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**BUILDING SERVITIZATION STRATEGY FOR AN  
INDUSTRIAL COMPANY: THE EXAMPLE OF ICI  
CALDAIE S.P.A.**

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## **Abstract**

This thesis aims at studying the implementation of the digital servitization paradigm as a new development strategy in industrial manufacturing companies. To do so, the author conducted an in-depth analysis of an Italian industrial company, ICI Caldaie S.p.A., a producer of industrial boilers and heating systems. The thesis describes the internal and external analyses the company's managers put in place to assess whether digital servitization represent the proper development strategy for the firm. Once this has been assured, the study describes how ICI Caldaie identified and selected the digital services to be included in its value proposition, starting from the customers' needs and interest. Finally, the thesis provides an evaluation of the resources and competencies required for the design, development and implementation of the digital services identified, thus offering the firm a strategic path for its future development.

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# Introduction

This thesis embarks on an exploratory journey into the transformative world of digital servitization within the industrial boiler manufacturing sector, with a keen focus on the case of ICI Caldaie S.p.A., a prominent player in this market in Italy, whose case description aims at deepening the knowledge about this new economic trend in the industrial manufacturing sector and, specifically, in the market for thermal solutions.

The advent of digital technologies has ushered in a new era where traditional product-centric businesses are increasingly integrating services into their offerings, thereby not only enhancing value but also forging closer relationships with customers. This transition, known as digital servitization represents a strategic shift that promises opportunities for growth, innovation, and competitive differentiation in many different manufacturing sector contexts, including the thermal solutions market. In this context, in fact, energy efficiency is increasingly becoming the key index that drives customers to purchase (Paschou et al., 2017). The physical characteristics of the product (the boiler) and its price are no longer the only parameters on which the customer bases its assessment and purchase decision, rather, the maximization of the performance and the possibility of obtaining customized solutions based on the needs of the individual customer become essential elements. This is even more critical for industrial clients: the manufacturer that wants to deploy digital servitization should develop the new value proposition considering that clients are in turn businesses with specific exigencies and interest and whose primary goal is to ensure the continuous uptime of their activities and processes (Rymaszewska et al., 2017). Thus, considering the long lifespan of industrial boilers, industrial clients are interested not only in a higher quality of the physical assets but also and more importantly in a continuous support throughout the products' lifecycle, guaranteeing their constant functioning and, thus, the industrial client's operations and activities' continuity. In this scenario, a strategy that can fulfill the specific customers' requirements and, at the same time, generate a competitive advantage for the industrial manufacturing companies that implement it is digital servitization. It is defined as transformation of manufacturing firms from selling products to providing integrated product-service solutions enabled by digital technologies. This transformation involves



the incorporation of digital technologies, such as IoT (Internet of Things), data analytics, and cloud computing, to enhance service offerings and create new business models focused on delivering value-added services alongside traditional products (Coreynen et al., 2017). From the industrial customer perspective, this innovative approach enhances customer value by providing personalized services and support that are tailored to specific needs and usage patterns (Baines et al., 2017). From a manufacturer's viewpoint, digital servitization enables them to enhance their offerings, streamline operations, build stronger customer relationships, and remain competitive in an increasingly digital and data-driven marketplace (Kohtamäki et al., 2019). However, to reap the benefits just described the implementation of the new economic trend of digital servitization requires an overall company's transformation: new skills, capabilities, resources, activities, operations, and cultural mindset are needed, ultimately leading to a reconfiguration in the manufacturers' business model (BM). This transformative process unfolds over time, following an evolutionary approach and requiring time and high commitment for a successful implementation. In the manufacturing of industrial boilers in Italy, this transition to digital servitization is made even more complex by the fact that such a strategy is new and lacks examples of companies that have effectively implemented and that can be used as a virtuous example and, therefore, as a guideline.

Accordingly, this thesis aims at presenting the case of ICI Caldaie S.p.A. that successfully embark on the digital servitization transition. In particular, the thesis has the primary goal of showing and describing the analyses, investigations, and procedures the firm undertook to ultimately arrive at defining what are the most appropriate digital services it should include in its value proposition to best satisfy its' industrial customers' needs and how it must modify its BM accordingly, to support the new offerings development and delivery.

To achieve the thesis goal, first, a comprehensive literature review on the digital servitization topic has been performed, allowing to lay the foundational understanding of this phenomenon. In particular, Chapter 1 presents the analysis of the extant literature: the chapter delves into the essence of digital servitization providing a comprehensive definition; it defines the role of digital technologies as enablers for the provision of advanced product-service systems (PSSs) and solutions; it presents an overview of the opportunities and risks of this economic trend; it presents the different categories of PSSs manufacturers can implement and add in their value proposition; it defines the dynamics

of transitioning to and implementing of a digital servitization BM; and, finally, it describes successful business cases in the industrial manufacturing sector that can represent empirical guidelines for the effective deployment of the digital servitization paradigm.

Considering the transformative nature of digital servitization, its implementation requires a preliminary investigation to assess whether the firm finds itself in the appropriate condition to deploy it successfully. Accordingly, Chapter 2 and Chapter 3 are dedicated to the analysis of the external and internal context in which the selected case – ICI Caldaie S.p.A. – operates, with the aim of ensuring the existence of a good and proper background for digital servitization. Specifically, Chapter 2 focuses on a comprehensive analysis of the industrial boiler manufacturing sector, particularly within the context of the broader industrial equipment manufacturing market in Italy. In Chapter 3, the narrative narrows down to an internal analysis of ICI Caldaie S.p.A., offering a meticulous overview of the company's history, current strategy, business structure, and operations. The analysis includes a thorough examination of ICI Caldaie's existing business model *as-is* and contextual analysis through SWOT and Porter's Five Forces frameworks, aiming at unearthing insights into the company's internal and external environments and at understanding whether digital servitization represents the right strategy for the company's innovation and growth.

In the last chapter (Chapter 4), the thesis deeply investigates how ICI Caldaie S.p.A. undertake and implement the digital servitization paradigm. Specifically, Chapter 4 explores the digital servitization goals and strategies envisioned by ICI Caldaie S.p.A. Then, the chapter describes the process of identification of the new digital services into the firm's value proposition, which entails the involvement of key customers through a dedicated survey to detect and examines their needs and interests and, thus, to select the most appropriate digital service offerings. The analysis also details how these new digital services will enhance the overall value, providing customers with greater efficiency, reliability, and cost savings. Following the overall internal transformation caused by digital servitization, the chapter proceeds with the analysis of the BM *to-be* of ICI Caldaie S.p.A., describing in detail what are the changes that the firm needs to carry out in each of the nine areas of the BM canvas. Once the strategic goal and the structure of the BM target are defined, the final section of the chapter is focused on the assessment of the

readiness of ICI Caldaie S.p.A. to adopt the digital servitization paradigm. This assessment includes an evaluation of the company's current capabilities, resources, and competences in relation to the requirements of digital servitization. This investigation examines the extent to which the company is prepared for the implementation of the three newly identified digital services and culminates with the realization of a matrix for the comparison of the necessary resources and competences for new digital services and those already owned by ICI Caldaie S.p.A. This comparative evaluation allows to assess how ready the company is for the implementation of new services and what resources need to be developed for an effective development of the new digital services. The results of the analysis represent for the firm a starting point for the development of a strategic plan for the full and successful implementation of digital servitization.

Overall, the purpose of this thesis is to bridge the gap between theory and practice in the field of digital servitization, offering valuable insights for researchers and practitioners on how manufacturing firms in industrial context can undertake the transformation towards digital servitization.

# Chapter 1. Literature review

## 1.1 Overview of the Servitization phenomena

In the present scenario, strongly influenced by globalization and rising competition, companies constantly look for innovative ways of doing business, adopting differentiating strategies. In these economic circumstances, a phenomenon has recently started paving the way for reshaping firms' competitiveness. This is defined as "servitization": a transformation process from being pure-product companies to the provision of integrated customer-centered boundless of product and services systems, offering clients personalized solutions (Vandermerwe and Rada, 1998; Frank et al., 2019).

The phenomenon of servitization, originally identified by Vandermerwe and Rada in 1998, spread out both in academic studies and in the practical fields in the last years (Paschou et al., 2020). Moreover, the recent COVID-19 pandemic has entailed a major alteration in the global economy, accelerating the transition towards this emerging economic paradigm that leverages the service strategy to improve efficiency, gain competitive advantage, strengthen the position in the market, differentiate from competitors and build closer and long-term relationships with customers. The servitization trend, indeed, meets the increasing demand of personalized solutions able to satisfy specific needs: customers look for reliable partners to help them in optimizing the use of their equipment, in supplying maintenance services, in providing support in the event of anomalies, and sharing updates on the products' status and usage condition, as well as recommendations to improve their performance. By providing a complete and personalized solution, servitization is one of the most effective strategies to address this requirement and, thus, transform firms' relationship with customers from a simple transactional process to a more reliable and long-lasting partnership by establishing a partnership throughout the entire product lifecycle. Organizations can experience profound shifts in their functioning and ability to provide value-added services to customers by integrating digital technologies and new business models. Enterprises can adopt various technologies, including big data, mobile devices, and social media. These

technologies enable micro-, small-, and medium-sized enterprises to achieve significant business improvements, such as enhancing the customer experience, streamlining operations, and creating innovative business models (Martínez-Peláez et al., 2023).

Hence, manufacturers, that usually built their business only on physical products, are now changing their approach, providing the market a new offer, increasingly emphasizing services and, thus, providing a complete solution of integrated products and services: this is why this transformation is known as ‘servitization’.

### **1.1.1 Digital servitization: digital technologies as enablers for the service transition**

Even though companies are showing a growing interest around this topic, they are frequently hesitant to embrace this change: this could be attributed to the significant shift required for transitioning from product manufacturing to delivering service-centric offerings. Such a transformation requires a comprehensive overhaul of both organizational structure and operational processes, adapting existing activities, capabilities, and resources (Kraus et al., 2021).

The introduction and implementation of digital technologies in manufacturers’ products and processes – defined as ‘digitalization’ – are emerging as effective enabler for supporting this challenging transition towards servitized business models (Chirumalla et al., 2023). In the last decades, with the advent of the Forth Industrial Revolution (i.e., Industry 4.0 – I4.0), technological discoveries brought several opportunities for reconfiguring companies’ business model by utilizing new digital technologies (Kraus et al. 2021). These can be exploited to find novel ways of creating, delivering, and capturing value, as well as to generate knowledge from field data, improve the firm's operational and environmental performances, and gain a competitive advantage (Aström et al., 2022).

Among the several digital discoveries, different I4.0 technologies have been classified and include internet of things (IoT), artificial intelligence (AI), digital twins, blockchain, additive manufacturing, big data and analytics, cloud computing, cyber security, mixed reality (virtual and augmented reality). The implementation of these digital technologies shifts the attention of the firm and its supply chain towards customers (Gray et al., 2013).

In fact, manufacturers can take advantage of the potentialities related to the introduction of these technologies, following the paradigm of digitalization, to no longer provide combinations of traditional products and basic services to their customers, but to be able to supply smart integrated solutions that include advanced smart services (Gebauer et al., 2020). Indeed, the utilization of digital technologies has the potential to significantly enhance the process of servitization by facilitating the development of advanced and innovative service offerings personalized to specific customer's needs (e.g., Eloranta & Turunen, 2016). This explains why more and more companies from various industries are incorporating performance monitoring sensors into their products, using diagnostic technologies (e.g., IoT) and analyzing big data, to remotely monitor the technical condition of production assets and prevent failures: thanks to the constant products' insights gathered through advanced digital technologies, manufacturing companies are able to monitor physical product usage and status and plan timely intervention, thus providing the required solution on the clock. This is made possible through the remote collection of field data on the equipment and their analysis in real time, so that providers constantly know how the physical good works, how it behaves in any given situation, when it fails and which components have to be constantly monitored, without waiting for scheduled inspection, thus diagnosing in advance anomalies and failure, and scheduling the delivery of spare parts or the intervention of technicians, without waiting for abnormal situations (Agarwal et al., 2022).

Indeed, product-centric companies introduce digital technologies to increase service delivery efficiency and the value of product-service offerings, while simultaneously changing processes and business models to guarantee the successful transition towards the new servitization paradigm (Candell & Söderholm, 2009; Lerch & Gotsch, 2015).

This combination of the two phenomena of servitization and digitalization is defined as "digital servitization": this has been conceptualized as the development of new services and/or the improvement of existing ones made smart and intelligent using digital technologies (Paschou et al., 2020). Specifically, according to Allmendinger & Lombreglia (2005), the term 'digital servitization' is associated with:

- a) a change in the nature of service offerings that become digital and 'smart';
- b) shifts in the organization's business models;

- c) the development of new strategic assets and the generation of competitive advantages, mostly due to the exploitation of data and information;
- d) the launch, monitoring, and control of initiatives aimed at achieving a more sustainable business, such as cleaner production methods.

This approach to business activities has gained popularity thanks to the current market conditions and the changes in consumers' requirements and behavior. In fact, as mentioned before, customers today are no longer satisfied with just buying a product, but they increasingly look for complete solutions to their challenges and needs. Using a digital servitization strategy helps companies in creating transparency, deeper integration, engagement and collaboration between a firm and its clients, entailing long-term relationships (Kamp et al., 2022; Taylor et al., 2020).

## 1.2 Opportunities of digital servitization

As underlined in the previous paragraph, in the era of the digital revolution, companies are striving to improve customer service in a modern way, to create innovative and convenient solutions personalized to the needs of the customer. In this perspective, digital service offerings open several opportunities for both manufacturers and consumers.

### **Companies' opportunities**

The digital servitization transition and the consequent adaptation in business models can involve several benefits for companies that decide to embark on the transformation.

These are manifold and encompass various aspects of a company's operations, such as:

*1. Competitive advantage:* the provision of digital services next to physical products allows companies to stand out from their competitors and position themselves as leaders in the industry. Clients of such companies increasingly appreciate not only the product itself, but also the whole experience of using it guaranteed by the associated services, which are easy to order and obtain, as all it takes is access to the network. Indeed, digital

servitization makes it possible to create for the customer a fast and affordable integrated solution that meets their needs and requirements. This integrative, complete and personalized approach (many convenient options that can be selected remotely) makes the company's products and services perceived as a unique experience, that, of course, attracts clients: by offering a specific solution to each customer, according to its specific needs, the company can significantly expand its client base and become a leader in its service market segment (Robinson et al., 2019, Weingärtner, 2018).

2. *Increased customer satisfaction*: digital servitization allows companies to understand more deeply the needs of customers and offer solutions that fully meet their expectations. For such purpose, the company implements big data analytics and, in general, advanced digital technologies in its activities, which allows to understand which products are more in demand and their actual usage and status. Having a constantly updated knowledge on customers' habits entails the creation of a personalized and integrated solutions, leading to increased customer satisfaction and trust. This approach not only achieves the greatest customer satisfaction, but also optimizes its costs through more conscious production (Wunderlich et al., 2013).

3. *Customer retention and loyalty*: by offering additional services to its customers, the company can strengthen the bond with them and increase their loyalty: when customers receive quality and modern(!) customized services along the entire asset duration, they feel a closer connection with their supplier, which contributes to customer retention on a long-term basis. By ensuring a long-lasting partnership, digital servitization increases customers' loyalty as it symbolizes convenience, development, and new technologies; thus, creating sustainability for the business and providing additional opportunities for the company to grow (Weinman, 2016).

4. *Development of long-term relationships with customers*: companies that rely on digital servitization often become partners with their customers, not just suppliers of goods, establishing a relational approach rather than a transactional one, going beyond the single purchase moment. This approach helps strengthen the bond between the company and the customer and increases the likelihood of continued cooperation in the future (Raddats et al., 2019).

5. *Additional and regular source of income*: providing different service packages can be an additional source of revenue for a company. Instead of relying only on the sale of goods, the company can offer periodical services related to the product and according to



its actual status for a fee. Specifically, using digital tools to collect real-time field data gives manufacturers the possibility to create different service packages targeted at different consumer segments and need (Grubic, 2018). Those services and solutions are not offered on a one-time transaction as happens with simple products, but are provided throughout the long-term asset lifecycle, guaranteeing a regular and periodic monetization and profit acquisition based on intangible offerings in the long run (Kohtamäki et al., 2020).

6. *Innovation and development*: the use of servitization requires the company to think innovatively and constantly develop its services: it must constantly monitor changes in the market and customer needs to adapt and offer new services. Using continuous data on its products and their operation, as well as feedback from customers, the company can adjust its commercial offer to make it more suitable and interesting for its customer category. This approach keeps the company ahead of the competition and ensures long-term business development (Eloranta & Turunen, 2016). With constant analytics, the company will eventually find the most suitable niche for its digital products and become the most serious actor in its segment.

### **Customers' opportunities**

Apart from positive development for businesses, the provision of digital services generates benefits also from the customers' side.

1. *Increased transparency*: digital servitization improves transparency and availability of data for customers, allowing them to make more informed decisions and use the vendor's services more effectively. Indeed, to offer services, manufacturers, need to collect field data and to share them with customers to ensure the proper offering is supplied. By having access to updated information, customers can learn about any aspect of a product they are interested usually through a digital platform or app, without having to request information each time from a manager or support team. It is the customer who either mentally or physically uses the offering in their context for value creation (Holmqvist et al., 2020).

2. *Increased interaction*: a big advantage for customers is the variety of feedback they can give to the company. With the advent of digital communication channels,

customers can get answers to their queries even faster and, for example, solve problems with their purchases - the speed of interaction with the salesperson is attractive and makes the customer feel important and needed. This increased interaction between the customer and the company contributes to establish a deep communication that, in turn, favor the high quality of service and allows customers to feel comfortable using the service or product (Fan et al., 2020).

3. *Optimization*: customers both in the business-to-business (B2B) and the business-to-customer (B2C) sectors are supplied with a personalized offering and, thus, an optimize user experience. Moreover, in the former case, digitalized services support the customer's business in optimizing costs and increasing business process efficiency, for example by preventing anomalies in equipment operations, reducing energy consumption, as well as prioritizing and optimizing equipment maintenance and planning. Instead of thinking in terms of how customers can be involved in the provider's activities, the interest should be in "*how customers prefer to involve providers in their lives or business activities*" (Heinonen and Strandvik, 2018, p. 12).

### **Sustainability opportunities of digital servitization**

Beyond the opportunities for business development and customers, other advantages related to the digital servitization strategy can be identified considering the broader perspective of long-term sustainability. Service solutions, in fact, include elements that support and improve environmental, economic, and social aspects of sustainability. Below a brief description of how servitization promotes sustainability in its three dimensions is provided.

1. *Economic feasibility*: this refers to the opportunities to gain revenues and profits through service solutions selling, creating value for providers, positively impacting on the financial and cash flow in the company; to the required investments to successfully deal with the transformation and to the changes in balance sheets it results in. In B2C contexts, digital service solutions can lead to increased utility, by lowering overall products' life-cycle costs, since the need to invest in a tangible product, such as a car, is eliminated. For example, members of carsharing organizations pay only the membership fee and the direct costs of using the car (euro/km traveled), which are often much lower than the cost of owning a car on a cost-effectiveness basis. However, many of the services

offered are quite expensive, and sometimes it makes more economic sense to own the product than to buy the service. This may change once there are many more service providers and service offerings on the market, which may lower the price (Bressanelli et al., 2018).

2. *Eco-friendliness*: the environmental validity of service offerings can be created through innovation in products or services, or both. Some service solutions treat tangible products as capital assets rather than consumables, so their long-term design increases the amount/volume of value-added services they can produce/provide, and thus resource use is reduced per unit of service provided. Moreover, service is a mean to connect production and consumer chains in a more integrated way, allowing to maintain physical goods in use for their entire lifecycle, assuring their correct functioning thanks to supportive services (Lindström et al., 2018).

3. *Social consequences*: the social impacts of digital service strategies can be divided into two levels: macro- and micro-impacts.

Macro-impacts include social and ethical qualities, impact on job creation, impact on the institution of ownership in society, and ultimately on well-being and quality of life. As an example, Integrated Pest Management (proper use of pests according to actual soil needs as recorded in real time by sensors installed in the ground) was developed through a collaborative effort between scientists, entomologists, agronomists, and pest control specialists. IPM leads to reduced environmental impact and reduced use of toxic chemicals, and this leads to better working conditions and health as workers are exposed to chemicals to a lesser extent (Georgakopoulos & Jayaraman, 2016).

On the other hand, micro-impacts are the consequences of service decisions in terms of customer acceptance and the level of satisfaction in individual customers. Social justice is an important feature of servitization because instead of relying on the large capital investment needed to buy material goods, service relies on monthly fees for services that can be provided by people from lower social classes.

### 1.3 Risks of digital servitization

Next to the above-described advantages of using digital servitization strategies in business models for companies, customers and the society, there are also some risks associated with the implementation of the digital servitization transition.

Digital servitization required a general change in the culture and in the organizational structure of the company to successfully implement a servitization strategy. Companies must be willing to make the necessary adaptations in their business model, redesign their processes, and fully commit themselves to providing high-quality services; otherwise, this business strategy will be doomed to failure.

If we break down this risk into its various components, we can distinguish the following:

1. *Financial risks*: the introduction of digital servitization may require significant investments for the introduction of advanced digital technologies, the development of new services, the training of personnel, and the creation of the necessary infrastructure. Companies must be prepared for the possible costs in the initial period before they see positive financial results from servitization (Gebauer et al., 2020).

In addition, companies must also consider the changes in the revenue model. As described before, instead of a one-time sale of goods, a company is transitioning to a long-term relationship with customers through the provision of services. In some cases, this can lead to revenue instability, especially in the initial period – actual profits may be significantly lower than expected (some customers may leave, unforeseen costs may arise). Such situation will last until the company establishes sustainable relationships with clients and launches paid services.

2. *Organizational risks*: the company must change its organizational culture to emphasize service delivery and customer satisfaction. This may require staff training and changes in internal processes so that the company is ready to provide high-quality digital services. In addition, integrating digital services into an existing business model may require changes in the company's organizational structure: for example, it may be necessary to create a new department or team responsible for providing and managing

services. This may require time and resources to properly implement it (Gebauer et al., 2020).

