging Yee aims to provide the best service and quality in accordance with customer demands, managing the entire production process, including decals, mold-making, prototypes, injection molding, heat transfer printing, screen printing, packaging, and exportation. Through customer marketing channels, the products are delivered to users all over the world.

#### **b. Analysis of the digital servitization dilemmas**

In recent years, due to fierce competition from third-world countries (mainly mainland China and Southeast Asian countries) with poor quality and counterfeit products, the company's profitability and order intake have shrunk slightly compared to previous years.

This is due to the following factors:

1. The serious issue of aging in the primary-level workforce and a general lack of interest in the manufacturing industry among younger newcomers.
2. The fierce competition from third-world countries (mainly mainland China and Southeast Asian countries) with poor quality and counterfeit products has led to a slight decrease in profitability and order intake compared to previous years.
3. The declining birthrate has caused a shrinkage in the market for baby/infant products, which originally accounted for a large proportion of the company's sales.

4. The high cost of setting up online trading platforms and disproportionately high shipping fees for home delivery.
5. The business-to-consumer (B2C) model via online platforms has failed to meet customers' expectations as it doesn't provide the option to trial products.

### **3.2 Introduction to Case B and an analysis of the digital servitization dilemmas**

#### **a. Company profile**

The company was established in 1991 and is engaged in the production of aluminum extrusion products. Currently, the company's products include various aluminum tubes, aluminum rails, aluminum strips, heat sinks, gardening equipment, furniture hardware, optoelectronic products, mechanical products, and bicycles. The company has three extrusion production lines, various processing machines such as saw tables, stamping presses, and milling machines, as well as a production team consisting of dozens of experienced practitioners.

#### **b. Analysis of the digital servitization dilemmas**

1. Recruitment is difficult in the traditional manufacturing industry due to the work environment and working hours.
2. A decrease in willingness to work overtime and shifts has led to a decline in productivity.
3. Since the raw materials are purchased from external sources, the company is reluctant to accept a large volume of orders.
4. The products are produced in an OEM model and so added value cannot be increased.
5. The turnover and profit of SMEs are limited, making it difficult to improve their research and development capabilities.

### **3.3 Introduction to Case C and an analysis of the digital servitization dilemmas**

#### **a. Company profile**

The company was established in 2005 and began production in July 2006. It specializes in the production and manufacturing of aluminum extrusions. Currently, the company produces various aluminum alloys including the 1000 series, 2000 series, 6000 series, and 7000 series. In addition to having advanced industrial extrusion machines, the production team also includes several experienced practitioners.

#### **b. Analysis of the digital servitization dilemmas**

1. Local employees are difficult to recruit, and migrant workers are restricted by quotas, making the recruitment process difficult.
2. The "one fixed day off and one flexible rest day" policy from the amended Labor Standards Act has caused serious problems for the company. Employees cannot work overtime, resulting in a decrease in productivity.
3. The company's production capacity is limited, and so it is reluctant to accept a

- large volume of orders.
4. Since the products are mostly made to order, the company cannot develop Industry 4.0 production systems.
  5. Lack of a sense of responsibility among employees.
  6. The products are produced in an OEM model and so added value cannot be increased.
  7. The only way to increase the added value of products is to improve the R&D capability.

#### **4. Analysis of digital servitization strategies**

Based on the problems identified in the case studies, this study proposes strategies for digital servitization, which are explained through the three case studies.

##### **4.1 Analysis of digital servitization strategies for Case A**

According to the results of the survey and the analysis, Case A has weaknesses in market demand insights, product prototype testing, and marketing promotion.

The recommended future development paths are as follows:

At the individual level, the focus should be on emphasizing the importance of key individuals and developing individual creativity. At the team level, it is necessary to strengthen effective team building, encourage greater participation of all personnel in innovation, and encourage extensive communication. At the organizational level, a flexible organizational structure should be established, along with a creative work climate, and a learning organization. Consultation and communication should be conducted with stakeholders to formulate innovative strategies, including identifying innovation capabilities and resources, as well as the significance of innovation to the company, each division, or each unit. Innovation guidelines should be established that are separate from daily operations, and focus should be placed on product, service, process, organizational, and/or operational model innovation. Collaboration strategies should also be considered, which involve conceptualizing ideas and collaborating with third-party partnerships. Fortunately, in recent years the founder of the company has been dedicated to developing a customer relation management system and developing digitalization, thereby enhancing marketing promotions and customer insight. At the same time, service quality is being further improved. Nevertheless, the company should consider the introduction of an innovation system on top of its existing foundations.

##### **4.2 Analysis of digital servitization strategies for Case B**

According to the results of the survey and the analysis, Case B has weaknesses in creative ideation, digital strategy development, and marketing promotion.