3. *Quality management risks*: the company must ensure the consistency of the digital services offered and control their quality to meet customer needs. To do so, companies may require changes in processes and systems and a level of expertise and skill in the staff to ensure a high level of digital service. In addition, the company must be prepared for the risk of customer dissatisfaction: if customers do not receive the expected level of service, it can negatively affect the company's reputation and lead to the loss of customers (Chávez et al., 2023).

4. *Associated risks*: the use of digital servitization in business also entails a number of accompanying risks. For example, the company may face changes in the market or in the requirements of clients, which will require adaptation of the digital services provided. This may require additional investments and changes in the company's business model. Accordingly, any external changes and reactions may provoke volatility in the business model and require additional costs to improve the services provided.

In addition, the adoption of digital servitization can increase the complexity of managing the business: the company must be able to effectively coordinate and integrate various aspects of service delivery, from marketing and sales to delivery and support. Managing all these aspects can be a challenge, especially for companies with no previous experience in service operations (Chávez et al., 2023).

5. *Technological risks*: the introduction of new digital services may require changes in production processes, logistics and information management. Companies should be prepared to invest in the development of advanced technologies and systems that can provide a high level of service, otherwise customers will not appreciate it and will prefer competitors (Chávez et al., 2023).

The identification of these potential risks associated to servitization is important to make companies that intend to approach this change aware and prepared to tackle the transformation, thus giving them the opportunity to grow and compete successfully in the marketplace by efficiently offering integrated solutions to their customers.

## 1.4 The concept and the different types of Product-Service Systems (PSSs)

As described before, the use of digital technologies, by supporting the servitization transition, enable companies transform their business adopting a digital servitization strategy, resulting in the provision of the so-called digital *product-service systems* (PSSs).

A PSS can be defined as consisting of ‘*tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs*’ (Tischner et al., 2002, p. 2). Many academics consider PSS as an excellent vehicle to enhance competitiveness and to foster sustainability simultaneously. As supported by Tukker (2004), PSSs can indeed:

- fulfil client needs in an integrated and customized way, hence allowing clients to concentrate on core activities;
- build unique relationships with clients, enhancing customer loyalty, and
- promote and entail innovation faster since firms take track and hence satisfy their client needs better.

According to the manufacturer’s core business and structure, PSSs can assume different forms with different peculiarities. The most diffused categorization in literature is provided by Tukker (2004), who identified three main PSSs archetypes:

- Product-oriented PSSs;
- Use-oriented PSSs;
- Result-oriented PSSs.

Each category itself includes subcategories with quite different economic characteristics. Below a short description of each PSS archetype and its subcategories is provided.

*Product-oriented PSSs* are value propositions still based on the physical products but enriched with some extra basic services. These services include the installation of the asset, the supply of spare parts and consumables or the advice and consultancy activity

through which providers offer advice on the most efficient use of the product. Product-oriented PSSs can be divided into:

- *Product-related services*, that include services that ensure the continuous and proper functioning of a product. Examples of these type of services are regular inspections, repairs, and maintenance performed by the provider to extend the life and functionality of the product;

- *Advice and consultancy*, when company provides customer support, warranties, installation, and training after the sale of the product to ensure customers can effectively use and maintain the product.

The second main category is *use-oriented PSSs*. Here, the traditional physical product still plays a central role, but the business model is not geared towards selling products. The product stays in the ownership of the provider and is made available to the customers in a different form, sometimes being characterized by a sharing mechanism among several users (Tukker, 2003). This type of PSSs includes three subcategories:

- *Product lease*, where the manufacturer owns the product and, instead of selling it, it provides the customer with the opportunity to use it for a period for a regular, pre-determined fee;
- *Product rent or sharing* is the case where the customer does not have unlimited access to the product, but may use it for a limited period, paying for the effective utilization in a pay-per-hour mechanism;
- *Product pooling* which differs from rental for the simultaneous use of the product by multiple customers. It is the practice of meeting the demand for several different products with a single, 'one-size-fits-all' product that can meet the needs of all customers. For example, Apple recently replaced dedicated models of its iPhone on the Verizon and AT&T networks with a single model containing a universal cellular radio capable of operating on either network.

The last category is *result-oriented PSSs*. In this scenario, the client and provider essentially reach a mutual agreement upon the level of performance or the outcome that the provider has to supply (Tukker, 2004,). Hence, there is no predefined product or service involved. Among the result-oriented PSSs, we can find:

- *Activity management/outsourcing* is a technique of hiring a third party outside the company for a specific task. These tasks usually include providing a service or creating goods. When done correctly, outsourcing can help businesses grow, without compromising product quality. It was first acknowledged as a corporate strategy in 1989. Later, in the 1990s, it developed into a crucial aspect of the company. Business process outsourcing was first used only by manufacturing companies, but today it is adopted in almost all businesses (Tukker, Tischner, 2006).

- *Pay per service unit*, for which the PSS still has a common product as a basis, but the user no longer buys the product, but only its performance. Thus, the customer can only use a certain function of the product without having to pay for its full use, as in the case of a *product lease* (Tukker, 2004). Well known examples in this category include the pay-per-print formulas now adopted by most copier producers: the copier producer takes over all activities that are needed to keep a copying function in an office available (i.e., paper and toner supply, maintenance, repair, and replacement of the copier when appropriate).

- *Functional result*. Here, the provider negotiates with the client to deliver a predetermined result. In contrast to the *activity management/outsourcing*, this category refers to a functional result that is not directly linked to the use of a specific technological system. The supplier is, in principle, completely free to choose how to deliver the result. Typical examples of this form of PSS are companies that provide a given ‘pleasant climate’ in offices, rather than specific gas or refrigeration equipment; or companies promising farmers minimal harvest losses, rather than selling pesticides (Tukker, 2004). The provider consistently enjoys a certain degree of autonomy in meeting the genuine ultimate requirement of the client. Nevertheless, translating abstract requests into tangible indicators of quality performance can often pose challenges, making it hard for providers to ascertain what exactly they need to deliver and causing clients to struggle in evaluating whether their demands have been met.

The *Table 1* below provide a synthesis of the different PSSs archetypes described above.

PSS archetype	Service	Focus	Ownership of the product	Value
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<b>Product-oriented PSSs</b>	Product-related service	Physical product	Customer	Product sales
	Advice and consultancy	Physical product	Customer	1) Selling not only the product but also basic services. 2) Selling only services to a certain product
<b>Use-oriented PSSs</b>	Product lease	Availability	Company	Use of the product without purchase
	Product renting/sharing	Availability & functionality of the product	Company	Shared use of the product between supplier and customer
	Product pooling	Availability of the product	Company	Use of a versatile product (perhaps the most expensive in its category) by different types of customers and supplier
<b>Result-oriented PSSs</b>	Activity management	Performance	Customer	delegating activities to an external provider
	Pay per service unit	Specific function	Company	Receiving certain services without purchasing a product
	Functional result	Performance	Customer	Obtaining an optimum result

Table 1. Types of Product-service systems. Source: Personal elaboration of the author.

The different categories of PSSs require different implementation approach. With this table, we can clearly trace the differences in the ‘tangibility’ of the services provided to the client, as well as the variety of service plans that the customer can get, based on client’s goals and needs. However, beyond the specificities of each offering, there are few general characteristics that qualify PSS solutions and, hence, digital service business models:

1) *Solution customization*: the provision of PSSs leads to a shift from standardization to customization of offerings. Solution customization refers to the value created by adapting a product, service, and software solution to customer needs. The solutions offered by manufacturing companies differ according to their level of customization, and the characteristics of products, services and software can be customized, modularized, or standardized (which is offered separately at different pricing models). Solution customization plays an important role in creating the value provided and the performance of the business model (Mattissens and Vandenbempt, 2010).

2) *Solution pricing*: digital servitization also implies a change in the revenue’s mechanisms, that reflect the characteristics of the value proposition. The price logic, hence, takes into consideration the different components of the solution: product, service or software offering. According to the PSSs type, the revenue mechanism can be associated to a product, agreement, availability, or a performance/outcome (Huikkola & Kohtamäki, 2018).

3) *Digitalization of solutions* – the exploitation of digitalization for the realization of advanced and personalized offerings implies a reconfiguration in the value proposition from pure physical goods to integrated digital solutions. Since the early days of servitization, digital measurements or software have been considered central to the business model. (Porter & Heppelmann, 2015): data and insights collected through digitalization allow to optimize product usage, guaranteeing the functioning and preventing failure thanks to remote monitoring and predictive and preventive services.

## 1.5 Transition to and implementation of digital servitization business models

The different configurations of PSSs identified above and applied in different contexts all aim to create a customer-centric lens using digital tools to give emphasis to customers' experience, providing personalized solutions that fulfill their specific demands and needs (Solem et al., 2022; Forkmann et al., 2017; Sjödin et al., 2016). These various PSSs typologies can be explained by the different needs of customers and the variety of possible solutions to these needs or even a combination of different solutions (Tukker, 2004).

To result in the supply of advanced PSSs, the transformative process of digital servitization must consider not only a change in the value proposition – resulting in PSSs –, but also a general reconfiguration of companies' business models and way of doing business, requiring an adaptation in processes, activities, capabilities, resources, and firms' culture (Paiola & Gebauer, 2020). Considering the conceptualization of business model provided by Teece (2010) who identified three major business model dimensions – value creation, value delivery and value capture – the adoption of digital servitization requires a configuration in at least one of these components, making it fundamental along the transformative process to understand which dimensions are involved in the corporate change in order to successfully implement digitalization and to move from pure product offering to integrated, smart PSSs.

Thus, for moving from the existing business model structure to a new one, companies define new characteristics of the three major components and subsequently develop the right changes. However, this transformation process is not an easy task: it is necessary to consider all aspects of the business model future configuration and compare them with the current business model structure so as to deeply understand what the adaptations are required in each component to ensure the achievement of high efficiency and good performances (Demil & Lecocq, 2010). Hence, the assessment of the new business model together with the previous one is necessary to maintain a coherence among the three business model components along the entire digital servitization transformative journey.

As a multidimensional construct that may ultimately results in different PSSs offerings, digital servitization entails multiple business model configurations that lead to various

optimal outcomes (Sjödin et al., 2019), according to the context in which a company operates and the clients' requests. Thus, each manufacturer carries out changes and reconfigurations that best adapt to its business activities and goals, depending on the context in which it operates and the market it caters to. In literature, several digitally servitized business models are examined. Among these, the following digitally servitized business model configurations are identified:

**1. Subscription-based services<sup>1</sup>.** In this model, customers sign up for a subscription plan that offers access to a product or service for a specific period, such as monthly, quarterly, or annually. This can include access to software, online content, streaming services, digital media, curated products, and more (Tzuo & Weisert, 2018). The concept of subscriptions has been widely adopted across various industries, including software, media, e-commerce, healthcare, and more, and this kind of business model has been growing on a quantitative basis in the last years. For example, the emergence of Netflix providing unlimited video streaming services in the 2000s shed new light on the subscription-based business model as the number of Netflix subscribers globally increased from 2.61 million in 2004 to more than 180 million as of the first quarter of 2020<sup>2</sup>.

The attractiveness of the subscription-based model lies in its ability to create predictable revenue streams, foster customer loyalty, and enable long-term relationships with users. Companies benefit from the recurring revenue, which can be more stable and predictable compared to the one-time sales that characterize physical products. For consumers, the subscription model offers convenience, cost predictability, and ongoing access to products or services without the need for repeated purchasing decisions. It often provides a sense of value through bundled offerings, exclusive content, discounts, and personalized experiences.

Companies utilizing this model need to focus on delivering consistent value to subscribers to keep them engaged and willing to continue their subscription. This may involve regularly updating and enhancing the product or service, providing excellent customer support, and understanding the evolving needs and preferences of subscribers.

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<sup>1</sup> <https://www.paddle.com/resources/subscription-business-model>

<sup>2</sup> <https://www.nets.eu/perspectives/Pages/Whitepaper-Subscription-economy-business-perspective.aspx>

Subscription-based configurations come in various forms, catering to different industries and customer needs:

- *Streaming services*: services like Netflix, Hulu, and Spotify offer subscription-based access to a vast library of movies, TV shows, music, and podcasts for a monthly fee. These platforms provide on-demand entertainment content without the need for individual purchases or rentals (Carroni, Paolini, 2020);
- *Software as a Service (SaaS)*<sup>3</sup>: subscriptions provide access to cloud-based software applications on a pay-as-you-go (also pay-as-you-run) basis. This is a pay-per-use model for cloud services. When a user needs a particular cloud service, they pay for it with an electronic payment and get access. The payment period is usually monthly, semi-annual, or annual. Examples include Microsoft Office 365, Adobe Creative Cloud, and Salesforce, which offer productivity tools, design software, and customer relationship management systems through subscription models;
- *Food services*<sup>4</sup>: subscription-based meal kit services such as Blue Apron and HelloFresh offer pre-portioned ingredients and recipes delivered to customers' doorsteps on a weekly or monthly basis;
- *Subscription-Box Services*<sup>5</sup>: these services deliver multiple products to subscribers on a recurring basis, often customized to their preferences. Such boxes with products are usually shipped on a monthly basis;
- *Health and Wellness*<sup>6</sup>: subscription-based fitness apps and platforms provide workout programs, classes, and personalized training for a monthly fee. Additionally, subscription services offer access to meditation apps, health coaching, and nutritional guidance.

These types of subscription-based services showcase the diverse range of offerings that utilize a subscription model to deliver ongoing value and convenience to consumers (Vendrell-Herrero et al., 2017).

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<sup>3</sup> <https://www.oracle.com/applications/what-is-saas/>

<sup>4</sup> <https://foodondemand.com/09202023/a-look-at-delivery-subscription-services-across-the-world/>

<sup>5</sup> <https://www.chargebee.com/resources/guides/subscription-box-business-models/>

<sup>6</sup> <https://www.purchasely.com/blog/health-wellness-app-monetization>

**2. Pay-per-use model.** This business model configuration, also known as usage-based pricing, is a business approach where customers are charged based on their actual usage of a product or service. This model is commonly employed in various industries, including telecommunications, cloud computing, utilities, and transportation. In a pay-per-use model, customers are billed for the specific amount of service they consume, whether it's data storage, minutes of voice calls, miles driven, or any other measurable unit. This approach is advantageous for both consumers and providers, as it allows for flexibility and cost control. Providers benefit from the pay-per-use model as they can attract customers who have varying levels of consumption, and they can scale their revenues based on actual usage (Baines et al., 2009a, Baines et al., 2009b; Vandermerwe and Rada, 1989). This approach can also incentivize customers to be more mindful of their usage and encourages efficiency. On the consumer side, this model allows for flexibility, as customers only pay for what they use and this can be particularly appealing for those who have fluctuating needs and don't want to commit to fixed monthly subscriptions or contracts (Gebauer et al., 2017). Beyond these benefits, for guaranteeing the correct functioning of this business model configuration it is extremely important for providers to implement transparent and understandable pricing structures, as well as clear mechanisms for tracking and billing usage.

Also, for the pay-per-use configuration, several business model typologies can be distinguished:

- *Cloud Computing*: in the realm of cloud services, customers are charged based on the resources they consume, such as computing power, storage, and network bandwidth;
- *Ride-Sharing and Mobility*: services such as Uber operate on a pay-per-use model, where customers pay for each ride based on factors such as distance, time, and demand;
- *Utility Services*: traditional utility services such as electricity, water, and gas often employ a pay-per-use billing structure. Customers are billed based on the amount of utility consumed during a specific billing period, allowing them to pay for exactly what they use;
- *Print and Copy Services*: pay-per-use models are prevalent in print and copy services, particularly in shared office spaces and commercial printing environments. Customers

are charged for each page printed or copied, with costs determined by factors such as color, size, and quantity;

- *Equipment and Machinery Rentals*: businesses often offer equipment and machinery rentals on a pay-per-use basis, allowing customers to utilize assets for specific durations and pay only for the time or quantity of usage.

**3. Freemium model.** The freemium model is commonly used in the software, gaming, and digital content industries. Companies typically offer a limited version of their product for free, with the option to upgrade to a paid subscription for access to more advanced features, enhanced functionality, or additional content. This model can help attract a large user base and convert some users into paying customers. Companies can also gather data on user behavior and preferences, which can inform their product development and marketing strategies. Thus, it is a model that can be effective for user acquisition and retention, as it allows users to experience the product before committing to a purchase (Reime, 2011).

Such model has different configurations:

- *Software and Apps*: Many software applications and mobile apps utilize a freemium model, offering a basic version with limited features or advertisements at no cost. Users can then upgrade to a premium version to access advanced features, remove ads, or unlock additional content;
- *Gaming*: This configuration is common also in the gaming industry, where games are offered for free with the option to purchase in-game items, upgrades, or expansions;
- *Content Platforms*: Media and content platforms, such as streaming services and news websites, often offer freemium models, providing free access to a limited selection of content, with the option for users to subscribe or pay for premium content, ad-free experiences, or exclusive features;
- *Cloud Storage*: Some cloud storage providers offer a freemium model, providing a certain amount of free storage space with the option to upgrade to a premium plan for additional storage capacity and advanced features.

These types of freemium models demonstrate how companies leverage the strategy of providing a free offering to attract users while monetizing through premium upgrades or additional services. This approach aligns with the concept of digital servitization, as it focuses on delivering value-added services and experiences to customers<sup>7</sup>.

**4. Platform-based model.** This configuration involves creating a digital or physical infrastructure that enables interactions between different groups of users. The platform serves as a facilitator or mediator, connecting producers and consumers, service providers and customers. These platforms leverage network effects, creating value as more users join and engage with the platform.

In this model company typically generates revenue by charging fees, commissions, or subscription payments from the users or businesses that participate in the platform ecosystem. Examples of platform-based businesses include online marketplaces, social media networks, app stores, and sharing economy platforms (Si et al., 2015, 2020).

This model presents several advantages, such as scalability, as the platform can grow and adapt to accommodate a larger user base. It also fosters innovation and can lead to the creation of new products and services within the platform ecosystem. However, managing competition and ensuring fair access for all users can be challenges associated with this model.

Platform-based model includes:

- *Marketplace Platforms*<sup>8</sup>: These platforms facilitate transactions between buyers and sellers, allowing individuals or businesses to buy, sell, or trade goods and services;
- *Sharing Economy Platforms*<sup>9</sup>: Platforms in the sharing economy enable individuals to share resources, such as accommodations, transportation (e.g., Uber, Lyft), or other assets and services, often on a peer-to-peer basis;
- *Social Media Platforms*<sup>10</sup>: Social media platforms connect users with each other and with content, enabling communication, networking, and interaction;

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<sup>7</sup> <https://hbr.org/2014/05/making-freemium-work>

<sup>8</sup> <https://www.appdirect.com/resources/glossary/marketplace-platform>

<sup>9</sup> <https://www.investopedia.com/terms/s/sharing-economy.asp>

<sup>10</sup> <https://www.investopedia.com/terms/s/social-media.asp>



- *Service Booking Platforms*<sup>11</sup>: These platforms allow users to discover, book, and pay for services such as travel accommodations (e.g., Booking.com), local experiences (e.g., Airbnb Experiences), and professional services;
- *Developer Platforms*<sup>12</sup>: Also known as application programming interfaces (API) platforms. API is a set of defined rules that enable different applications to communicate with each other. It acts as an intermediary layer that processes data transfers between systems, letting companies open their application data and functionality to external third-party developers, business partners, and internal departments within their companies.

Platform-based models play a central role in digital servitization, as they enable the delivery of digital services, facilitate transactions, and create value by connecting users and providers in various domains. These platforms often generate revenue through transaction fees, commissions, subscriptions, or advertising, and they drive ecosystem growth and network effects as more participants join the platform (Baines et al., 2019)

There are many variations and combinations of the above-described models that companies can use to create value and generate revenue through digital services. Each model has its own advantages and challenges, and companies may choose to adopt one or a combination of these models depending on their specific industry and customer needs, thus deploying hybrid business models. The purpose of adopting hybrid business models is to create a more versatile and adaptable business strategy that aligns with evolving customers' preferences and market demands. By providing a range of options, companies can attract and retain a broader customer base, capture different usage patterns, and optimize revenue streams. Additionally, combining models can help differentiate offerings, increase customer satisfaction, and foster long-term relationships, ultimately leading to sustained business growth and success in the digital servitization landscape.

Choosing the right business model in digital servitization allows companies to adapt to changing customer needs, build more sustainable and recurring revenue streams, foster innovation, and establish long-term relationships with customers. These benefits

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<sup>11</sup> <https://www.hotelimize.com/blog/what-is-an-online-booking-system-and-how-do-i-choose-one/#:~:text=Put%20simply%2C%20an%20online%20booking,and%20enter%20the%20information%20manually.>

<sup>12</sup> <https://www.ibm.com/topics/api>

contribute to the overall competitiveness and growth of the company in the evolving business landscape.

## 1.6 Digital servitization: successful business cases

The digital servitization trend penetrated many business sectors. More and more connections between traditional products, services, and digital technologies emerged and companies have been able to create a variety of ways to provide their digital services in an attractive way. Hence, more and more companies and businesses are paying attention to the digital servitization trend and are switching from the usual sales model to a digital service model that allows them to get money from customers on an annual, monthly, weekly, or even daily basis.

A classic example is the tool manufacturer *Hilti*<sup>13</sup>, a developer, manufacturer, and distributor of construction tools and products. Its product portfolio includes anchor systems, cutting, sawing, and grinding, drilling and demolition, installation systems, facade mounting systems, construction chemicals, diamond coring and cutting, firestop, measuring systems, solar, cordless systems, direct fastening, insert tools and screw fastening among others. The company also provides support and services such as engineering services, training and advice, tool services, logistics and administration, and quality and testing services. Similar to fleet management in the automotive industry, Hilti offers its customers a complete service package: by paying a monthly rate, customers receive all the tools they need. In addition to the cost of tools, service and repairs, the tariff also includes insurance against theft, inventory, and upgrades.

Another successful example of the digital servitization transition is *Adobe*<sup>14</sup>. The company stopped selling physical and digital copies of its popular but very expensive *Photoshop* and *Illustrator* packages, offering its customers a monthly subscription to this software. This approach helped Adobe's leadership to simultaneously solve two

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<sup>13</sup> <https://www.hilti.com/content/hilti/W1/US/en/company/company/about-hilti.html>

<sup>14</sup> <https://www.adobe.com/about-adobe.html>

problems: the company's software became more affordable for customers, and the problem with piracy was closed.

*Apple* is also a perfect example of the successful use of digital servitization. The starting point is June 6, 2011, when Steve Jobs introduced the *iCloud* service, that connects all *Apple* devices with a single cloud storage service. Users could sync their photos, passwords, documents, contacts, and documents. Now it made sense for iPad users to buy a MacBook, because the devices worked perfectly with each other. Over the course of a decade, the system has evolved, getting faster and more convenient. Their products, like iPhones and Macs, come with a wide range of unique services such as *AppleCare*, *iCloud* storage, and more. This creates a complete solution that satisfies customer needs and establishes long-term relationships. Subsequently, the company also move to a subscription model, launching *Apple Music*, a streaming service for listening to music, a counterpart to Spotify. To date, the company counts eight subscription services: *Apple TV+*, *Apple Music*, *Apple Fitness+*, *Apple Arcade*, *Apple News+*, *iCloud*, *Apple Podcasts* and *Apple Books*. All these subscriptions individually are quite expensive. But customers can get an *Apple One* subscription, which includes games, music, movies, and cloud storage. The secret of the *Apple* ecosystem is very trivial – everything works conveniently and as seamlessly as possible<sup>15</sup>.

Customers often benefit when companies switch from a proprietary model to a subscription. For example, *Apple Music*'s subscription price was set quite reasonably, but there was still downward pressure on the company from the public. Later, when Google launched a similar service, *Apple* was forced to lower prices after all in order to stay in the market. In the same way, some magazines offer a special price an order of magnitude lower than usual if the customer subscribes digitally for at least a year.

Another example is the Remote Print Service model from printer and copier manufacturer *Xerox*<sup>16</sup>. Customers no more pay for the physical printer, whose ownership remains in *Xerox*'s hands; rather, billing is based on the number of copies made. In this way, the customer saves on equipment purchase and maintenance (including cartridge changes)

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<sup>15</sup> The *Apple* Ecosystem: from the commonization of advanced hardware towards a services-oriented industry. [https://tesi.luiss.it/28627/1/214691\\_PASTORELLA\\_GIACOMO.pdf](https://tesi.luiss.it/28627/1/214691_PASTORELLA_GIACOMO.pdf)

<sup>16</sup> <https://www.xerox.com/en-us/small-business/insights/how-digital-transformation-works>

and pays only for each copy. This model allows the customer to significantly improve cost planning and reduce overall costs, resulting in greater overall satisfaction.

Similar models are also offered by *Nespresso*<sup>17</sup> that provides coffee pods and machines, offering customers a unique experience: machines' ease of handling, wide variety of coffee flavours, coffee enjoyment and well-thought-out marketing strategy (i.e., high degree of servitization) contribute to the successful distribution of this system. The company offers its customers service contracts for its machines with convenient online support, and also provides a different selection of capsule flavors selling contracts on a monthly subscription basis. In particular, Nespresso offers a subscription service called "Nespresso Club": customers can sign up for the club and receive a regular delivery of coffee capsules based on their preferences. The subscription service ensures a steady stream of recurring revenue for Nespresso, as customers receive their favorite coffee blends without the need to make individual purchases.

Among the companies that have implemented digital servitization in their business model, there is also *Airbnb*<sup>18</sup>, an online accommodation booking platform. Airbnb has lodging options ranging from a room in a hostel to a large apartment or house and helps to reach a wide variety of customers, based on their ability to pay. Even in a small community you can find Airbnb listings, making it the best platform to find a place to live among the other ones.

The company not only provides a platform for rentals around the world, but also offers additional services such as guest escorts, housekeeping, and concierge services. Moreover, the client has the opportunity to communicate directly with the host, with whom you can discuss conditions before booking. An Airbnb host is a friend in an unfamiliar city who can answer questions and provide valuable advice. This helps create a fulfilling experience for customers, increasing comfort and satisfaction.

*Amazon*<sup>19</sup> is also an example of a company that has successfully leveraged servitization in e-commerce. Not only does the company provide a shopping experience, but it also

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<sup>17</sup> [https://businessmodelanalyst.com/nespresso-business-model/#Retail\\_and\\_E-commerce](https://businessmodelanalyst.com/nespresso-business-model/#Retail_and_E-commerce)

<sup>18</sup> <https://bmttoolbox.net/stories/airbnb/>

<sup>19</sup> <https://www.ecommerce-digest.com/amazon-case-study.html>

offers a wide range of services, such as next-day delivery, loyalty programs and streaming video subscriptions. This helps meet customer needs and build long-term relationships.

There are various examples of successful implementation of digital servitization in the B2B sector as well. For example, *Frigoveneta* (industrial refrigeration and large-scale distribution) was able to successfully integrate digital servitization by developing the *OptiSpark* control system. Frigoveneta's *TeleGest* system ensures constant monitoring by Frigoveneta Service's internal engineers, each specialized in a specific field: mechanics, electrics, electronics, informatics. In addition to the engineers of the Remote Monitoring Center, Frigoveneta Service has an internal team of refrigeration specialists, as well as carefully selected employees trained in Italy and abroad for service operations, both online and on-site, carried out promptly and professionally, 24 hours a day, all year round.

Last but not least, *Gruppo AB*, a manufacturer of power supply and cogeneration plants, offers its customers a multi-year agreement that runs throughout the lifecycle of major plant components, which includes remote assistance and technical support. With its own monitoring system, the company has collected a database of typical breakdowns or uptime of certain equipment, which allows it to implement intelligent systems that predict the need for maintenance work and increase the sustainability of the equipment.

The successful examples of business cases that have implemented digital servitization strategies demonstrate that there are various ways of embedding this emerging trend into business processes, profoundly transforming the value proposition of companies, and opening up new opportunities for growth. By using digital services for enriching or advancing their offerings, companies can build a new and unique way of interacting with their customers, which will significantly emphasize their market position and competitiveness.

## **Chapter 2. Empirical analysis: the industrial boilers market**

After the analysis of the state-of-the-art of literature, performed in the first chapter, it is worth to carry out an empirical analysis of the digital servitization phenomenon, to understand the practical aspects that characterize it. To this purpose, this chapter is dedicated to the analysis of a particular sector – the industrial manufacturing industry and, more specifically, the industrial boiler market, while Chapter 3 will examine the case of ICI Caldaie S.p.A., a firm operating in this field that is experiencing the transition towards digital servitization, where I spent six months for an internship, having the opportunity to directly observe the company’s dynamics and to analyze the building strategy of digital servitization.

Specifically, this chapter is structured in the following way:

- Description of the industrial equipment manufacturing sector, with main characteristics and market trends;
- Analysis of firms in the sector that effectively implemented digital servitization strategies;
- PESTEL analysis to identify the external factors that may impact on the industry and, in turn, on companies (including ICI Caldaie S.p.A.) operating;
- Porter’s Five Forces analysis, performed with the aim of deeply understand the external context in which the selected company runs its business.

### **2.1. The industrial equipment manufacturing market in Italy: description and trends**

Italy is the second industrial country in Europe with its strategic and diversified sectors such as machinery and equipment, fashion products, food, automotive and pharmaceuticals. The industrial sector, which represents 16.6% of Italian GDP, is highly export oriented. According to ISTAT data, the number of active companies established in Italy is 4.3 million. 372 thousand of these companies operate in the manufacturing

sector.<sup>20</sup> In this, the machinery sub-sector constitutes the 46% of the Italian industry, accounting for the 7% of the entire economy and about half of all exports, accounting for a sizeable 18% of international trade and making it the fifth largest machinery exporter in the world<sup>21</sup>.

Given the importance of this economic area, nowadays there are 5,000 Italian companies specialised in cutting-edge technology for the creation of mechanical instruments and machinery components, generating 80 billion euros world-wide. The production of mechanical instruments and machinery components is; hence, a relevant field and numbers testify to the country's crucial role: Italy is leader in the supply of machineries and is well known worldwide for its high technological standards<sup>22</sup>.

In this context, digital transformation (i.e., digitalization) is one of the main factors driving the current market for B2B companies and its innovative strategies: more and more companies are becoming aware of the need to have an online presence and use online channels to attract new customers and establish productive business relationships, as well as to include digital technologies as key resources for the business processes and products.

In 2023, the adoption of advanced technologies such as artificial intelligence, robotics, and the Internet of Things (IoT) has increased overall efficiency and productivity of companies in terms of reducing costs by providing with additional services using digital tools.<sup>23</sup>

Gartner Agenda Insights for the Manufacturing Industry study<sup>24</sup> analyses the growth of investments in digital servitization tools in 2023 compared to 2022 which can be identified by looking at the analysis conducted among Chief Information Officers (CIOs) of different companies.

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<sup>20</sup> <https://www.trade.gov/country-commercial-guides/italy-advanced-manufacturing>

<sup>21</sup> <https://madeinitaly.gov.it/machinery/>

<sup>22</sup> [https://worldmanufacturing.org/wp-content/uploads/17/6-2022\\_World-Manufacturing-Report\\_E-Book.pdf](https://worldmanufacturing.org/wp-content/uploads/17/6-2022_World-Manufacturing-Report_E-Book.pdf)

<sup>23</sup> <https://www.sciencedirect.com/science/article/pii/S2667345223000275>

<sup>24</sup> <https://www.gartner.com/en/industries/manufacturing-digital-transformation>

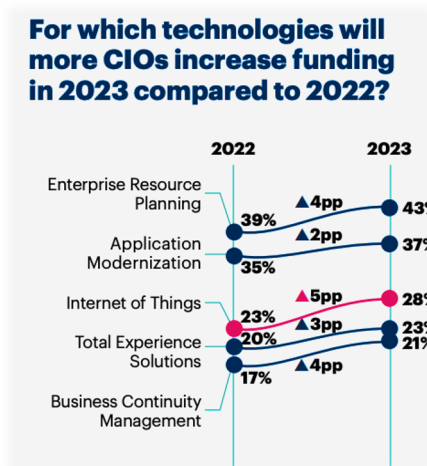


Figure 1. Funding in technologies in Manufacturing Industry in 2023 compared to 2022, Gartner Portal<sup>25</sup>.

As shown in the *Figure 1*, companies are increasingly investing in technologies such as Enterprise Resource Planning, Application Modernization, IoT, Total Experience (TX) Solutions and Business Continuity Management. Among these, three technologies are directly related to digital servitization. Application modernization is the process of taking existing legacy applications and modernizing their platform infrastructure, internal architecture, and/or features. It enables companies to deliver new product-related options and services to customers directly in a digital format. Also, TX focuses on designing and delivering exceptional experiences using digital technologies in a holistic and integrated way for the employee, the customer, and the user. It includes customer experience and employee experience. Factors contributing to good customer and user experience include user-friendly interfaces, responsive online customer support, easy interaction with a product, personalized marketing, and seamless interactions that promote favorable impressions of the brand. To achieve such goals, digital assets are being integrated into the company's products and platform. The IoT is also one of the technologies related to services. Equipping industrial plants with sensors, software and other technologies allows the user to connect the equipment to a network to share data with other devices and systems over the Internet. With low-cost computing, cloud computing, big data, analytics and mobile technologies, physical objects can share and collect data with minimal human intervention. In this hyper-connected world, digital systems can record, track, and

<sup>25</sup> <https://www.gartner.com/en/industries/manufacturing-digital-transformation>



regulate every interaction between connected things and people. The physical world meets the digital world, and they collaborate.

The technologies mentioned – Application Modernization, Total Experience (TX) Solutions, and IoT – are directly related to digital servitization due to their roles in enabling and enhancing service-centric business models. Examples of how each of these technologies contributes to digital servitization are reported below:

- **Application Modernization:** Upgrading legacy applications enables companies to offer new digital services, enhancing customer experience through features like personalized recommendations and proactive support.
- **Total Experience (TX) Solutions:** By focusing on both customer and employee experiences, TX solutions enable companies to design seamless, personalized service interactions. Leveraging AI, data analytics, and automation optimizes every touchpoint, differentiating offerings and driving satisfaction and loyalty.
- **Internet of Things (IoT):** IoT connects physical products to digital networks, allowing for real-time monitoring, data collection, and remote management. This facilitates value-added services like predictive maintenance and remote diagnostics, enhancing customer satisfaction.

Overall, these technologies enable companies to create new revenue streams and business models centered around services and experiences, meeting evolving customer preferences in the digital age.

The increasing investment in the above-described tools demonstrate that digital servitization plays an increasingly key role in this industrial sector, helping industrial manufacturer in meeting customer needs, providing a high level of customized offerings, and creating strong relationships with clients. Digital servitization indeed supports the collection of insights into a wide variety of factors in their performance by collecting information from customers and partners. Companies that receive external data from third parties can look for financial partners who can use that information directly and provide feedback to improve data quality. As a result, customers will be guided to purchase or lease more efficient equipment based on equipment condition or utilization, or even receive more favourable financing terms<sup>26</sup>. At the same time, deep analytics in relation to

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<sup>26</sup> [5 trends that will dominate the Equipment Industry \(annata.net\)](#)

customers and the company's environment allows companies to develop and customize their offerings to a whole new level. By relying on such deep analytics, manufacturers can consistently offer the most competitive products and services and integrate new digital innovations with the lowest risks.

These potentialities explain why the new paradigm of digital servitization is ever more permeating the strategies and business approach adopted by industrial equipment manufacturers, helping them in creating, delivering, and capturing value also through advanced digital services.

The implementation of a digital servitization strategy also support industrial business in achieving an extremely important target nowadays: sustainability and carbon neutrality. Many manufacturers are investing in information technology and seeking renewable energy sources for their products – automating production processes and implementing emission control features, for further reducing their environmental impact. The remote control of physical goods made possible by a constant, real-time collection of field data through digital sensors, allows to control and eventually adjust the performance of the products by providing the necessary services, thus ensuring their correct use, and functioning and, in turn, the minimum energy consumption.

Moreover, the research of sustainability profoundly affects the design and quality of manufactured products: since the design stage, manufacturers must project and realized machines and goods (Mohsen et al., 2023).

The above-described characteristics of this market testify an increasing application of the digital servitization paradigm in companies operating in the analysed industrial equipment sector. With the aim of assessing the precise digital servitization strategy and value offering, the following paragraph deeply describes five cases of industrial firms that have successfully implemented this new economic paradigm.

## **2.2. Industrial equipment manufacturers: successful cases of digital servitization**

The analysis of this sector reveals that several companies have started introducing digital servitization strategies and, consequently, adapting the business operations to this new trend. An examination of these cases was conducted, to learn the best practices, thus supporting the goal of this thesis of guiding ICI Caldaie along its path towards the digital servitization paradigm. The analysis includes competitor companies and comparable small and medium-sized firms that offer similar products and solutions and operate in the technical equipment industry.

### **2.2.1 Methodology**

The cases were selected with the help of ICI Caldaie's management as the best practices among businesses and competitors in this area of the economy.

The first step consisted in studying the characteristics of companies directly competing with ICI Caldaie: during the internship in the company, ICI Caldaie's senior management proposed the list of the company's competitors that they considered to be the strongest in the market. Thus, we looked at those businesses that, according to ICI Caldaie's own internal research, already appear to be the most interesting actors on the market and already introduced advanced solutions.

Empirical data were gathered through the study and analysis of accessible data: thus, we studied the companies' agreements and project documents presented on their online websites and also consulted publicly available information on business journals.

The information on the companies surrounding ICI Caldaie obtained using those secondary data is reported below, indicating for each case the history of development, products and services offered using digital technologies, features, mission/current strategy of the company. Based on this information, it is possible to draw conclusions about the success of the business, the degree of quality of its services, and, ultimately, the overall development in this sector of the economy.

## 2.2.2 Results of the analysis

The analysis allows to obtain information about five companies and their digital servitization strategies. The main information and most interesting results are reported below.

*Epta Group* is a multinational group specialized in commercial refrigeration systems. It was originally founded as an Italian family business by the visionary Italian entrepreneur Luigi Nocivelli and then managed to expand its horizons to a huge scale. In the 1970s, he began to nurture the dream of rebuilding Italy's electromechanical industry. Two decades followed, during which he achieved a series of successes with his savvy and entrepreneurial flair. By 2003, Luigi Nocivelli had created his home appliance empire by founding the Epta Group.

The company soon developed into an international enterprise, operating in more than 80 countries and with 11 production facilities around the world. Epta's head office is located in the centre of Budapest, Hungary where you can find a full-fledged sales staff, technical support, and also after-sales service department.

Nowadays, Epta Group operates worldwide through long-established brands Costan (since 1946), Bonnet Névé (since 1930), Eurocryor (since 1991), Misa (since 1969), Iarp (since 1983) and Kysor Warren (since 1882). The company's products include traditional refrigerated cabinets, vertical and semi-vertical positive-temperature cabinets, vertical and horizontal negative-temperature cabinets, plug-in refrigerated cabinets for retail and food and beverage applications, medium and high-capacity refrigeration units, refrigerated cabinets and cold rooms for the food service industry.

Recently, the multinational company, specialized in developing commercial refrigeration solutions for the retail, hospitality, food, and beverage industries, has introduced digital servitization into its organization. Epta always offers solutions that combine complete systems and high levels of operational and energy efficiency, as well as a wide range of after-sales services. 'Readiness and competence' are the key words when the company offers after-sales services to support customers and fulfil all their needs. Services are provided successfully thanks to a highly skilled support teams: technical experts who

actively work with retailers to provide them with professional advice, excellence solutions and remote monitoring programs.

Striving also for sustainable innovation, the company has introduced remote management of the machines for detecting anomalies, for fault interpretation and the generation of predictive algorithms, and remote monitoring of spare parts through *LineON*. This is based on cutting-edge connectivity and offers a wide range of services whilst supplying useful information for managing plug-in cabinets. LineON features the option of remote monitoring for 24/7 analysis of a variety of plug-in cabinet parameters, such as temperature, moisture, and actual consumption rates. It also includes the geolocation of the cabinet and manages alarms whilst gathering information on sales and generating reports. It is a truly complete solution which provides the opportunity to obtain more than just feedback on the performance of the plug-ins; it is also an efficient marketing tool that keeps track of consumer habits and preferences.

LineON is available in three different modes:

1. New Equipment, i.e., with technology already incorporated during production and direct access to services.;
2. Ready to Connect, with IoT services readiness during production, in favour of a simple subsequent activation;
3. Full Retrofit, i.e., to equip plug-ins already installed with a specific accessory box.

Moreover, several call centre operators around the world are on hand to provide information and support. From spare parts quotations to conversion management, they have the answer to every customer query. They can also help with technical advice and customized solutions, as well as with billing and payment.

Globally, Epta sustains a strong competitive lead, striking the right balance between geographical location and business lines. A lead achieved through its brands (all leaders in their respective refrigeration segments) and the coverage afforded by the 40 technical and commercial sites it owns outright.

Epta's development plan fosters both internal and external growth. It is based on three key principles: acquiring companies which complement the Group's core business;

entering new countries; and consolidating existing partnerships – that reveal the strong strategy behind the group’s activities.

*Frigoveneta* is an Italian leader in the design and implementation of industrial refrigeration systems, air conditioning systems and innovative solutions for energy efficiency. It was founded in 1980 and was originally focused on commercial plants, but soon moved into industrial refrigeration and large-scale distribution. In 2004 Frigoveneta became a Joint Stock Company and in 2005 Frigoveneta Service srl, a company specializing in after-sales technical support, was established.

The firm was able to successfully integrate digital servitization by developing the *OptiSpark* control system, an innovative engineering solution and automation system that ensures the highest performance of the boilers, preventing maintenance, simulating more efficient control schemes, and increasing efficiency based on predictive load. In 2018, Frigoveneta developed *TeleGest* to provide the visualisation interface that allows you to control your system and individual utilities regardless of what your business is system. Specifically, the TeleGest system ensures constant monitoring by Frigoveneta Service's internal engineers, each specialized in a specific field: mechanics, electrics, electronics, informatics. This system received the “Industry 4.0 ready” certification from Bureau Veritas (a French company specialized in testing, inspection, and certification), signifying the company's ongoing process of technological innovation. As a result, courses, and exams for obtaining the ‘Refrigerator Technician License’ are held at the company’s main offices. To ensure an efficient and effective managing of products and customers’ relationships, in addition to the engineers of the Remote Monitoring Center, Frigoveneta Service has an internal team of refrigeration specialists, as well as carefully selected employees trained in Italy and abroad for service operations, both online and on-site, carried out promptly and professionally, 24 hours a day, all year round.

Thanks to its digital resources, the organization provides two online contracts: Online Contract and Online Contract Plus. They combine follow-up remote control activities with scheduled maintenance and mandatory leak detection. The firm also provides ongoing direct telephone support, and it has also released its own app available for customers to monitor and manage Frigoveneta's equipment status from any device.

*Cannon Bono Energia* has similar activities. The company was founded in 1958 and it has specialized in the design, manufacturing, installation, and maintenance of industrial boilers.

Cannon Bono Energia is currently present in 40 countries where it has an extensive commercial and production network of more than 900 people working in 15 production plants and 40 local representative offices, providing assistance to 15,000 production plants: they supply products, services and technical assistance, speaking to customers in their own language, sharing their mentality and customs, keeping in close contact with the market.

The company aims at being always one step ahead. For this reason, it implements the Industry 4.0 paradigm, that allows it to provide digital tools to modernize existing boilers. Servitization is another step forward that allowed the company to introduce digital services such as data collection for boiler monitoring and remote technical support. Overall, the company aimed to move much of the after-sales service for its products to an online format, and it succeeded. In particular, the company provides its customers with two broad sets of services exploiting the servitization strategy: *OptiSupport* and *OptiCloud*. *OptiSupport* gives the customers the potential of augmented reality and provides direct remote access for Cannon Bono Energia technicians to the boiler control system. The customer can communicate with the operator of the company, as well as interactively connect with augmented reality through an application for Android or iOS, exchange documents in real time, make changes to the settings of boiler circuits, remotely adjust the desired configuration of the boiler operation. On the other hand, *OptiCloud* is a software and hardware system based on collaboration with Connect IT company<sup>27</sup> for obtaining and cloud processing information about boiler equipment operation to model more efficient control schemes. Connect IT provides software solutions, implementation services and ongoing support and improvement services that range from operationally smart commercial applications through to financial management in the construction related sectors that rely on scaffolding, formwork, safety systems, plant and transport and labour management. Specifically, *OptiCloud* provides such a set of features:

- 1) data collection and secure cloud storage;

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<sup>27</sup> <https://www.connectitsoftware.com/>

- 2) data download in Excel format;
- 3) secure access via an account with a reserved username and password;
- 4) process parameter display;
- 5) availability and continuous updating of specialized documentation;
- 6) data analysis in the cloud using big data and machine learning for performance and preventive maintenance reporting.