The recommended future development paths are as follows:

The recognition of senior management towards investment in innovative management resources should be emphasized. To meet the needs of the innovation management system, employees must develop appropriate capabilities and exhibit

key behaviors in response to specific job functions. Key behaviors refer to the key areas in which employees must perform at a certain level in order to demonstrate superior performance in their given role. The key areas and behaviors will vary depending on the role.

It is recommended that the company focus on the following development paths:

- a. Develop market-oriented marketing strategies.
- b. Use big data analysis and collaborate with relevant industry manufacturers to develop a Health Cloud system.
- c. Develop a customer relationship management (CRM) system to further develop a consumer base.
- d. Enhance customer satisfaction and loyalty by upgrading hardware and software equipment, and thereby develop brand power.

### **4.3 Analysis of digital servitization strategies for Case C**

According to the results of the survey and the analysis, Case C has weaknesses in creative ideation and marketing promotion.

The recommended future development paths are as follows:

In the communication process, it is necessary to coordinate both top down and bottom up to ensure that members of different levels of the company can fully communicate to form a consensus. In addition, after each department or individual achieves their goals and KPIs, the company should design a variety of reward and incentive mechanisms to strengthen the internal and external motivations for innovation among employees. Most importantly, their required and expected results must be identified. In this way, the company can communicate about and promote its innovation management system. In addition to continuing the aforementioned internal and external communication and promotional activities, the company should also develop internal and external cooperation strategies, promoting internal cooperation to enable ideas and knowledge to be shared among employees, teams, and work units.

## **5. Conclusions and Recommendations**

Many researchers have suggested that as digital technology continues to develop and progress, most studies are still focused on the technological aspects (Golinelli et al., 2020), but technology itself cannot provide value; value is created by the collective use of technology (Guarcello and de Vargas, 2020).

This study has come to the following important conclusions:

### **5.1 Conclusions**

Digital servitization must provide sufficient incentives to motivate internal innovation, which already has a certain foundation and level of depth in the company. At this stage, companies must find ways to elevate the level of innovativeness among their employees, not relying solely on external incentives for motivation. Rather, they must find ways to inspire their employees' intrinsic



motivation for innovative management. While rewards can encourage more people to contribute ideas, the average number of ideas tends to decrease, though their quality improves. This is the "motivation crowding-out effect," meaning that external incentives weaken intrinsic motivation. However, this effect does not account for the reduction in the number of ideas per employee. The real problem lies in structuring incentives to create a focus on proposing better ideas. External incentives and penalties are ineffective for creative, conceptual work or innovation. In fact, they may even weaken intrinsic motivation. In order to achieve greater innovation capabilities, companies require more than just incentives to raise external motivation for innovation. Instead, they need to encourage and fully achieve intrinsic motivation to realize their organizational innovation capabilities. At the individual level, the focus should be on emphasizing the importance of key individuals and developing individual creativity. At the team level, it is necessary to strengthen effective team building, encourage high participation of employees in innovation, and encourage extensive communication. At the organizational level, a flexible organizational structure should be established, along with a creative work climate and a learning organization.

Innovation comes from combining the interests of stakeholders, effectively collecting and screening ideas, and developing and integrating ideas with the company's strategy, to create a preliminary operational concept. These concepts must be developed into a service blueprint that can be further designed to serve customers. Using pioneer users to trial the service and collecting and analyzing actual data can provide feedback that guides the adjustment of service blueprints and the establishment of indicators of service standards. The establishment of subsequent business models involves changes in the job content and interactions between departments such as engineering, marketing, sales, and finance. Many tasks must be adjusted accordingly. The innovation process, service quality, and financial risks of the company are all different from the past, and so the company must change and manage organizational innovation. Wealthy companies generally lack awareness and sensitivity to the external and internal issues that affect their innovation management systems, and so they must strengthen their outside-in and inside-out analytical skills.

## **5.2 Recommendations**

This study has analyzed digital servitization capability taking reference from Münch et al. (2022) socio-technical systems framework. Based on the analytical framework in Table 1, this study has analyzed three case studies of the difficulties facing three SMEs and offered response strategies. Subsequent researchers could conduct qualitative research and discuss more case studies in depth using the analytical framework of this study, or extend the framework by integrating the five organizational capabilities of digital transformation proposed by Konopik et al. (2022). Furthermore, subsequent research could use Münch et al. (2022) socio-technical systems framework and integrate the five dimensions of digital

transformation (i.e., leadership, strategy and business ecosystems, digital technology and data management, organizational design and processes, and business operations and innovation), to conduct quantitative analysis and build an empirical research model for digital servitization capability.

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