*AB Holding S.p.a.* is an experienced, leading manufacturer of modular, localized power supply and cogeneration plants. The organization is committed to the continuous development of sustainable biofuels and emission control technologies. The company has been in the market for 40 years and is a global benchmark for energy sustainability solutions.

AB Service, a business unit of the group, offers its customers a multi-year agreement that runs throughout the lifecycle of major plant components, which includes remote assistance and technical support. AB Service has been digitizing maintenance operations since 2016: these activities are constantly tracked, making it easier to identify the training activities required to maximize the effectiveness of the services offered by the technicians.

Also trained customer service centres are the part of the digital servitization, which remotely diagnose and maintain systems from needs analysis to activation. Due to this centralized structure, AB Service can continuously monitor plant operation and coordinate corrective maintenance activities.

The main feature of the company is continuous monitoring, which consists of providing support 365 days a year through the dispatch service. The company's customers can contact the dispatchers on the hotline and discuss problems and quickly find the right specialist for their issue. All systems are remotely connected for coordinated and timely monitoring. Using its own monitoring system, the company has collected a database of typical breakdowns or uptime of its certain equipment, which allows it to implement intelligent systems that predict the need for maintenance work and increase the sustainability of the equipment. The company has developed proprietary software that utilizes a variety of equipment self-diagnostic tools that service workers and customers



use to determine the optimal timing and methods of maintenance. Continuous monitoring and preventive maintenance measures reduce the direct impact on customers and ease of use.

*Italcarrelli S.p.A.* is the last organization from the list of analysed companies. It is a world leader in the design and manufacture of special machines and solutions for the movement and storage of goods, with a highly qualified team of specialists. Throughout its existence on the market since 1962, the company has been investing in the research of innovative solutions and, thanks to this, has been providing its own products to large companies all over the world.

The company has undertaken the path of digitalization and servitization, providing product launches, training, and after-sales services, as well as spare parts provision worldwide, exploiting the potential of digital technologies. In particular, the organization has agreements with hundreds of support centres worldwide to provide the best technical service to customers, no matter where they are located. The company also provides a service that consists of sending their highly trained technicians around the world to provide the assistance needed for the customers. *Italcarrelli S.p.A.* can work quickly and clearly thanks to an improved organization and logistics: they can provide spare parts to customers in a short time, often within 24 hours of receiving a message. Moreover, the company has the advantage of a remote assistance group. All *Italcarrelli's* machines are equipped with a remote assistance unit. With this system, technicians can remotely connect to the machines from their own headquarters at any time and perform checks, debugging, setting changes, software modifications and so on.

By introducing digital servitization into the company's organization, the company has been able to reach a new level and expand its customer base, increasing supply and thus demand.

All the B2B organizations described above have considerable experience in their field of activity. Although they already achieved important goals, they do not stand still, rather they constantly improve the level of their products and introduce new services, striving to build long-term and mutually beneficial relationships with their customers. Generally, digital servitization in such organizations is currently carried out in the form of remote

assistance and round-the-clock remote technical support with the help of constant monitoring.

Table 2 below shows a synthesis of the information collected about the selected companies.

Company name	Epta S.p.A.	Frigoveneta S.p.A.	Cannon Bono Energia	AB Holding S.p.A.	Italcarrelli S.p.A
Website	<a href="https://www.eptarefrigeration.com/en">https://www.eptarefrigeration.com/en</a>	<a href="https://www.frigoveneta.it/">https://www.frigoveneta.it/</a>	<a href="https://www.cannonbonoenergia.com/">https://www.cannonbonoenergia.com/</a>	<a href="https://www.gruppoab.com/it/">https://www.gruppoab.com/it/</a>	<a href="https://italcarrelli.eu/">https://italcarrelli.eu/</a>
Main product	Refrigerators	Industrial refrigerators	Steam generators, thermal oil heaters, boilers	Modular, on-site power and cogeneration plants	Design and production of large-capacity self-propelled platforms, machines for transporting flat glass and special equipment used for the handling needs of the most important companies worldwide, operating in the most varied industrial sectors.
Periodical maintenance	Ordinary and extraordinary	Recovery and Update; Scheduled preventive maintenance upgrade of industrial boilers	Programmed periodical maintenance (OptiSpark application), Internal inspection activity	AB plant service and maintenance (preventive, corrective), Overhauling (Disassembly and cleaning, Control activities, Reassembly, Redelivery, and testing)	JCB Machine Care – complete machine warranty for agriculture and construction machinery. Available for up to 5 years / 10,000 hours. JCB Machine Health Checks and Vehicle Health Checks are essential for keeping your

					equipment working efficiently.
Incidental maintenance	Spare parts; E-commers; Fleet management	Telephone support h24; Refrigeration leak control with e-mail alert; Failure interventions	Original spare parts, Revamping,	Original spare parts, Assistance and technical support, Customers service centres	Provide efficient and immediate support as well as prompt spare parts delivery provide spare parts to our customers in a very short time, often within 24h from the receiving of the communication
Remote services	Remote control (anomalies , interpretations of malfunctions, generation of predictive algorithms ); spare parts monitored remotely via LineON	OptiSpark control system	Remote services (data collection for boiler monitoring, Remote assistance,	Remote monitoring tools (24/7/365)	Get connected with the machines from our headquarters, at any time, and perform check-up, debugs, change settings, modify software, etc.

Table 2. Competitors' digital services analysis review.

The study of these five companies that have already implemented digital servitization in their organization also helps in better understanding the general dynamics of this phenomenon in the industrial manufacturing market. We can derive that the process of digital servitization is significantly influenced by the development of digital technologies, which help to provide not only a wide range of solutions, but also their support in real time. Moreover, in the long term, the introduction of digital servitization creates not just a product or service, but a unique user experience and a strong relationship between the

consumer and the company. Therefore, it is necessary to constantly improve the user experience and offer unique solutions that meet the demands of the market, to remain competitive in the field. Furthermore, the analysis of the five companies revealed that having a 24/7 daily support service available for customers is a successful solution: the companies are trying to be helpful to the customer in a difficult moment by answering calls and handling the request in real time.

Ultimately, thanks to the design, development and implementation of digital services, industrial companies can improve the whole business organization and competitive advantage.

### **2.3 Industrial boilers manufacturing market: PESTEL analysis**

To better understand the context in which industrial boilers manufacturers (including ICI Caldaie S.p.A., the case study at the centre of this thesis's analysis) operate, we performed a PESTEL analysis, so as to identify, as the acronym suggests, the main political, economic, social, technological, environmental, and legal trends that qualify this industry.

This analysis allows to objectively assess the organization's position in the market, tracking opportunities and risks. Specifically, it reduces the probability of errors in intuitive determination of the company's strategy, dividing the factors of the general external environment into six main segments and consistently consider the range of opportunities and threats arising for firms in each of these segments. Thus, the PESTEL analysis helps companies to create a clear picture of the contextual conditions in which they operate, to correctly assess the risks and opportunities for the business, and, in turn, it helps them in determining their future path of development.

### 2.3.1 Methodology

The *PESTEL analysis* (also known as PESTLE analysis) represents the following six categories of external factors: political, economic, social, technological, environmental, and legislative factors.

We gathered the necessary data and information on each category of external factors using sources such as government publications, industry reports, market research and reliable news sources. After collecting the information, we described the potential opportunities and threats posed by each factor. Based on the collected data, a report with a brief description of all the six external aspects that impact on the industrial boilers manufacturer sector is provided, with the final aim of supporting ICI Caldaie in evaluating the company's current strategy, as well as developing new plans and strategies that will focus on mitigating the detected risks that are caused by these external factors.

### 2.3.2 Results of the PESTEL analysis

Below a description of the external elements that are relevant for the industrial boilers manufacturing sector and that may influence the way of doing business of companies that operate in this field.

1. **P (political)** – political factors. These factors determine the extent to which government and public policy can affect an organization or a particular industry. According to most economists, the growing number of political risks is now becoming the main threat to the equilibrium of the world economic system, which is based on market economy and globalization (Christine Lagarde, President of the European Central Bank). A few examples of governmental choices and events that may affect industries and companies' ways of operating are briefly described below.

CO2 taxes and regulations:

All Member States of the European Union, plus Iceland, Liechtenstein, and Norway, are part of the EU Emissions Trading System (EU ETS), a market created to trade a capped number of greenhouse gas emission allowances.

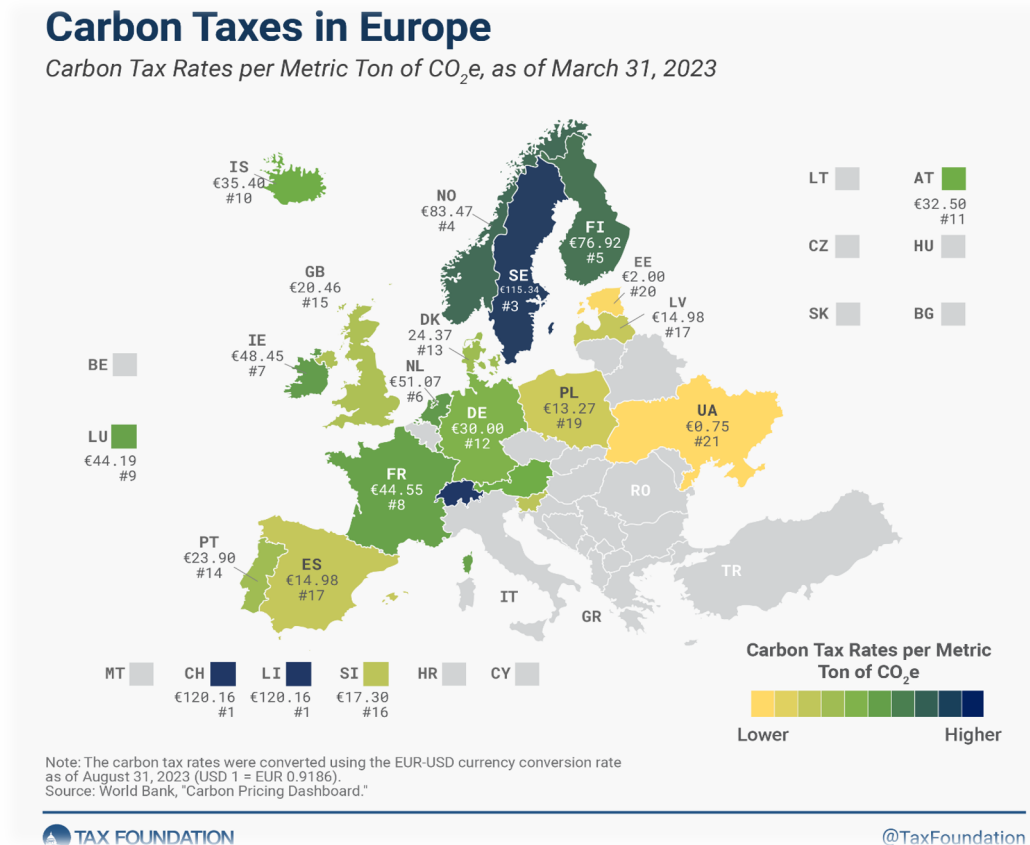


Figure 2. Carbon Tax Rates in Europe per Metric Ton of CO<sub>2</sub>e, as of March 31, 2023<sup>28</sup>.

This statement means that producers like industrial manufacturers must care about the level of emissions resulted by their production processes and products and moreover they must identify ways to control emissions for the entire products' lifecycle, also after the sales transaction moment. To do so and comply with governments' regulations, cutting-edge digital technologies are increasingly adopted to monitor gas emissions and obtaining data to be used to obtain a major efficiency. Also, servitization may help in this sense: providing customers with personalized solutions designed for their specific needs implies that there is an optimization of resources and products (Rymarczyk, 2020); moreover, since the transition towards servitization means that companies assume the risk of the correct functioning of the product/machines (since the aim is to guarantee the higher

<sup>28</sup> <https://taxfoundation.org/data/all/eu/carbon-taxes-in-europe-2022/>

performance and any kind of services to fix anomalies and faults represents a cost for the provider), they are incentivized to realize high-quality, long-lasting goods (Rymarczyk, 2020).

### Russia and Ukraine conflict

One year on from Russia’s invasion of Ukraine, the global energy landscape has changed dramatically. The EU used to import around 40% of its natural gas, more than one-quarter of its oil and about half of its coal from Russia in 2019. In 2022, Russia cut deliveries sharply, but nonetheless it supplied approximately 60 billion cubic metres (bcm) of natural gas by pipeline to the European Union throughout the year. Specifically, this figure includes 30 bcm of natural gas by pipeline during the April-September period, when gas storages were filling, contributing either directly or indirectly to storage injections<sup>29</sup>.

**Assessment of the natural gas balance of the European Union in case of total cut-off of Russian flows and limited LNG availability, in 2023**



IEA. CC BY 4.0.

Note: Baseline demand includes ensuring supply to Ukraine and Moldova. See Annex for assumptions.

Figure 3. Assessment of the natural gas balance of the European Union in case of total cut-off of Russian flows and limited LNG (Liquefied Natural Gas) availability, in 2023<sup>30</sup>.

<sup>29</sup> [https://commission.europa.eu/news/focus-reducing-eus-dependence-imported-fossil-fuels-2022-04-20\\_en](https://commission.europa.eu/news/focus-reducing-eus-dependence-imported-fossil-fuels-2022-04-20_en)

<sup>30</sup> IEA. International Energy Agency Website: [www.iea.org](http://www.iea.org), <https://www.iea.org/news/how-the-european-union-can-avoid-natural-gas-shortages-in-2023>

To satisfy the energy demand, a remaining gap of 27 bcm of natural gas needs to be addressed with additional actions, to satisfy the conditions of refilling gas storage levels to 95% and maintaining gas supply security through to the spring of 2024, without excessive strains on markets and European consumers. Without additional efforts, Europe risks much less-desirable ways of bringing supply and demand into balance. These include higher spikes in gas prices to levels that force demand reductions, alongside renewed pressure on energy bills and the risk of applying rationing and emergency measures to protect consumers. This would have broader implications for economies and fiscal positions.

European countries need to act to narrow the potential supply-demand gap identified above. Circumstances vary widely: the opportunities to act and the vulnerabilities in case of insufficient action are not evenly distributed across the European Union. However, all countries and consumers face detrimental consequences in the event of a return to extreme strains on gas markets. The risks are particularly strong for Europe's industrial consumers, which would be first in line for cuts to gas supply if the situation deteriorates. The range of action for resolving this challenge is presented at *Figure 2.4* as Summary of additional actions required to fill the remaining EU gas supply-demand gap, in 2023.



## Summary of additional actions required to fill the remaining EU gas supply-demand gap, in 2023

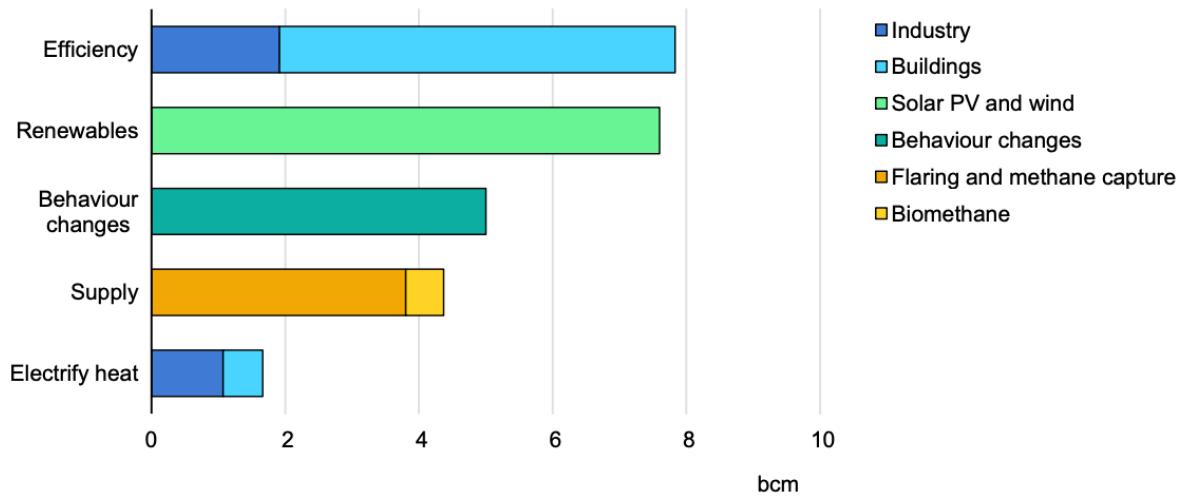


Figure 4. Summary of additional actions required to fill the remaining EU gas supply-demand gap, in 2023<sup>31</sup>.

A major consequence of this gas shortage due to the conflict between Russia and Ukraine is the sharp decrease in boilers demand, leading to a period of crisis for manufacturing companies operating in the energy sector. *Figure 2.5* below shows the changing of steam boilers demand by country from 2019 until 2022 and proves the statement above that Russian market share is one of top 10 markets in Europe. So, it means that shortage of supply there is negatively impacted the situation on boilers sales.

<sup>31</sup> IEA. International Energy Agency Website: [www.iea.org](http://www.iea.org), <https://www.iea.org/news/how-the-european-union-can-avoid-natural-gas-shortages-in-2023>

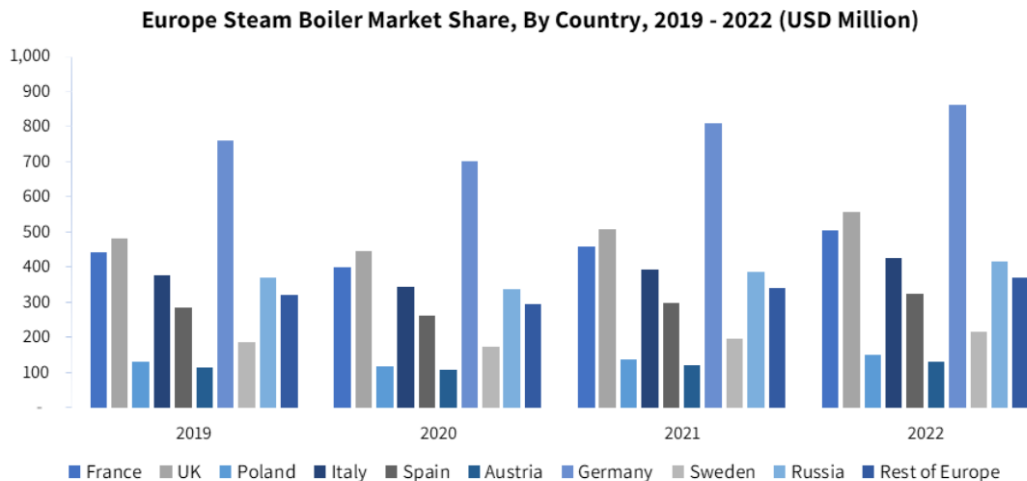


Figure 5. Europe steam boiler market share, by country, 2019 – 2022 (USD Million)<sup>32</sup>.

Moreover, sanctions against Russia and Belarus which impacts ton the Italian companies' branches in Russia: several industrial equipment companies (including industrial boilers ones) supply to Russia different types of products and services. As result of sanctions, the delivery of some part of equipment has been prohibited to the Russian market, negatively impacting on economical wealth of these companies, and limiting the opportunities to develop new service proposals for Russian clients.

Summarising political factors described about it is fair to point out that industrial products market has been faced with shortage in demand due to economic slowdown and loss of export markets, which is aggravated by increasing regulations of carbon emission and slowdown in economy. All these factors act as a trigger to optimize cost and increase efficiency in production with the goal to be sustainable to current trends.

2. **E (Economic)** – economic factors. The global and domestic economic conditions affect the performance of companies, their possibility to invest in innovative projects and their potential growth. This is true for all market sectors, including the industrial boilers manufacturing we selected for the thesis's analysis. In the last years, several economic elements have impacted on the industrial boilers manufacturers' strategies, choices, and performances. A description of the main ones is reported below.

<sup>32</sup> <https://www.gminsights.com/industry-analysis/europe-steam-boiler-market>

### Italy's GDP and inflation rate:

Italy's economy was heavily impacted by the global financial crisis and only emerged from recession in 2015. In the last year, the country was one of the most affected by the COVID-19-induced crisis. The country, which showed 6.6% growth in 2021, was again hit by problems in 2022, this time related to the COVID-19 pandemic. Economic growth slowed to a rate of 3.2%, although the first three quarters saw strong growth. However, in the last quarter, energy prices negatively impacted energy-intensive industries, while declining real incomes and restrained exports slowed economic growth.<sup>33</sup>

The Italian economy is expected to grow by 0.7 percent in 2024 and the figure should rise to 1.2 percent in 2025. This is what follows from the OECD's interim forecasts, which were unchanged from November's. While in Italy, inflation is expected to reach 1.8 percent in 2024. The OECD adjusted the figure downward by 0.8 percent from that announced in November. However, price growth is expected to be 2.2 percent (-0.1 percent) in 2025. Figure 2.6 present main economic indicators of Italian economy.<sup>34</sup>

Main Indicators	2022	2023 (E)	2024 (E)	2025 (E)	2026 (E)
<b>GDP</b> (billions USD)	2,012.01	2,186.08	2,284.08	2,365.54	2,443.49
<b>GDP</b> (Constant Prices, Annual % Change)	3.7	0.7	0.7	1.0	1.1
<b>GDP per Capita</b> (USD)	34,085	37,146	38,926	40,437	41,902
<b>General Government Balance</b> (in % of GDP)	-1.9	-2.1	-3.4	-3.4	-2.7
<b>General Government Gross Debt</b> (in % of GDP)	144.4	143.7	143.2	142.8	141.9
<b>Inflation Rate</b> (%)	n/a	6.0	2.6	2.2	2.0
<b>Unemployment Rate</b> (% of the Labour Force)	8.1	7.9	8.0	8.1	8.2
<b>Current Account</b> (billions USD)	-24.52	15.26	19.76	28.98	36.44
<b>Current Account</b> (in % of GDP)	-1.2	0.7	0.9	1.2	1.5

Figure 6. Italy economic indicators from 2022 to 2026.

Based on figures and description above it could be concluded that the growth rate of the Italian economy will slow down in 2023 and in 2024. Such conclusions are also contained in an updated note to the document on the economic and financial state of the Republic.

<sup>33</sup> <https://www.lloydsbanktrade.com/en/market-potential/italy/economical-context>

<sup>34</sup> <https://www.attijaritrade.ma/en/choose-your-markets/country-profiles/italy/political-outline>

Speaking about the slowdown in Italian economy, it is worth mentioning its certain positive features. Firstly, the crisis allows for a so-called ‘natural selection’ in the industrial market. Only the most viable enterprises that actively use the tools of effective resource management policy.

Secondly, the struggle of enterprises for survival in a highly competitive environment may lead to lower prices for certain goods or services, which also has a positive impact on the economic situation in the country. Crisis leads markets to natural pricing. Moreover, the crisis in the country allows for a general recovery of the economy and brings domestic producers to the domestic producers to the forefront.

Thirdly, crises are a kind of impetus for technological renewal of capital, it is in crisis that technological innovations appear.

#### Unemployment:

Nowadays the cost of production is rising significantly, and large energy-intensive enterprises are losing markets. This, in turn, causes an additional problem: unemployment. Researchers at Confindustria, an Italian representative organization of Italian manufacturing and service companies, have estimated that 582,000 manufacturing jobs will be questioned in 2023. The situation with unemployment in Italy even now is not favourable: 2022 was marked by a rather high level of unemployment – about 10%. Especially, high unemployment degree is observed among young people (aged from 15 to 24) for whom it reaches 28%<sup>35</sup>.

All factors described above create for B2B manufacturing firms risks, especially those operating in the energy sector, such as an increase in operational cost and shortage of market share, caused by optimization of energy consumption and less spending by households and companies.

However, this economic scenario can be a chance for firms to propose to the market new offerings, targeted for the new customers’ requests, thus proposing services and solutions that can help clients in solving problems and supporting their business. One example is

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<sup>35</sup> [https://economy-finance.ec.europa.eu/economic-surveillance-eu-economies/italy/economic-forecast-italy\\_en](https://economy-finance.ec.europa.eu/economic-surveillance-eu-economies/italy/economic-forecast-italy_en)

the proposal of online monitoring of the energy consumption and modelling of efficient way of using boilers, avoiding idle time of customers' production line.

3. **S (Social)** – socio-cultural factors. These factors may affect customers' behaviours and preferences. Understanding them, hence, allows to better identify the needs and wants of clients. Below a brief description of those factors that affect the industrial boilers industry, in which ICI Caldaie operates, is reported.

Increasing global dependence on digital ecosystems:

This tendency creates the space for developing new solution for customers to monitor physical products and to change setting of their functioning in remote mode online from mobile devices. At the same time, this trend requires companies to adopt innovative business model and undertake the digital servitization path. Undoubtedly this direction requires more involvement of management to analyse the internal and external organizational environment and reconcentrating sources and forces on creating new strategy<sup>36</sup>.

Digitalization is essential for companies to remain competitive in today's marketplace. It can improve operational efficiency, reduce costs, and enhance the quality of products or services. In addition, digitalization helps companies better understand their customers' needs and provide them with a more personalized experience.

'Green energy' trend:

A general social aim is the consistent reduction of NOx emissions while maintaining high product quality and reliability. To achieve this, companies must study the proper approach and carry out an optimization work as there are many parallel processes with very high dynamics: this is the energy transition, the European Green Deal, which just stimulates carbon regulation, and processes to develop more environmentally friendly practices around the world.

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<sup>36</sup> S. Soellner, R Helm, P. Klee, H. Endres, "Industrial service innovation: Exploring the transformation process to digital servitization in industrial goods companies" (Industrial Marketing Management Volume 117, 02.2024, Pages 288-303)

Large investors and lenders are implementing new approaches to the assessment of borrowers and the assets they take on their balance sheets, and as part of this assessment they are working to identify the environmental and social risks of corporate governance. If a company does not meet environmental standards, it is easier to abandon investment in such a business than to explain and tell investors and the public why they continue to work with a company that pollutes the environment<sup>37</sup>.

Moreover, a realization has emerged: we need to act responsibly and set an environmentally friendly example for consumers. Of course, the use of ‘green energy’ can not only help to create a positive image for companies, but also reduce energy costs.

4. **T (Technological)** – technological factors. This type of factors considers the pace of technological innovation and development, which can affect both the market as a whole and a particular industry. Factors may include changes in digital or mobile technology, automation, research, and development. The Italian government promotes technological development and firmly supports R&D through tax credits, tax reductions on patent and intellectual property income. The high degree of technological innovativeness supports and enables the servitization trend, that became most relevant at the time of the Covid-19 pandemic as during a pandemic, many consumers started approaching a remote format of solutions to their problems, which requires the development of new innovative products and systems. Partnership with technology companies is undertaken by firms to build the equipment and software’s needed to provide remote assistance to their customers.

Italy is the 8th most integrated country in the EU in terms of digitalization. Most Italian SMEs have a basic level of intensity of digital technologies (60%, which is significantly higher than the EU average, above the EU average of 55% in EU). However, when considering the deployment of specific technologies, the results are mixed. Thanks to legislative intervention, almost all Italian companies (95%) use electronic invoicing.

The country also shows good results in terms of specific technologies. The country is also showing good results in the diffusion of cloud services: 52% of enterprises use this.

technology (well above the EU average of 34%).

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<sup>37</sup> [https://www.ren21.net/wp-content/uploads/2019/05/gsr\\_2019\\_full\\_report\\_en.pdf](https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf)

The use of ICT for environmental sustainability is also relatively widespread in Italian companies, although it is lower than the EU average.

The use of big data is low (9% of Italian firms use it, compared to the EU average of 14%), as is the use of technology based on artificial intelligence (6% of Italian firms, compared to the EU average of 8%), as is the use of AI-based technologies (6% of Italian firms, compared to the EU average is 8%)<sup>38</sup>.

Companies can offer alternative services, reduce emissions through production optimization and pay more attention to environmental protection. Consumers are increasingly concerned about environmental issues, so investing in technology can be a decisive factor in choosing an equipment supplier.

5. **E (Environmental)** - environmental factors. With the growing importance of corporate social responsibility, this element is becoming more and more significant. Especially when it comes to companies that are involved in energy supply or boiler manufacturing, trend to be ethical to the environment works as image factors which could move companies to invest more in “green energy” equipment and avoid high emission in CO2. Working on this industrial companies can choose alternative ways of delivery services such as remote control instead of direct visit the customers and decrease emissions by provide clients with services of production optimisation. It is important for firms to pay due attention to environmental protection. The current trend of ESG policies is a testament to this: a company should endeavour to invest capital aimed at making a positive and lasting impact on society, the environment and overall business performance. The responsible attitude of organizations towards the environment can often be a determining factor of choice for consumers, as the eco-trend is now topical. GS1-Italy 2022 conducted a seminal study, "The New Consumer Code"<sup>39</sup>, which contributed to the identification of six key thematic areas that define what influences Italians’ consumption: among these, there are the emotionality of products and brands, innovation in the

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<sup>38</sup> Dzappala S. Highlights of the Implementation of the Strategy for Digitalization of the Italian Economy until 2025. Information and Innovations. 2023;18(1):43-59. (In Russ.) <https://doi.org/10.31432/1994-2443-2023-18-1-43-59>

<sup>39</sup> [https://nuovocodiceconsumi.gs1it.org/media/filer\\_public/b6/8e/b68ef6cd-f07a-4164-b4bc-6cbf100c8642/new\\_consumer\\_code\\_gs1\\_report\\_online\\_eng.pdf](https://nuovocodiceconsumi.gs1it.org/media/filer_public/b6/8e/b68ef6cd-f07a-4164-b4bc-6cbf100c8642/new_consumer_code_gs1_report_online_eng.pdf)

consumer experience, omnichannel and shopping experience, territoriality, convenience, but also the "care for the environment and humanity".

With the growth of corporate responsibility, an ethical attitude to the environment is becoming an important factor for companies in energy and industrial production. It can be used both as an image tool and to attract investment.

6. **L (Legal)** – legislative, legal factors. Different legislations are more and more influencing and driving companies' business operations. To comply with new standards, firms must adapt their way of doing business, to obtain certifications that may be relevant in the decision-making process and evaluation by customers, since certificate attest the high standards of products and processes. Among these, there is the need to pay attention to the following elements:

- 1) tariffs on imported components or raw materials and export regulations can influence the sourcing, production costs, and global market access<sup>40</sup>;
- 2) national energy policies<sup>41</sup>, including incentives for renewable energy adoption, taxation on energy sources, and subsidies for energy-efficient technologies, can shape the market for heating systems and influence customer decisions, pushing them to buy or choose a more efficient heating/cooling system;
- 3) legislation related to environmental protection, emissions standards<sup>42</sup> and energy efficiency requirements can impact the design, production, and sale of heating systems cause require additional control of production and service quality to meet the legislation guidelines for products certifications, which creates a pressure for obtaining equipment certificates from SGS<sup>43</sup>, complying with the unique requirements of the country in which companies operate.

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<sup>40</sup> <https://customsdutyfree.com/customs-or-import-duty-for-electric-appliances-to-italy/>, [EU may reduce import tariffs on some raw materials \(awebertools.com\)](https://awebertools.com)

<sup>41</sup> [Italy's New Energy Policy: National Interests vs Green Transition — Valdai Club](https://www.valdai.club/en/italys-new-energy-policy-national-interests-vs-green-transition)

<sup>42</sup> [Oil & Gas Laws and Regulations Report 2023 Italy \(iclg.com\)](https://www.iclg.com/en/energy/oil-gas-laws-and-regulations-report-2023-italy)

<sup>43</sup> SGS (formerly Société Générale de Surveillance (French for General Society of Surveillance)) is a Swiss multinational company headquartered in Geneva, which provides inspection, verification, testing and certification services. Its 99,600 employees operate a network of 2,600 offices and laboratories worldwide. URL: [https://en.wikipedia.org/wiki/SGS\\_S.A.](https://en.wikipedia.org/wiki/SGS_S.A.),



The analysis of the external factors that affect the industrial boilers manufacturing industry revealed not only the key characteristics of this context according to the PESTEL analysis, but also that it is a constantly changing sector, trying to always be at the forefront of innovation. In this sense, digital servitization represent a paradigm that highly interests companies operating in this field and it is, thus, destined to expand further and further.

## 2.4 Industrial boilers manufacturing market: Porter's Five Forces analysis

To further deepen the contextual analysis and better understand the characteristics of the specific sector of industrial boilers in which the reference company, ICI Caldaie, operates, the analysis of the Porter's Five Forces has been performed. This takes into consideration and analyses the following five elements: threats of new entrants, pressure from suppliers, pressure from buyers, threats of substitution, and competitive rivalry.

1. *Threats of new entrants.* This force assesses how easy or difficult it is for new companies to enter an industry. Factors affecting this include the presence of barriers to entry such as high capital requirements, economies of scale, regulatory constraints, and brand loyalty. High barriers to entry usually mean lower competition and higher profitability for existing players<sup>44</sup>. This problem is ever-present in the market, so it is important for companies to continuously develop and improve products and services. By doing so, the emergence of new competitors would have a minimal impact on the activities of the organization.
2. *Pressure from suppliers.* The bargaining power of suppliers is one of the five forces that determine the intensity of competition in an industry. This assesses the ability of suppliers to influence the prices and terms of their products or services. When there are few substitutes or many buyers depend on a few large suppliers, these suppliers can exert significant power, potentially driving up costs for companies within the industry<sup>45</sup>.

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<sup>44</sup> Barney, J.B., and Hesterly, W.S. (2015). Strategic Management and Competitive Advantage.

<sup>45</sup> Monczka, R.M., Handfield, R.B., Giunipero, L.C., and Patterson, J.L. (2015). Purchasing and Supply Chain Management.

3. *Pressure from buyers.* Buyers always want to buy goods for a lower price, but of high quality. In the context of digital servitization, consumers increasingly look for a personalized approach to their needs and an easier provision process. This is why firms are actively implementing the new paradigm of servitization in their production in a digital format, to respond to the constantly evolving consumers' needs and product selection criteria<sup>46</sup>. This phenomenon must be constantly monitored, and trends must be caught in time to remain relevant and attractive on the market.
4. *Threat of substitution.* Unfortunately for producers and fortunately for consumers, any product or service can be substituted. In such a situation, it is important to have a strong reputation and a sound, trust-based relationship with customers. The company should strive to create a product and a personal brand, characterized by stable customer relations, quality assurance, reliable support, and high-quality services, which no one else in the market among competitors possess, thus making the firm indispensable for consumers<sup>47</sup>.
5. *Competitive rivalry.* This force considers the intensity of competition among existing firms within the industry. High levels of rivalry, characterized by many competitors, and consequent frequent price wars, aggressive advertising campaigns, and continuous product innovations, can reduce profit margins and destabilize the market<sup>48</sup>.

This framework can be applied to the specific case of the industrial boilers industry in which ICI Caldaie operates, to analyse the context surrounding it, to understand where the company stands among its competitors, what challenges exist among competitors, and what opportunities for growth it can grasp in this environment.

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<sup>46</sup> Best, R.J. (2009). Market-Based Management.

<sup>47</sup> Treacy, M., and Wiersema, F. (1997). The Discipline of Market Leaders: Choose Your Customers, Narrow Your Focus, Dominate Your Market.

<sup>48</sup> Porter, M.E. (1980). Competitive Strategy: Techniques for Analyzing Industries and Competitors.

## 2.4.1 Methodology

The data for the analysis was obtained through interviews with ICI Caldaie's leading employees and observations of the behaviour of other companies in this segment, as well as the study of publications on the state of the industrial boilers manufacturing sector.

The resulting observations will show which forces pose the highest risks to the business. The most serious forces can be dealt with.

The data obtained can then be used as a starting point for defining the business development strategy for several years ahead.

## 2.4.2 Results of the Porter's five forces analysis

Below a brief description is provided for each of the five dimensions of the Porter's five forces analysis applied to industrial boilers market in which ICI Caldaie operates, revealing the major highlights.

### 1. Pressure from suppliers

In Porter's (2011) view, powerful suppliers capture more of the value for themselves by charging higher prices, limiting quality or services, or shifting costs to other industry participants – raw materials and spare parts manufacturers – , who pay the increased cost of raw materials, and their customers, who ultimately pay the increased cost of goods<sup>49</sup>.

In the industrial boiler sector we are analyzing, we can identify various types of suppliers and divide them by groups:

- **Manufactures** are suppliers that produce spare parts for boilers and production line and assemble them to industrial boilers producers. There are different types of manufacturers. The first ones whose products are standard and easy to find elsewhere will exert low bargaining power. The number of suppliers affects the boiler company's ability to find replacement quickly and also resulted in the amount of the costs associated with this transition from one supplier to another.

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<sup>49</sup>[https://www.researchgate.net/publication/328462314\\_Michael\\_porter's\\_five\\_competitive\\_forces\\_and\\_germic\\_strategies\\_market\\_segmentation\\_strategy\\_and\\_case\\_study\\_of\\_competition\\_in\\_global\\_smartphone\\_manufacturing\\_industry](https://www.researchgate.net/publication/328462314_Michael_porter's_five_competitive_forces_and_germic_strategies_market_segmentation_strategy_and_case_study_of_competition_in_global_smartphone_manufacturing_industry)

Alternatively, those with industry-specific knowledge which can create, little competition does have a strong power over buyers. These are for example R&D companies that create new technical solutions for products and services. For such type of suppliers, bargaining power is high, because it would be difficult to find or replace current supplier and can be resulted in high switching cost;

- **Importer suppliers of energy** for boiler production plants are often referred to as domestic distributors and wholesalers. Their bargaining power is like R&D solution manufactures as they are unique in the market and their products is difficult to substitute;
- **Logistic providers** as for spare parts as for delivery boilers to clients have analogous power as typical manufactures but have possibility of forward integration especially in terms of switching business model from product to service.

Suppliers in industrial boiler industry are made up of firms that produce components and accessories such as valves, control instrumentation, steam traps, pipes and tubes, fans, actuators, and pressure relief valves for boilers and heat exchanger equipment. Boiler manufacturers rely on input components made primarily of steel and aluminium, including safety valves, water level indicators, pressure gauges, steam traps, boiler tubes, casing, insulation, fuel equipment, and circulating pumps from upstream suppliers. According to Moses (2019), suppliers of raw materials of this global industry accounted for an estimated 44.7% of revenue from sales of raw material in 2019 all over the world. These suppliers may wield greater power when these materials are in shorter supply and/or in greater demand. However, as the level of complexity for the products increases, the costs of labour, capital, and technological expertise would in turn increase to represent a greater and greater percentage of overall costs, further emphasizing the critical role suppliers play in the industry's economic landscape and their potential to influence market dynamics and competitive strategies. Therefore, as Albrecht et al. (1992) states, the suppliers of these inputs can command greater supplier power with increased product sophistication. This power is further boosted by the fact that the boiler industry is not the sole market for these raw material suppliers, who can also supply their products to the automotive, construction, machinery, and aerospace industries. To mitigate the risks of material shortages, particularly high-quality alloy components, which can lead to an

increased frequency of repairs, it is crucial for boiler manufacturers to use high-quality products. Consequently, these producers often opt for long-term contracts that may include commitments to specific purchasing volumes. Moreover, these long-term agreements typically come with stringent exit clauses, such as compensation for unpurchased volumes or penalties over specified periods. Such conditions contribute to high switching costs for manufacturers under long-term contracts, thereby enhancing the supplier power within the industry<sup>50</sup>.

In recent years, the industrial boiler market has faced several challenges due to geopolitical uncertainty, supply chain disruptions, changing consumer preferences, and increasing regulatory scrutiny. Those events deeply also influence the supply chain and provision mechanisms<sup>51</sup>.

In particular, the gas supply has lately represented a challenge for the entire industrial boiler industry and not only. According to Biderman et al. (2023), it is expected that in the short and medium term, gas will continue to play an important role for industrial producers in Italy, as well as for transport and, above all, for industrial boilers manufacturers using gas as fuel. This explains why geopolitical factors, such as trade tensions due to emerging constraints associated with the Covid-19 pandemic and changes in government policy due to the Russian-Ukrainian war, have the greatest impact on the energy sector, driving up production costs due to higher electricity and transport tariffs.

It should be noted that the increase in the gas fuel prices provoked by geopolitical factors will also affect transport service providers, that often work in collaboration with the manufacturers of industrial boilers, both for delivering products to customers and for the purchase of raw materials<sup>52</sup>.

Consequently, the above-mentioned geopolitical situation leads to periodic delays in the supply of components to companies, which can seriously affect logistics planning. Suppliers are responsible for such delays, but at the same time, they are not the cause of it and companies cannot impose any sanctions on them. It is necessary to consider possible risks and remodulate the strategy on the part of suppliers and strive to prevent

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<sup>50</sup> <https://greenprofitsolutions.com/blog/golden-handcuffs-vendor-contract-terms-pros-cons-bankers/>

<sup>51</sup> <https://www.statista.com/outlook/io/manufacturing/material-products/fabricated-metals/worldwide>

<sup>52</sup> <https://trans.info/italian-transport-sector-demands-state-action-334504>

delays by regulating possible controversial issues (for example, missed delivery dates, defective goods) and eliminating damage in advance.

Manufacturers that can effectively balance the costs associated with the economic situation and digital investments with a focus on quality are likely to weather the current crisis and ultimately prove more resilient<sup>53</sup>.

The factors above described influence the bargaining power of suppliers in the specific industrial boiler market. Leveraging those factors, powerful suppliers can significantly impact the profitability of an industry by increasing costs through higher prices and potentially reducing the quality of goods and services. This scenario not only worsens relationships with downstream businesses, but also intensifies competition between them as companies seek to maintain profit margins amid rising costs.

However, as many positive factors continue to influence the market, the outlook for manufacturing remains positive. Among these factors are:

- Rising global demand. As economies around the world grow and modernize, the demand for industrial products, including boilers and other manufacturing equipment, increases. This expansion is driven by sectors such as energy, construction, and healthcare, which require more sophisticated infrastructure and machinery<sup>54</sup>. With growing economies and modernization efforts worldwide, there is a heightened demand for industrial boilers across various sectors like energy, construction, and healthcare. This translates into increased sales opportunities for suppliers in the industrial boiler market. As demand rises, suppliers can expect a surge in orders and contracts for their products.
- Ongoing technological advancements. Continuous innovations in technology contribute to the efficiency and capabilities of manufacturing processes. Developments such as improved materials science, enhanced design software, and smarter production techniques allow manufacturers to produce more advanced

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<sup>53</sup> <https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever>

<sup>54</sup> Garetti, M., and Taisch, M. (2012). Sustainable Manufacturing and Design: Concepts, Practices and Needs.

and reliable products<sup>55</sup> And this also refers to the industrial boilers producers. Suppliers must innovate to meet evolving demands, collaborate closely with manufacturers for specialized solutions, optimize supply chains, ensure quality and compliance, and differentiate themselves in the market. Embracing innovation and adaptation are key for suppliers to thrive in this dynamic and competitive industry.

- Increasing investment in automation and digitalization. The industrial boiler market is witnessing a surge in investment towards automation and digitalization. Automation is revolutionizing production processes by boosting efficiency, curbing labor costs, and mitigating human errors. This leads to heightened productivity and superior quality of boiler systems. Concurrently, digitalization in the industrial boiler market is reshaping the landscape for suppliers: they must adapt by providing advanced components for automated processes, digital solutions for remote monitoring and maintenance, customizable products, streamlined supply chain integration, and service-oriented business models. This necessitates innovation, flexibility, and collaboration to meet evolving customer needs and remain competitive.

These trends create opportunities for suppliers to expand their market reach, align their offerings with manufacturers' evolving needs, and strengthen collaborative relationships. Suppliers providing raw materials, components, machinery, and innovative technologies stand to benefit from increased demand and can enhance their competitiveness by offering value-added services and expertise. Overall, the symbiotic relationship between manufacturers and suppliers is becoming increasingly integrated and collaborative, driven by the pursuit of efficiency, flexibility, and innovation in the manufacturing ecosystem.

To conclude our analysis of the pressure from supplier in this specific industry, other elements must be considered and are described below:

1. Despite the fact that the number of representatives of each group of suppliers in the market mentioned before may be sufficient, it can be difficult to find a replacement due to the fact that constant maintenance of product quality is required, and it is not easy

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<sup>55</sup> Phaal, R., Farrukh, C.J.P., and Probert, D.R. (2012). Technology Roadmapping for Strategy and Innovation: Charting the Route to Success.

to find the necessary new supplier , therefore, dependence on those with whom long-term partnerships have already been built is high, which means that bargaining power of this factor is medium;

2. Due to the fact that, as mentioned earlier, it is preferable for manufacturers of industrial boilers to have long-term relationships, which are usually strengthened by long-term contracts, the costs of finding a new one and subsequent re-signing of the contract will be expensive for companies, as they may entail additional costs for test deliveries, payment of obligations under contracts with old suppliers and, possibly, time on simple production lines, which leads to the conclusion that the risk of high switching costs is relevant. Nevertheless, sometimes a change of a low-quality supplier, even with high costs for finding a new one, can positively affect the quality of products and services provided, and if there is enough on the market, as in the market of industrial boilers, it can be quite justified. Based on the above, that bargaining power of switching costs is medium;

3. Working with logistic partners such as transportation companies typically requires relying on their performance and ability to deliver the product or service to customers. By controlling later production steps, a company can reduce delivery risks. Integrating logistic companies can help increase the certainty of providing the correct deliveries to customers.

Considering all the above describe elements that impacts on the supply mechanisms in the industrial boiler manufacturing context, the overall degree of intensity of the pressure from suppliers' force can be evaluated. Specifically, this evaluation the assessment resulted in the allocation of a medium intensity.

## 2. Pressure from buyers

Porter (2011) describes powerful customers as the flip side of powerful suppliers, who can capture more value by forcing down prices, demanding better quality or more service, and generally playing industry participants off against one another, at the expense of industry profitability.



In the B2B scenario, buyer power gives industrial customers the ability to squeeze industry margins by pressuring the suppliers to reduce prices or increase the quality of services or products offered<sup>56</sup>.

In the boiler manufacturing industry, the key buying industries are relatively few and, specifically, they are represented by the construction industry, manufacturers such as automotive manufacturers, commercial sector such as healthcare facilities, office buildings, and education facilities, heating and refrigeration, distributors (especially for foreign markets). According to Moses (2019), the automotive sector, commercial sector, exports, and heating and refrigeration sectors account for 46.1%, 24.3%, 19.1%, and 8.1% of total industry revenue, respectively. However, within each market sector, there are many downstream buyers, with purchase volumes proportionate to the size of the producers<sup>57</sup>. Downstream buyers who engage with large manufacturers often represent only a small fraction of the manufacturer's total clientele. Consequently, these buyers typically possess limited bargaining power<sup>58</sup>.

Generally speaking, the boiler industry landscape has become more competitive and customer-centric over the past five years, largely driven by the affordability and attractiveness of imported products, which increases the influence of buyers<sup>59</sup>. Imported boilers may be offered at lower prices as compared to domestically manufactured boilers, or contain various innovative solutions, forcing local manufacturers to reduce prices or offer more favorable terms and conditions to remain competitive<sup>60</sup>.

Porter (2011) argues that a customer has negotiating leverage if:

- There are few buyers, or each one purchases in volumes that are large relative to the size of a single vendor;
- The industry's products are standardized or undifferentiated;
- Buyers face few switching costs in changing vendors, and

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<sup>56</sup> <https://corporatefinanceinstitute.com/resources/management/bargaining-power-of-buyers/>

<sup>57</sup> Brock, J. W. (2009). Structure of American Industry.

<sup>58</sup> Waldman, D. E., & Jensen, E. J. (2012). Industrial Organization: Theory and Practice.

<sup>59</sup> <https://www.marketresearchfuture.com/reports/industrial-boilers-market-983>

<sup>60</sup> <https://www.statista.com/outlook/io/manufacturing/industrial-products-services/machinery-equipment/worldwide#output>

- Buyers can credibly threaten to integrate backward and produce the industry's product themselves if vendors are too profitable.

In summary buyers wield considerable influence in the industrial boiler market according to Porter's framework. Their negotiating leverage can shape industry dynamics, potentially impacting profitability. In essence, the industry contends with substantial pressure from these influential buyers, necessitating adaptation through competitive pricing, innovation, and superior service to safeguard market share and profitability in this customer-focused environment.

Considering all the elements and trends in the industrial boiler market dynamics, we can assess the intensity of the pressure of buyers force as moderate to high.

### 3. Competitive rivalry

Global industrial boilers market size was valued at USD 16.21 billion in 2022 and it is projected to grow from USD 16.97 billion in 2023 to USD 25.04 billion by 2031, as presented in Figure 2.7 exhibiting a compound annual growth rate (CAGR) of 4.98% during the forecast period (2023 - 2031)<sup>61</sup>. The rapidly growing industrialization across the world together with growing oil & gas and food & beverage industry is set to drive demand in the market during the forecast period.

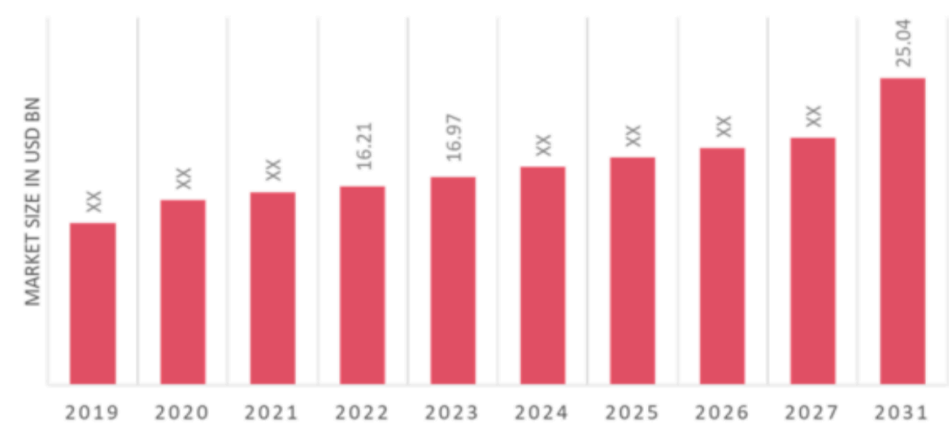


Figure 7. Industrial boiler market trend<sup>62</sup>.

<sup>61</sup> <https://www.marketresearchfuture.com/reports/industrial-boilers-market-983>

<sup>62</sup> <https://www.marketresearchfuture.com/reports/industrial-boilers-market-983>

As a consequence, the demand for industrial boilers is increasing significantly across industries: in all industrial contexts, the steam generated by boiler systems is utilized to carry out heating operations, representing a key resource.

Recently, the industrial boilers market has been divided by application into chemicals & petrochemicals, food & beverage, metals & mining, manufacturing, and others. The chemical & petrochemical segment dominated the market in 2022. The rise of this segment has been driven by the huge demand for the high-quality steam that is used in the production of chemicals. Its rise has been aided by the enormous need for a wide variety of chemicals across all industries. Worldwide demand for industrial boilers in the chemical & petrochemical industry is increasing because of the increased demand for diverse chemical & petrochemical products. As a result in Figure 2.8, it is anticipated that this category will continue to be important over the projection period<sup>63</sup>.

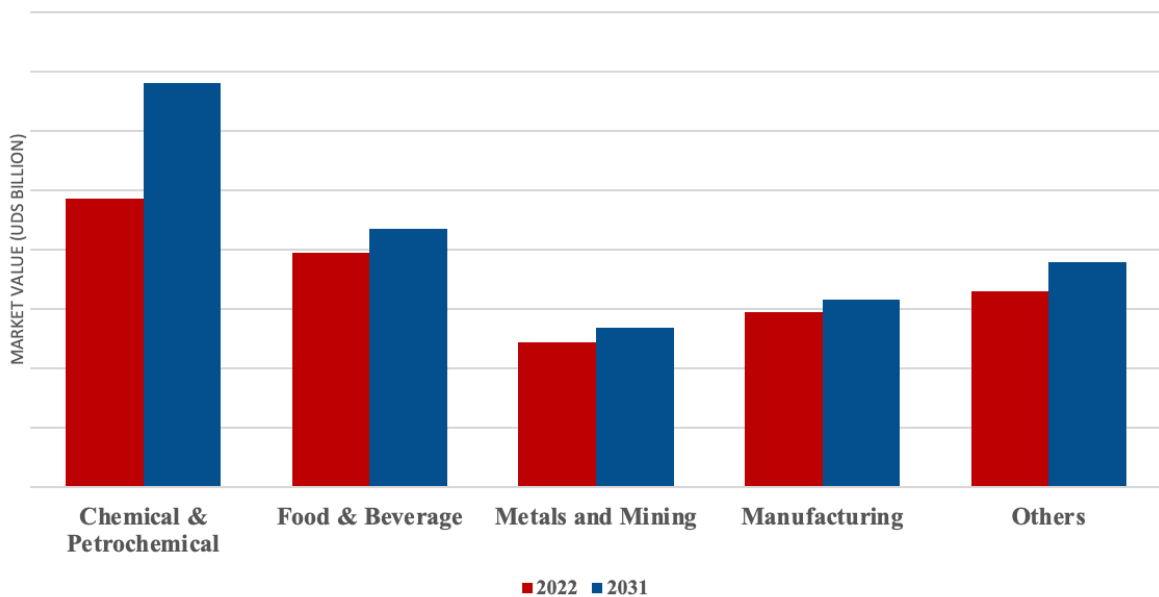


Figure 8. Industrial Boilers Market, by Application, 2022 & 2031 (USD Billion)<sup>64</sup>.

As follows from a study conducted by the Market Research Future agency, the increases in the market value described above suggests that competition will be ever stronger, with

<sup>63</sup> <https://www.marketresearchfuture.com/reports/industrial-boilers-market-983>

<sup>64</sup> <https://www.marketresearchfuture.com/reports/industrial-boilers-market-983>

companies operating in the sector seeking to obtain the greater market share possible<sup>65</sup>. Consequently, industrial boilers companies strive for market leadership by constantly introducing new technologies in their production. Such implementations encourage companies and the industry to develop technologically, stimulating a high degree of innovation.

There are already companies in the market that offer their customers not only products, but also services in digital format. For example, Cannon Bono Energia<sup>66</sup> (a company that designs, manufactures, installs, services, and maintains industrial boilers for standard and special applications including plug-in solutions, package solutions, and site-erected plants) offers its customers after sales contracts that allow them to be in constant contact with the company and receive wide range of services to ensure the effectiveness of the investment and the long life of the products. For companies that have not yet adopted advanced technologies and do not provide personalized services, it becomes necessary to make every effort to use digitalization tools effectively and to embrace the servitization trend to avoid the pressure of competitors and remain relevant to customers. It is also important how quickly and efficiently the company provides its services in comparison with similar packages of services from competing companies. Customers will choose the brand of boiler equipment that best meets their expectations for an affordable price. So, companies need to constantly review their propositions based on user experience and create a comprehensive solution at the lowest costs to keep the best price for their services.

Porter (2011) contends that rivalry is destructive to profitability if it gravitates solely to price because price competition transfers profits directly from an industry to its customers. If price competition is sustained, it also trains customers to pay less attention to product features and service.

Considering criteria mentioned by Porter we can evaluate the intensity of rivalry according to competition-based price and competition based on non-price dimensions.

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<sup>65</sup> Market Research Future (MRFR) is a global market research company that takes pride in its services, offering a complete and accurate analysis regarding diverse markets and consumers worldwide. Source: <https://www.marketresearchfuture.com/reports/industrial-boilers-market-983>

<sup>66</sup> <https://www.cannonbonoenergia.com/about-us/>

Starting from the former one, based on information from some industrial boilers producers' website, most of the industry products are sold to food and beverage processors and industrial construction operators, which are constantly searching for cheaper alternatives. Hence, the only way to differentiate from competitors is to work at special proposals for the customers, which can help them to decrease their costs by using customised solution or additional services such as remote control or packages of services integrated to the product like final solution.

In summary, while the inability to significantly raise prices may indicate low pricing power, the presence of competitive pressures from buyer switching and the need for differentiation suggest a medium level of competition based on price. Companies must compete on multiple fronts beyond just price to succeed in such an environment.

Looking at the second form of competition, according to Moses (2019), buyers of boiler products seek quality to increase the value of their purchases. Manufacturers that can build quality into their boiler and heat exchanger products are usually able to safeguard their reputation. Such businesses are better positioned to hold onto long-term clients and business relationships by providing this value to downstream buyers. Among the product performance attributes that influence competition, the strength to weight ratios, waterproof ability, malleability, corrosive performance, safety, installation costs and recyclability emerge (Moses, 2019). The author also mentioned other possible attributes, that include product lifespan and durability, combustion efficiency, fuel flexibility, serviceability, frequency of maintenance and cleaning, susceptibility to leakage, maximum allowable working pressure, and hydrostatic performance. Specifically, the author reported that to gain business, manufacturers must build quality into their products, materials, specifications, safety features, parts, delivery, and service.

However, other non-price attributes such as service quality introduced by technological innovations or off-the-shelf solutions as well as tailored made projects would become the determining factor in the competitive edge of each boiler manufacture the intensity of rivalry amongst industry competitors.

In conclusion, the global industrial boilers market is experiencing significant growth driven by factors like industrialization, expansion in key industries, and rising demand

for high-quality steam. Competition is intensifying, prompting companies to innovate and offer digital solutions to enhance customer experience.

In essence, companies in the industrial boilers market are actively adopting digital technologies, tailoring their services to meet individual customer needs, and continually refining their product offerings based on feedback and cost-effectiveness. Although competition on price persists, other factors such as the quality of products and the introduction of innovative services are gaining prominence. This means that while price remains a factor, it is not the sole focus of competition. Companies are paying increasing attention to non-price aspects like product reliability, efficiency, and the ability to provide value-added services.

Based on the factors described above, rivalry force in the industrial boiler market can be characterized as average on both price and non-price factors to attract and retain customers.

#### 4. Threat of new entrants

The industrial boiler market was valued at 10.5 USD billion in 2023 and is projected to expand and is projected to grow to USD 180 billion by 2032<sup>67</sup>, and such growth signals a favourable competitive environment for entrepreneurs, also guided by the support from the government policies that favour the expansion of domestic manufacturing capacities and thus foster the entrance of a number of industrial facilities worldwide, creating a positive environment for industry growth<sup>68</sup>.

According to Porter (2011), government policy can hinder or aid new entry directly, as well as amplify or nullify the other entry barriers.

The mechanical machinery context where industrial boilers producers operate is still the largest market in Italy with a value of 80 billion euros, followed by chemicals. The Italian government is in process to attract trade investors to the country economy with the goal to improve credibility and liquidity especially in industrial market which is proven by

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<sup>67</sup> <https://www.marketsandmarkets.com/Market-Reports/industrial-boiler-market-130210505.html>

<sup>68</sup> <https://www.gminsights.com/industry-analysis/industrial-boilers-market>

Law 181/89. This incentive, managed by Invitalia<sup>69</sup>, aims to increase industrial development and employment growth in areas affected by complex and non-complex industrial crisis (as defined by the Government). It provides funding - grants and loans up to the 75% of the eligible expenses - for investment projects of at least € 1 million, presented by companies of all sizes, aimed at:

- revitalizing industrial activities;
- safeguarding employment levels (an increase in the workforce to be completed within 12 months is required);
- attracting new investments;
- environmental redevelopment and restoration<sup>70</sup>.

International companies enter the market attracted and inspired by the experience of already existing successful firms. All the factors described above are relevant for new entrants. For example, companies presented in *Figure 9* provide their products and services in the market but considering slowdown in economy at European market they could try to attract new customers to increase profitability of the business that could be a challenge for Italian boiler producers.

#### **Global Top 10 Industrial Boiler Manufacturers [2023]**

Alfa Laval AB  
Babcock & Wilcox Enterprises, Inc.  
Bosch Industriekessel GmbH  
Cleaver-Brooks, Inc.  
Harbin Electric Co., Ltd.  
Hurst Boiler & Welding Company, Inc.  
IHI Corporation  
Miura Co., Ltd.  
Thermax Limited  
Zhengzhou Boiler (Group) Co., Ltd.

Figure 9. Global Top 10 Boiler Manufacturers, 2023<sup>71</sup>.

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<sup>69</sup> Invitalia is the National Agency for Inward Investment and Economic Development. It is owned by the Italian Ministry of Economy. <https://www.invitalia.it/eng>

<sup>70</sup> <https://www.ice.it/en/invest/investment-incentives>

<sup>71</sup> <https://www.blackridgeresearch.com/blog/list-of-global-top-industrial-boiler-manufacturers-companies-makers-suppliers-in-the-world>

In order to draw final conclusions, it is necessary to consider other factors that influence this force.

Porter (2011) highlights the critical role of securing product or service distribution for new market entrants. The challenge intensifies when distribution channels are scarce and already monopolized by existing competitors. In Italy, for example, larger manufacturers of boilers and heat exchangers typically control their own sales distribution, integrating distribution activities in their operations. In contrast, smaller or newer manufacturers often depend on third-party distributors to bring their products to market, encountering additional hurdles. This is because, as Albrecht et al. (1992) explain, buyers generally prefer dealing with producers known for their reliable and effective distribution networks.

Beyond distribution, the availability of dependable suppliers for spare parts plays a crucial role in the decision of entry in a new market, as these suppliers enable manufacturers to quickly address operational issues and reduce costly downtimes. For newcomers in the industry, establishing trust and a strong reputation among these suppliers can take years, adding to the challenges they face.

Additionally, entering the boiler production market requires substantial capital investment to cover raw materials, employee wages, logistics, marketing, and R&D solutions to remain competitive.

However, there is a silver lining. The industry's low switching costs, due to the presence of numerous manufacturers with little market dominance in steam generating equipment, provide a unique opportunity for new entrants. They can capitalize on this by enticing customers away from competitors through incentives, price reductions, and enhanced service offerings. This strategy could help newcomers overcome initial barriers and establish a foothold in the market.

After examining the potential threats to entry as defined by Porter (2011), we can assess that the threat of new entrants in the boiler and manufacturing industry in the specific Italian context is moderate.



## 5. Threat of substitution

The assessment of the threat of substitution in the industrial boilers industry must also consider the sustainable trends that characterize the entire economy in the last years. With carbon emissions rising and causing harm to our planet through global warming, many world business leaders have pledged to make changes to help reduce their emissions.

One of the biggest changes businesses are undergoing is the switch from fossil fuels to renewable energy sources. Sustainable energy sources (e.g. solar, wind and water) can deliver a constant supply of renewable energy without emitting carbon emissions.

These alternative energy sources not only contribute to climate change, but they also have the added benefit of never running dry (hence the name ‘renewable’), unlike fossil fuels that will soon be used up. In particular, the industrial boiler market follows the trend of “green energy” not only because it is ecologically friendly but mostly due to cost efficiency. This direction should be considered as key perspective to meet the customer needs and save the market share.

There are a few options when it comes to make industrial boilers companies and provide sweat more sustainably. Below are some of the most common types of gas and oil boiler alternatives<sup>72</sup>.

### **Heat Pumps**

Unlike a traditional boiler, heat pumps don't require gas or oil as they solely use electricity. Should this electricity be from a renewable source, there will be no carbon emissions produced. However, most electricity sources use fossil fuels, meaning that heat pumps aren't entirely carbon-free.

### **Solar Heating Systems**

Whilst solar heating systems cannot eliminate gas usage, they can reduce it by up to 60%, which is a sizeable saving, especially if used across large numbers of companies. These systems use heat from the sun to warm hot water, even in colder weather, through solar collectors. The hot water is then stored in a tank, like a conventional boiler system.

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<sup>72</sup> <https://iheat.co.uk/boiler-help/renewable-energy-and-boilers>

## **Combi boiler**

A combi boiler is a type of boiler that can provide both hot water and central heating. They are also known as ‘combination boilers’ as they were originally designed to combine all the components of a traditional central heating system into one compact unit.

One of the main advantages of a combi boiler lays in its efficiency. Some modern combi boilers are built with a flue gas heat recovery system, that works by collecting the gas created by burning gas or oil and using it to heat water from the mains. This allows the system to burn less fuel and achieve an efficiency of over 90% in the process.

According to Porter (2011), the threat of a substitute is high if the substitute offers an attractive price and performance relative to the industry's product and the buyer's cost of switching to the substitute is low. In the specific case of the industrial boiler manufacturers, the threat of substitutes may be considered high since the trend in recent years is to implement renewable energy sources, as described above. Notwithstanding the fact that new boilers will be more attractive to the customers in terms of cost efficiency and low carbon emission, when it comes to changing types of gas and oil boiler for alternatives, the costs of switching to such systems are high due to the vast scope of the project scale and costs. Hence, what compensates and reduces the threat of substitution is the high cost of setting boilers based on “green energy”. Ultimately, the threat of substitute for industrial boilers market is medium, because, despite the attractive price and performance, switching costs are rather high.

Applying Porter’s Five Forces to the boiler manufacturing industry allow us to better understand the competitive landscape in which the industry is currently found. Specifically, summarizing results of Porters’ five forces model analysis at the boiler industry we can recognize that the level of attractiveness of the industry is medium, based on the average score among the five forces’ levels. The results are synthesized in *Figure 10*.

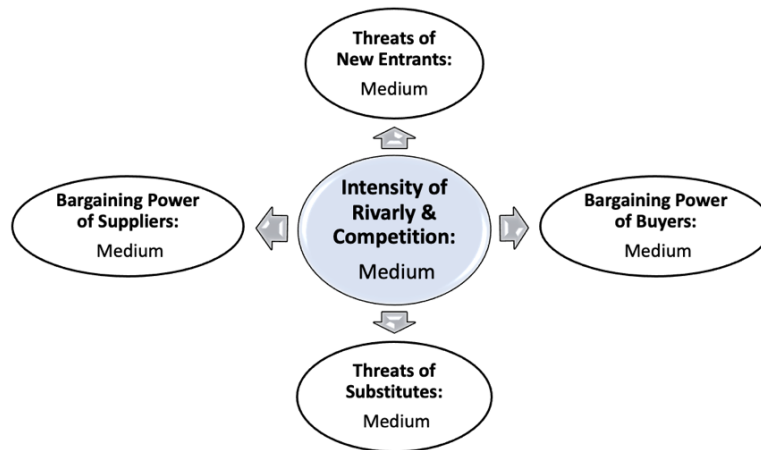


Figure 10. Porter's Five Forces applied to Industrial Boilers Market. Source: Personal elaboration of the author.

## 2.5 Results from PESTEL and Porter's five forces analyses

The PESTEL analysis, as well as the Porter's five forces one, are useful methods to obtain a comprehensive picture of the context in which an organization runs its business. The combination of these two analyses provides an even more detailed assessment. In fact, while developing the strategy requires an understanding of the macroenvironment, this understanding only provides half the picture; it is vital that it possess a comprehensive depiction of rivals, alternative products/ solutions, the bargaining power of suppliers and customers and the potential effects these elements may have on the firm. While the first types of information can be obtained through the PESTEL analysis, the second one requires five forces analysis to be done.

Based on the results of these analyses and in accordance with the goal of the thesis of analysing the basic steps of development of a new servitization business model for the selected industrial company, ICI Caldaie S.p.A., it is possible to identify the key takeaways from the correlated results of the two analyses above conducted:

- 🌍 The current market situation characterized by economic slowdown and geopolitical factors requires more efficient businesses in planning and controlling operational cost and in finding new ways of profitability;

- 🌈 Environmental and socio-cultural trends encourage to shift companies' mindset towards a more sustainable model. This trend also influences customers who are increasingly looking for “green energy” and for digital services necessary to create a personalized and, hence, sustained solution. While these factors represent an opportunity and favorably impact industrial companies in the B2B equipment manufacturing sector, favoring investments on the new digital servitization phenomenon; it is also important to consider that the “go-green” trend creates challenges in terms of substitutive products, new entrants, and competitive rivals. This requires incumbent firms to invest in new R&D technologies with the aim of modifying boilers to provide customers and the market with a new solution based on alternative sources of energy, as well as services that guarantee a constant control of the boiler settings, to avoid extra power in period of low production and to save energy, and a longer asset lifecycle.
- 🌈 Legal requirements set by government (and, specifically, the Italian government) are in line with all the trends described in the previous paragraph, calling for energy savings and resource optimization. Digital servitization represent a valid strategy to reach these targets.
- 🌈 New entrants threat together with the economic slowdown are bringing the risk of market share shortage. This risk leads companies in this sector to embark on a digital servitization journey as a differentiating strategy. Next to a competitive advantage, this economic paradigm also contributes to establish a collaboration with suppliers to decrease and optimize logistic cost and increase level of services provided by the company and with customers, who, receiving a personalized offering, set up long-term relationships with the firm.

All the elements lead to the conclusion that the path of digital servitization in the current market situation is not only the tendency to be modern and trendy but also a requirement to save the business profitability and adopt to the global changes.

## Chapter 3. Internal analysis: the ICI Caldaie S.p.A. case

This chapter is dedicated to the internal analysis of the company ICI Caldaie S.p.A., a leader in the production of domestic and industrial boilers, operating in the industrial equipment manufacturing sector analysed before.

The aim is to investigate the opportunities for the company the implementation of digital technologies will bring and to identify the new digital servitization strategy to be adopted in ICI Caldaie.

Specifically, the internal analysis of the company will include the following themes:

- ICI Caldaie S.p.A. description and history;
- Description of the products and services currently available in the company's value proposition;
- Identification of the current strategy, operations, and business model structure;
- Delineation of the new digital servitization strategy;
- Results of the SWOT analysis, for evaluating the convenience and suitability of adopting digital servitized strategies considering strengths, weaknesses, opportunities, and threats that characterize the company.

Chapter 4, instead, will focus on the definition of the strategy and business model *to-be* that ICI Caldaie S.p.A. intends to implement to successfully undertake the digital servitization path.

### 3.1 ICI Caldaie S.p.A.: description and history

ICI Caldaie S.p.A. is an Italian leading company that produces heating equipment. It has been on the market since 1958 and it specializes primarily in the production of boilers, modular boilers, hot water equipment, steam generators, burners, and chemical water treatment systems.

It was founded in the province of Verona, Italy, as a manufacturing company for high water content steel boilers. The peculiarity of this company is that it does not stand still and constantly strives for development. In 1997, the company began to expand and opened its first direct subsidiary in Salisbury, UK. Closer to 2000, the company became the largest manufacturer of boilers for centralized use in Italy. In 2004, ICI Caldaie expanded its product range by applying measures to reduce consumption, and to improve energy efficiency and cost management. The level of digitalization in the world was increasing every year and ICI Caldaie was not standing still. In 2009, the company announced the development of software and hardware for the launch of ‘Eterm’, a remote-control system for heat generation machines. A year later, concrete energy efficiency projects were already presented: *SIDERA 30*<sup>73</sup> and *CHP Net*<sup>74</sup>. The ‘SIDERA 30’ project proposed an innovative application of hydrogen as fuel, which is achieved by methane conversion. The Clean Hydrogen Partnership (‘CHP Net’; as per its legal name Clean Hydrogen Joint Undertaking) is a unique public private partnership supporting research and innovation (R&I) activities in hydrogen technologies in Europe. At the same time, ICI Caldaie became one of the top four operators in the steamship sector<sup>75</sup>: the company has always been characterized by high internal and external skills in technological industrial research, large production capacity and flexibility; this leads the firm to obtain this result. In 2017, the firm introduced the innovative ‘EcoVapor’ steam production system<sup>76</sup>. EcoVapor is the first steam boiler with a fully integrated burner designed with end users in focus. Due to the high degree of modulation offered by the EcoVapor model, the user can produce only the steam they really need, thus eliminating waste. Using the EcoVapor system enables lower operating costs, reduced emissions, and flexible production configurations without affecting the environment and society.

As its history demonstrates, ICI Caldaie is continuously researching and developing more and more highly reliable heat generators to keep pace with the technological development of mankind. Today it offers a full range of products on the Italian and foreign markets.

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<sup>73</sup> The Sidera 30 micro-cogeneration project using fuel cells, that is being developed by ICI Caldaie, is the perfect solution. This machine can replace boilers in centralized units by taking over their functions and integrating the production of electricity. <https://www.c-o-k.ru/library/catalogs/ici-caldaie/9944/27517.pdf>

<sup>74</sup> [https://www.clean-hydrogen.europa.eu/projects-repository/cistem\\_en](https://www.clean-hydrogen.europa.eu/projects-repository/cistem_en)

<sup>75</sup> <https://www.icicaldaie.com/en/company/about-us>

<sup>76</sup> <https://www.ecovapor.icicaldaie.com/en/>

## **Current value proposition**

The company offers a wide range of products and services tailored to meet the needs of residential, commercial, and industrial customers.

### Products:

1. Boilers: ICI Caldaie manufactures a variety of industrial and commercial boilers, including steam boilers, hot water boilers, thermal oil heaters, and biomass boilers. These products are designed for different applications and are known for their energy efficiency and reliability.

2. Heat Generators: The company provides heat generators that use different fuel types such as natural gas, diesel, and biomass. These generators are designed for applications requiring high-temperature thermal energy.

3. Burners: ICI Caldaie offers a range of industrial burners for various combustion processes. These burners are designed to deliver efficient and clean combustion, meeting environmental standards.

4. Solar Systems: ICI Caldaie also provides solar thermal systems for domestic hot water production and space heating, harnessing renewable energy to reduce carbon emissions and energy costs.

### Services:

1. Design and Engineering: The company offers engineering services to assist clients in selecting and designing the most suitable heating solutions for their specific needs.

2. Installation and Commissioning: ICI Caldaie provides installation and commissioning services to ensure that its heating and hot water systems are installed and operational according to industry standards.

3. Maintenance and Support: The company offers maintenance programs and technical support to optimize the performance and longevity of its products, ensuring reliable operation over time.

4. Training and Consultation: ICI Caldaie may also provide training for operators and maintenance staff on the use and upkeep of its heating systems, as well as consultation services for energy efficiency and regulatory compliance.

### **Company's mission**

With the wide value proposition above described the main mission of the company is to satisfy the needs of the consumers with the products and services included in its portfolio. This is achieved by continuous improvement of the company and the implementation of supporting new digital technologies applied to process and products. A large team, consisting of highly qualified specialists in the design and manufacture of complex high-tech thermal systems, strives to meet all customer needs and satisfy all requirements related to the management, monitoring and maintenance of the energy systems offered by the company.

The company's mission is supported by certain values that have been developed throughout the firm's lifecycle:

1. For ICI Caldaie, not only customer satisfaction is important, but also the environment. That is why, the company chooses solutions that are both environmentally friendly and economical.
2. It is also one of the company's values to go hand in hand with the client: the firm makes every effort to follow its clients from the early design stages to the realization of the final product. Using this method of cooperation, the company realizes a customized solution that integrates perfectly with the client's plant, allowing for significant improvements in terms of management and energy savings. With the same purpose, the company also offers to sign a maintenance contract that allows for routine inspections and protects the operation and functioning of the product over time.
3. Another important point in the firm's value system is certification. ICI Caldaie has a strong quality culture, which gives it the ability to be competitive in the market. The continuous improvement of the company has enabled it to obtain ISO 9001 certification, ASME certification, ISO 14001 environmental certification, ISO 45001 health and safety certification, CE certification and labelling, construction in



accordance with the Gas Equipment and Pressure Tanks Directives, as well as several national certificates for export to other countries. The certificates held by the company once again confirm the high quality of the products the company manufactures.

According to the company's mission previously described, the firm is committed to continuous improvement in terms of developments and, in turn, in transformations that need to be carried out to improve the organization of activities and increase the efficiency of the company.

Following its innovative essence and being aware of the increasing widespread of this trend, the company is now looking at digital servitization to take it to the next level and serve as a growth lever. The implementation of this new economic paradigm, however, requires a general reconfiguration of the firm's business model and structure, which is far from easy and follow a long evolution process. Before undertaking this path, it is essential to understand the current company's situation, to identify critical points as well as strengths, to be prepared to successfully experience the transition towards digital servitization and the necessary transformation. For this reason, the following paragraphs will be dedicated to the analysis of the present situation in ICI Caldaie S.p.A. The following chapter, instead, will perform an analysis of the strategy and the business model "to-be" the firm intends to implement.

### **3.2 Current strategy, business structure and operations in ICI Caldaie S.p.A.**

To deeply understand the business of ICI Caldaie, it is important to clarify the business approach, the structure and organization the firm has adopted to carry out its operations. This paragraph, indeed, aims at describing the current strategy, operations, and business model in ICI Caldaie S.p.A.

### 3.2.1 Methodology

For this purpose, we decided to conduct interviews with employees of ICI Caldaie to accurately comprehend the present situation and dynamics in the company.

We interviewed managers and employees at different organizational level and from various departments within the company (i.e., Sales department, Finance department, Project department and Engineering department) to gather a variety of views and assessments of the ICI Caldaie's structure and organization, current market position, as well as its growth opportunities and challenges, thus obtaining a complete and exhaustive analysis.

Specifically, the data collection process followed these steps: identification of the respondents, application of the interview, its transcription and further analysis with interpretation of the results.

Requirements for conducting interviews were determined *ex-ante*:

1. The employees surveyed should represent different departments to get the greatest variety of expert opinions and assessments. This was necessary to cover a variety of aspects of the development of the company and its services in the study, and to find out whether there are similar opinions on a particular issue (this will help in identifying the importance of problems).
2. Before starting the interview, the researcher should have asked the interviewee to state their position and relevant responsibilities, to understand in what way, the interview could be conducted.
3. Recording and further transcription of the interview was mandatory in order not to miss important details of the conversation.

We conducted a total number of 8 interviews with employees with experience ranging from 1 month to 5 years. We conducted the interviews in a face-to-face format in the main headquarter of the company. The duration of the conversation with each employee ranged from 7 to 60 minutes depending on the experience of the employee (the more knowledgeable a person is in his/her field of work, the more detailed answers we received).

The interviews were based on open questions (Appendix A), useful to guide and structure the discussion with the company’s contacts. *Table 3* below synthesizes the data related to the interviews.

Role in the company	Main responsibilities	Interview’s duration	Type of interview
Project manager	- to manage projects and orders - “after sales” control	60 min	Structured open questions
Sales department employees	- searching for new clients - managing old clients	40 min	Structured open questions
Head of the Management office and Program management office	- to support the clients during the project - to carry out and improve the efficiency of current business model	49 min	Structured open questions
Accounting and Administrative manager (Finance department)	- credit control - debt collection - budget preparation - interface with external consultants	20 min	Structured open questions
Research Lab employees	- developing a monitoring system - test on boilers and new prototypes - support the service department when there are technical problems with boilers or electrical problems with burners	34 min	Structured open questions
Technical department manager	- research and development - project management regarding the plants that are made outside	7 min	Structured open questions
After-sales service manager	- after sales service	15 min	Structured open questions

Table 3. Synthesis of the data collection method.

Once we had all the conversations with the company employees in hard copy, we proceeded to separate out unnecessary information that do not fit our research aim and to label the interesting themes and micro-themes that were useful for our research questions. Among the recurrent topics we identified were:

1. Relationship with suppliers;
2. Customer needs;
3. Value proposition;
4. Weaknesses and challenges.

In addition to highlighting themes, we made notes of important details in the employees' answers, such as experience in the company, aspects of work, position held and job responsibilities, to enrich our investigation.

### **3.2.2 Results of the data collection**

For each of the discussion areas we have identified, we analysed and synthesized the respondents' feedback to obtain an overview of ICI Caldaie's current situation.

#### **Relationships with suppliers**

ICI Caldaie has different relationships with its suppliers. In particular we can distinguish three main types of relationships:

1. Provision of raw materials and components: in this case, the suppliers provide their products at a fixed cost and *'you cannot negotiate'* (Engineer, Technical department). Thus, the relationship with such suppliers is standardized and follows clear norms on deadlines. Such supplying companies may occasionally delay their deliveries, but given their monopoly in the raw materials market, ICI Caldaie continues to use their services in such cases.
2. Engineering and system design assistance: the company has historical partnerships with these suppliers, and in this case the company can negotiate regularly according to the project it has to realize, being able to *'achieve a good value for money'* (Engineer, Technical department).
3. Project implementation partnership (work on construction sites, transportation of equipment): in this case, partners have a certain power over decision making in projects because *'they do something that ICI is not able to do internally'* (Engineer, Technical

department). Hence, suppliers can take advantage of their position and disrupt project deadlines because the company is dependent on them.

### **Customer needs**

To be successful, ICI Caldaie must fulfil customers' needs and requests. From the interviews with internal managers and employees, several aspects of the clients' needs and desires emerge:

1. Customers of companies such as ICI Caldaie are not just looking for a product, but for *'a complete solution for a specific request that gives them economic advantages and that respects environmental legislations'* (Sales manager, Sales department), *'clients are asking more and more for customized implementations'* (R&D specialist, Research Lab). The search for individualization and the desire for a quality user experience is one of the trends that show customers' attitudes towards companies' products in the 21st century, which can be seen even in the industrial sector of the economy.
2. Customers increasingly look for integrative and supporting services after products' purchase. In fact, it is much more convenient for the buyer of a product to address various queries to the manufacturer of it. Customers want *'after-sales contracts'* that include warranties for the care of the equipment and the ability to receive technical support and assistance in case of necessity (Engineer, Technical department). This relates to the fact that the manufacturer knows best the mechanics and peculiarities of its products, and according to such competence, it can offer the most suitable configuration of solutions for the customer according to the specific need.

### **Value proposition**

The company's goal is to satisfy customers' needs and requests with its products and services. Its value proposition, thus, has been designed accordingly:

1. A special feature of the company is the diversity of its commercial offers: ICI Caldaie responds very flexible to customer requests, *'sometimes even too flexible'* (R&D specialist, Research Lab). The individuality of the realized projects, the ability to create something unique according to non-standard customer requests and *'the ability to personalize the product itself can be an advantage of ICI Caldaie among competitors'* (Sales manager, Sales department).

2. ICI Caldaie offers a whole set of products, a complete technological ecosystem instead of a single product. For example, the company can provide the customer not only with a boiler, but also with a complete thermal unit (boiler, central component and corresponding burner, whose performance is guaranteed). This way, the company is *'not just providing products or services but providing customers with complete solutions'* (Head of the Management office and Program management office), being able to solve the customer's problem comprehensively and, in turn, increase its profit.

3. ICI Caldaie proposes a remote monitoring system: the quality of such diagnostics service can improve the quality of its products as quickly as possible. This service is under demand among the clients, but the company needs to understand *'how to promote it'* (Head of Project management department). The Research Lab staff is also constantly working on improving the existing technical diagnostics system and *'developing a range of similar software services in line with technological advances and customer requirements'* (Engineer of Technical department). Moreover, pricing for this solution has not been identified yet and possibly, the prices established by ICI are at low level comparing with the competitors.

### **Weaknesses and Challenges**

Although the continuous strain of the firm for being competitive and remain innovative in the industry, it also faces some challenges and present weaknesses.

1) The company does not have the most proper production structure: the commercial offers in the firm's portfolio are too many, and the great variety of configurations entails additional costs. The production processes are set up in such a way that difficulties appear literally at every stage of production and often *'the company cannot fully follow the customers' requests'* (Head of the Management office and Program management office). So, ICI Caldaie faces difficulties from the very beginning with the design of the best proposal for the client, as it takes a long time to estimate delivery times, calculate costs and design times, as the product components are not universal and new drawings are required for each personalized project. Also, due to the wide variety of equipment, it is difficult to implement machine analytics to make the use of the products as convenient as possible for customers.

2) As a consequence of the previous point, therefore, another challenge in production and in particular at ICI Caldaie is to meet the customer deadlines. Such difficulty arises

with customized designs, which are difficult to predict in advance, and *'the development of drawings and then the production of the product is entirely dependent on ICI Caldaie's largest supplier, Davcoil, which often delays the deadlines'* (Head of Project department). This can lead to serious reputational and financial costs for ICI Caldaie. Also, suppliers' products are made to order, and this complicates the process of supplying components.

3) Unfortunately, there is now a shortage of personnel competent in industrial equipment. Sales staff do not always understand the essence of the customer's needs and offer a solution *'that seems right to them but not to the customer'* (Engineer, Technical department), which leads to the previous problem with too large a variety of configurations. Instead of finding a quick and optimal solution, customers are often offered unnecessary add-ons and services, making it more difficult to use the company's products.

4) Currently, it is quite difficult for the company to develop and organize in-line production due to various costs caused by the great variability of the company's products mentioned before. While ICI Caldaie offers its customers a huge range of commercial offers, which are difficult to implement in integration due to the uniqueness of the projects, *'the costs of production do not leave room for investment in the development of the organizational structure of the company'* (Head of the Management office and Program management office).

The numerous discussions and meetings with employees and managers from various departments of ICI Caldaie allow us to build the company's business model *as-is* and discuss the results and key metrics with the company's management, to understand what the main criticalities are and what can be improved. The description of the business model's dimensions in the ICI Caldaie *as-is* situation is provided below. To complete the analysis, we also performed a SWOT analysis, to understand whether, which and how to implement business changes. Description and analysis of the SWOT is reported in the next paragraph.

### 3.2.3 ICI Caldaie's business model *as-is*

Based on a large amount of data obtained because of internal analysis of the company and interviews with key respondents, we were able to clearly define the current business model of the company. The synthetic visualization of the model is presented below in *Figure 11*.

<p><b>KEY PARTNERS</b></p> <ol style="list-style-type: none"> <li>1. Producers (ESCO);</li> <li>2. European community or other institutions;</li> <li>3. CAT (technical assistance);</li> <li>4. Logistic providers.</li> </ol>	<p><b>KEY ACTIVITIES</b></p> <ol style="list-style-type: none"> <li>1. Production and selling of boilers;</li> <li>2. Research &amp; Development of new solutions and prototypes.</li> </ol>	<p><b>VALUE PROPOSITION</b></p> <p>Services:</p> <ol style="list-style-type: none"> <li>1. High quality products;</li> <li>2. Basic after sales services;</li> <li>3. Consultancy;</li> <li>4. Training of the customers.</li> </ol>	<p><b>CUSTOMER RELATIONSHIP</b></p> <ol style="list-style-type: none"> <li>1. Transactional relationships.</li> </ol>	<p><b>CUSTOMER SEGMENTS</b></p> <ol style="list-style-type: none"> <li>1. Final customers (industrial companies = 40%);</li> <li>2. Private residences</li> <li>3. Organizations (hospitals, schools, etc.)</li> <li>4. Distributors (including abroad).</li> </ol>
<p><b>KEY RESOURCES</b></p> <ol style="list-style-type: none"> <li>1. Tangible: <ul style="list-style-type: none"> <li>• Production spaces and equipment</li> <li>• Software for data</li> <li>• People and Soft skills</li> </ul> </li> <li>2. Intangible resources: <ul style="list-style-type: none"> <li>• Experience and technical knowledge.</li> </ul> </li> </ol>		<p><b>CHANNELS</b></p> <ol style="list-style-type: none"> <li>1. Direct: - personal sales - web sites - phone and e- mails</li> <li>2. Indirect: - distributors (Italy) - dealers (abroad).</li> </ol>		
<p><b>COST STRUCTURE</b></p> <ol style="list-style-type: none"> <li>1. Operational costs (raw materials, employees, logistics, marketing);</li> <li>2. Investments (R&amp;D projects).</li> </ol>		<p><b>REVENUE STREAM</b></p> <ol style="list-style-type: none"> <li>1. Product;</li> <li>2. Services (spare parts);</li> <li>3. Transportation.</li> </ol>		

Figure 11. ICI Caldaie business model 'as-is'. Source: Personal elaboration of the author.

Key partners:

Partnerships with suppliers of raw materials, components, and technology are essential for ensuring a reliable supply chain and maintaining quality standards.

One of the key partners of ICI Caldaie is Esco Lifesciences Group which provides comprehensive and reliable services to clients that include dependable inventory of ready parts, technical support, field-based engineering, factory engineers, and after sales representatives. Esco service engineers have extensive experience and undergo up-to-date



trainings, certified field service representatives who can service many kinds of equipment.

Moreover, in order to develop cutting-edge, innovative solution for the provision of heating system, ICI Caldaie often works in partnership with universities and research centres. In the last years, to meet new customers demand and emergent trends, they started working in two directions: sustainability and green Energy by collaborating in different projects as a member of European communities together with European Union Funding for Research & Innovation.

ICI Caldaie also cooperates with service companies, technical support providers and installers (CAT – Technical Assistance centres) in regions without its own representative office to provide comprehensive after-sales services and to provide customers with efficient and reliable support.

Moreover, the company engages with industry associations to learn about best practices, comply with standards and track developments in the industry.

Finally, collaborating with logistic companies helps ICI Caldaie widening sales channels, promoting its products, and ensuring efficient and effective distribution to customers in various regions.

#### Key activities:

To carry out its core business, the most important activities performed within ICI Caldaie are:

- 1) Production and selling of boilers. The company manages production manufacturing facilities, controlling product quality as well as compliance with industry standards. Sales activities include managing relationships with distributors and dealer networks to promote and sell products to various customer segments;
- 2) Research and development: engaging in continuous research and development activities to innovate, enhance product performance, satisfy precise and customized customers' requests, and introduce new energy-efficient and eco-friendly heating solutions;
- 3) Development of hydrogen project with EU communities done by R&D department of the company to meet the market requirements: the development of hydrogen-based heating technologies (innovative boilers) which is an important

strategic direction to face the challenges identified through the Porter's five forces analysis and the PESTEL analysis: in era of "green energy", it is important to change modification of equipment based of alternative energy sources in order to cover market needs and create an image of "environmentally loyal" company.

Value proposition:

ICI Caldaie's offering is composed of different elements:

- Production and sales of high-quality boilers: the high quality of products attracts customers, especially in such a segment of the economy, when in many cases customer's own productivity and profit depend on it;
- Services: the company has a wide range of after-sales services, which makes it really special for customers (installation, spare parts, warranty). Services enable ICI Caldaie to '*manage with our customer their working space and working time*' (Engineer, Technical department). All services are presented in standard form, via call center, where customers call in case of problem. In the one hand it guarantees clear and direct communication with the client and deeper understanding of the problem, but on another hand, it requires more efforts from ICI to resolve them and control the number and quality of how them have been resolved and at what level of cost.
- Consultancy: sales staff and engineers advise the company's clients in order to take into account all the wishes and propose and develop an individually suitable project. This proposition is successful mainly because '*the customer can feel lack of technical competence, so he relies on the supplier for that*' (Engineer, After-sales service);
- Training of the customers: after the project is completed, the company's employees explain in detail the specifics of using the products and are also ready to re-advise the buyer in any situation and provide assistance to customers that '*don't have technical skills, nor environmental laws knowledge, they rely on the company for that*' (Sales manager, Sales department).

Customer relationship:

According to the sales channels, products are sold to customers both directly and through distributors.

In both cases, transactional relationships are a strategy that aims to increase efficiency and volume of point-of-sale transactions. ICI Caldaie uses this approach by focusing on making the sale, rather than forming a long-term relationship with the customer by providing guarantee and accidental maintenance including consultancy services. Once the business completes a transaction, there is no further economic interaction with the customer.

#### Customer segments:

The firm caters to different categories of customers, offering its products for both commercial and domestic uses. Specifically, ICI Caldaie serves:

1. Industrial and commercial enterprises that require industrial-scale heating and hot water solutions (such as manufacturing facilities, commercial buildings). Such clients *'have a strong decision power'* (Engineer, Technical department) and show interest to digital services and prove demand in not only products, but customized solutions;
2. Private residences (individual homeowners and residential property developers) that seek energy-efficient, reliable, and sustainable heating and hot water systems for residential properties;
3. Distributors, through which ICI Caldaie extends its market and supplies its products to medical institutions, educational institutions, and hotels, as well as clients abroad.
4. Organizations (hospitals, schools, etc.) are also the targeted segments as company supply boilers there although ICI Caldaie does it via distributors, but the market share of such clients is sufficient despite the fact that it is difficult to have direct communication with them and to understand their needs better.

#### Key resources:

A key defining characteristic of a business's net worth and operational value depends on its assets. In properly managing its tangible and intangible assets, a company can maintain a healthy balance sheet and ensure operational success. To that end, succeeding in asset

management directly increases an organization's value. In order to guarantee high-level products and services, it is crucially to own specific equipment. ICI Caldaie can boast a huge production capacity thanks to over 30,000 square meters of indoor space outfitted with some of the most advanced equipment and machinery to produce boilers.

In addition to this great technical and productive potential, ICI Caldaie can count on well-experienced human resources and on a sales team of specialized technicians who can offer their expertise in the assessment, sizing or upgrading of heating systems. In accordance with the information from the company website, *'ICI Caldaie is a dynamic company, characterized by high internal and external skills in technological industrial research, great production capacity, and extreme flexibility in terms of design and production of 'turnkey' solutions, oriented to choices that allow our customers to be more competitive in their business'*<sup>77</sup>.

#### Channels:

ICI Caldaie reaches its customers exploiting both direct and indirect channels.

In the former case, the company has its own customer base and carries out commercial offers directly. Sales are also made through the company's website, having studied it, you can write an email or call the sales department hotline. Company has its own six sales offices in Italy, United States, United Kingdom, Romania, Ukraine, and Kazakhstan<sup>78</sup> that manage the orders made by clients.

In the latter case, ICI Caldaie collaborates with authorized distributors and sales representatives – that allows expand new markets abroad and provide localized customer support<sup>79</sup>.

#### Cost structure:

There are two mainstreams of expenses operational and investment. The former contains raw materials for equipment production, professional skills of engineers, warehousing and logistic, marketing and promotion. The latter is related to money the company spends

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<sup>77</sup> <https://www.icicaldaie.com/en/>

<sup>78</sup> [https://www.icicaldaie.com/en/locations/?jsf=e-pro-loop-builder&tax=tag\\_sedi:152](https://www.icicaldaie.com/en/locations/?jsf=e-pro-loop-builder&tax=tag_sedi:152)

<sup>79</sup> [https://www.icicaldaie.com/en/locations/?jsf=e-pro-loop-builder&tax=tag\\_sedi:152](https://www.icicaldaie.com/en/locations/?jsf=e-pro-loop-builder&tax=tag_sedi:152)

for R&D projects for the modernization of boilers and to provide customers with personalized solutions.


#### Revenue stream:

In ICI Caldaie, the main revenue streams are based on the sales of products(boilers) and basic services (mainly spare parts sales). Next to these voices, the company obtain an income also through logistic services: specifically, by providing the customers with transportation of boilers or spare parts for them on demand.

The above description and definition of the business model *as-is* served as a crucial foundation for strategic planning, performance assessment, and the formulation of future business strategies and initiatives. By knowing the company's starting point, we have laid the foundation for potential innovation and the evolution of the company's business model o embrace the digital servitization paradigm and to remain competitive and relevant in a changing business landscape.

### **3.2.4 Opportunities for improvement**

From the analysis of the BM *as-is* and the interviews made with managers and employees, it can be observed that there are several opportunities for ICI Caldaie to improve its business activities and performance, leading to a more solid position in the market:

 Improving after-sales service to customers is one of the company's growth opportunities: Very often customers do not know how to properly handle certain equipment, and ICI employees can *'not only repair their units in a timely manner, but also advise customers on the specifics of using their products'* (Head of Project department). It is necessary not only to provide timely technical assistance and *'advice to the customer over the phone'* (Manager of Sales department), but also remote monitoring and assistance, real-time monitoring to understand how the boiler is operating, preventing problems, and solving problems as they arise. Apart from quality, it is necessary to develop the speed of service (especially in the remote branches of the company) so that customers can quickly get help when requested – *'increasingly, help is needed as quickly as possible, and ICI Caldaie does not have*

*many representatives in the branches to provide fast and timely maintenance services*' (R&D specialist, Research Lab). This situation requires an increase in qualified personnel, for which it is necessary to look for new employees and train them through internal courses. Improving the technology base of service centers can further speed up customer service. In addition, it is necessary to provide after-sales service in other territories of the company's presence, not only in Italy – *'this will increase the company's accessibility to customers (speed of intervention, reduction of transportation costs)'* (Head of Management Office and Program Management Office).

🌈 ICI Caldaie's project management department is already developing a package of services that will cost a certain amount of money rather than being provided for free, that represent an opportunity to innovate the value proposition. It means that the firm can expand its offering by developing service packages that can be sold to customers who are not yet planning to purchase a product such as model of boiler constructed in accordance with customer requirements like production line capabilities and plant space: providing more services will have a positive impact on the company and is an opportunity for growth because *'quality services will encourage customers to contact the company not only for a one-off service, but also for a product or a complex project'* (Accounting and Administrative manager). Also, the development of a unified product catalogue of complex solutions to the most popular customer requests can support the firm in the revision of the production structure, thus saving resources and optimizing other business processes.

🌈 Another great opportunity for ICI Caldaie is represented by the development of the digital customer service area by improving the electronic platform for technical support, collecting information from customers about the most popular errors and breakdowns and, thus, improving the quality of online support. In fact, from the interviews it emerges that *'customer training and optimizing customer use of equipment for specific conditions should be included in the service package'* (Head of the Management office and Program management office).

🌈 A financial accounting system for projects with a clear system for estimating the costs associated with providing services needs to be developed because the ratio of

cost to solution provided can increase dramatically depending on the complexity of the service. The company should develop a tariff system by which projects can be priced in advance – *‘so that the financial part of the project does not change from case to case’* (Accounting and Administrative manager). This approach to financial activities will greatly simplify the project implementation process and negotiations with clients, as well as help to use resources efficiently and optimize costs.

We can hence conclude that the absence of changes in the company's strategy may lead to the loss of customers in the future: the ambition of creating a unique offer for each specific request of clients requires an adaptation of the company's current structure.

In conclusion, according to the factors that characterize the context in which it operates and the opportunities for improvements identified, the analyses performed suggest that ICI Caldaie should make a step forward embracing the digital servitization trend. This requires a reconfiguration of its commercial offerings, developing and providing integrated product-service systems and, consequently, an adaptation of the business structure, to ensure the successful company's transformation.

### **3.3 ICI Caldaie S.p.A.: analysis of the context with the SWOT analysis**

To enrich the analysis of ICI Caldaie S.p.A., obtain a complete overview of the firm's position and status, and better understand whether the digital servitization may represent a viable strategy for the company, we also conducted the SWOT analysis.

The SWOT analysis is an analytical framework, invented in the 1970s, that allows to assess the competitive position of an organization or a project, identifying areas where it can be improved and risk to avoid and developing the proper strategies based on this assessment to identify. Specifically, it supports managers and, generally speaking, companies in detecting strengths, weaknesses, opportunities, and threats, guiding the decision-making process. These four spheres give the name to this tool, creating an acronym.

### 3.3.1 Methodology

After getting detailed answers from employees to our questions about the company and dividing the information received into several topics, we built a SWOT analysis of the company, using in some aspects the information received from employees and external factors, already discussed above in the PESTEL and Porter's Five forces analyses.

The information received expand the knowledge about the position of the company in the market, allowing also to determine the long-term prospects of the company.

### 3.3.2 Results

The result of this analysis in ICI Caldaie are synthesized in *Table 4* and presented in more details below.

Strengths	Weaknesses
<ul style="list-style-type: none"><li>• Ability to realize unique projects, in contrast to competitors;</li><li>• Remote monitoring system, which allows to collect information about the product and improve its quality;</li><li>• Comparably inexpensive products and services;</li><li>• Ability to detect problems in advance and eliminate them promptly (advantage for customers);</li><li>• Ability to customize equipment for specific conditions to maximize performance;</li><li>• Ability to implement large-scale projects at the level of an entire</li></ul>	<ul style="list-style-type: none"><li>• Difficulty in meeting agreed deadlines with customers;</li><li>• Excessive flexibility in design, which complicates equipment design and delivery, as well as after-sales service;</li><li>• Dependence on some regular suppliers, which can delay the manufacture or transportation of equipment;</li><li>• Staff starvation, insufficient number of qualified technical staff for such diverse orders;</li><li>• Absence of some services as paid services, some of the services are provided free of charge.</li></ul>



<p>industry, not just private client requests;</p> <ul style="list-style-type: none"> <li>• Trusting relationships with suppliers.</li> </ul>	
<p><b>Threats</b></p> <ul style="list-style-type: none"> <li>• Lack of relevance among a large part of customers, as there are already companies on the market offering simpler and clearer complex solutions;</li> <li>• Dependence on suppliers may lead to reputational losses for the company, as cases of delays occur quite regularly;</li> <li>• Technological lagging behind younger competitors may lead to the loss of some private clients in the future;</li> <li>• Difficulty in calculating all possible costs of providing certain services and products, which may significantly increase costs.</li> </ul>	<p><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>• Creation of complex solutions for customer requests, not just a product and a small set of services for it;</li> <li>• Development of the catalogue, providing more services;</li> <li>• Product simplification, striving to create several optimal solutions that can be customized for the customer already during the installation process, not at the design stage (this will simplify logistics and production time);</li> <li>• Training of technical staff and quality customer consulting;</li> <li>• Expansion of service points in other countries where the company is present, which will make it more accessible and attract new customers;</li> <li>• Developing several company proposal models that take into account all costs depending on the complexity of the project;</li> <li>• Improving the quality of the digital services provided, as this will simplify the</li> </ul>

	<p>use of the products and improve the customer experience;</p> <ul style="list-style-type: none"> <li>• Exploring new technological solutions and adapting them to the already established remote monitoring system, developing the remote monitoring system.</li> </ul>
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Table 4. SWOT analysis in ICI Caldaie S.p.A. Source: Personal elaboration of the author.

### Strengths

The company has gained a large number of customers due to its advantages at different stages of production. In the design process, ICI Caldaie offers the possibility of realizing unique projects (including projects of large scale – at the level of the whole industry), customization of products for specific customer goals. Company's assistance encompasses both the pre-sale and post-sale areas, '*ensuring comprehensive support for customers' thermal needs*'<sup>80</sup>. Flexibility and customizability of the commercial offer allows to cover different customer segments, and relatively inexpensive products and services are an additional advantage. Trusted relationships with suppliers allow to achieve the most favourable terms of supply of components, which greatly simplifies the production process.

After the installation of products, the company provides tools for after-sales service of customers, which allows the company to get additional profit. Even at the stage of boiler operation, the company has implemented an important tool that attracts customers – a remote monitoring system that allows collecting information about the product and improving its quality: '*today our solutions are innovative, connected (therefore monitorable and adjustable even in real time) and continuously improvable, always evolving to allow every company to unleash its potential*', as it says on the company's webpage<sup>81</sup>.

<sup>80</sup> <https://www.icicaldaie.com/en/about-us/>

<sup>81</sup> <https://www.icicaldaie.com/en/about-us/>

## **Weaknesses**

However, the challenges that the company regularly faces now can seriously slow down or prevent it from incorporating new digital technologies into its growth strategy. Penalties and other financial costs in the absence of a good development strategy will prevent the necessary research and implementation of digital tools. The staff hunger that exists in the market now additionally complicates the work on service maintenance – there are not enough qualified personnel to provide quick service to all customers. This situation has arisen from several reasons.

First of all, excessive flexibility in design does not always contribute to quality customer service – deadlines are delayed due to project approvals and the production process does not move, while downtime in production incurs additional costs. Over-loaded designs are still quite difficult to satisfy, as engineers need to be dedicated to the numerous nuances of the equipment, which requires additional time. According to the Head of Project management department, *'it is not a company structured for designed solution, design projects'*. The staffing famine that now exists in the marketplace further complicates service operations: there is not enough qualified personnel to provide fast service to all customers. As a result, service activities of unique projects can take a long time due to the necessity to group technical masters from different departments and to provide exclusive dedication to the specifics of the project.

Secondly, the company provides most of its services for free, while competitors have a clear price list. Reorganization of the company's financial and project structure is seriously needed to value the whole company's offering, including not only the assets (i.e., boilers) but also services. It is important in terms of digital servitization path because without clear pricing it would be difficult to sell services.

## **Threats**

One of the main general risks for a company is to implement a strategy not sufficiently structured: an inept strategy leads to difficulties in calculating costs, and in such

conditions, it becomes simply inappropriate to develop certain business segments, as the priority is to keep the company profit-making.

It is important to consider that boilers' production is rather complex and almost every order has specific requirements to organize production process very well to avoid extra costs for size and modernization. Since there is no standard solution for it, planning the solution must be done more precisely considering all the specific request of the customer's order. For designing and guaranteeing an optimal solution, suppliers also play a key role. In this scenario, supplier dependency could be a serious problem for ICI Caldaie and turn away some more customers due to the cases of delayed deliveries in production that happen regularly, and this is an important reputational risk for the company.

In addition to long resource-intensive production, the company is seriously hampered by the lack of investments in new developments and optimization. Technological lagging behind younger competitors may lead to the loss of some private customers in the future, who now, despite all the shortcomings, continue to use the services of ICI Caldaie. This risk is partly related to a problem in the financial segment of ICI Caldaie, which is also a challenge for the company. The disorganized financial structure of the business, already described in the 'Weaknesses' paragraph, suffers from the fact that the cost of the final product is quite difficult to calculate at the stage of commercial offer since often there are additional costs during production, transportation, and installation (component delays, price increases, supply cancellations, other external factors), that are not included in the initial cost. The difficulty of calculating all possible costs can significantly increase the costs of projects, and profits are allocated to closing such costs rather than to possible improvements. Thus, there is a rather serious risk for the company that one day, due to such multiple costs, the business will stop being profitable.

## **Opportunities**

Given the existing threats for the company, it is possible to put forward several possibilities that arise if the companies properly face the challenges and risks. By solving problems and improving already well performing business areas, the company can reach the highest level in its segment.

First of all, ICI Caldaie needs to seriously engage in the development of new commercial offers - to develop its own catalogue, with a varied company's offers, to which configurations and additional services can be matched. Such catalogue should be accessible and understandable for both customers and employees, so that the former ones can easily get advice and make a choice, and the latter ones can correctly calculate the possible costs and the number of resources required.

Improvements should also apply to possible configurations/additional services: the final offer should include absolutely all necessary services and options required by the client. In some cases, customers with a 'unique case' do not need a 'unique product', but only the right configuration of services for it. The company can develop several optimal solutions that can be customized for the customer already during the installation process, rather than during the design phase, and this will simplify logistics and production time. In this way, the combination of the product and its services will be both unique for customers and convenient for technicians without additional design and complication of the product mechanics.

The exploitation of products and services in multiple configurations will also free up a lot of human resources: it will be possible to better train customer advisory staff to understand more aspects of a company's products, and technicians will be able to concentrate on a few specific schematics and drawings, resulting in faster customer service.

Furthermore, ICI Caldaie has already taken a big technological step by developing its own remote monitoring system. The company can improve it by incorporating the latest technological developments into the system and adapting it to the needs of the industrial sector. The use of new technological solutions can also be applied to the company's activities with the aim of making it more convenient and accessible for customers to use the product. Technological convenience will attract even more customers, as today usability and technology are one of the most important aspects when choosing a company in any sector of the economy.

Moreover, as underlined before, one of the main opportunities is represented by the expansion of service offerings. The company positions itself as an international firm, and therefore customers from any part of the world may require supportive services. By

investing in value proposition expansion, the company will make its products even more accessible to potential customers, at least because logistics costs will be reduced.

The SWOT analysis applied to the ICI Caldaie case and above described helps in identifying possible strategies for the company's development, revealing that digital servitization represent a paradigm that ICI Caldaie is ready to exploit. Moreover, the SWOT represents a useful framework that can support the company's management in identifying the direction of adaptation current business model to the new paradigm of digital servitization.

In synthesis, the internal analysis of ICI Caldaie carried out in this chapter as well as the examination of the context in which it runs its business, performed in Chapter 2, support the intention of the company to further develop its business in the direction of digital servitization, exploiting the large customer base that already trusts the company and is confident in its reliability and quality and leveraging the level of technological development.

Undertaking this new strategic approach will support the company in maintaining competitiveness and establishing long-term, strategic relationships between suppliers, customers, and financial intermediaries in the supply chain, thanks to the provision of personalized solutions, based on product-service systems, that allow to satisfy customers' specific needs.

With this right strategy, the above-described risks will be mitigated and the opportunities and advantages deriving from the digital servitization paradigm can be exploited.

## **Chapter 4. The ICI Caldaie S.p.A. case: transition towards digital servitization**

The results of the external and internal analyses of ICI Caldaie S.p.a. conducted in the previous chapters allow to deeply understand the context in which the selected case runs its business as well as the characteristics and the various aspects of its current operational BM (i.e., business model as-is). These analyses not only enable to obtain a comprehensive overview of the key aspects of the company's current functioning, but they also reveal that both external and internal factors suggest the necessity of innovate firm's strategy and structure, pointing out the digital servitization trend as a potential alternative and advantageous economic paradigm to apply.

The implementation and exploitation of digital technologies and the expansion of the value proposition of the company including digital services, however, require an adaptation of the entire BM, as well as a change in the corporate strategy and culture. This reconfiguration is far from being simple; rather it consists of an evolutionary process over time, progressively modifying the strategic approach, designing, and providing the right digital services for ICI Caldaie's clients, and adapting the different components of the BM accordingly.

Based on this consideration, the aim of this chapter is to ultimately present the new digital servitization strategy ICI Caldaie's intends to implement, the new digital services it desires to propose to its industrial customers, as well as an analysis of the changes in the BM components the company needs to integrate to successfully achieve the digital servitization transition.

First, the company's goals are outlined, emphasizing the need to enhance customer experience, streamline operations, expand market reach, foster innovation, and ensure sustainability. Then, we explore the introduction of new digital services aimed at revolutionizing customer interactions with ICI Caldaie's products and brand. These services include predictive maintenance, optimal selection of the boiler, optimal boiler setting and regulation. Moreover, the chapter further digs into the expected BM

adjustments necessary for successfully implement the identified digital services. Specifically, each dimension of the Business Model Canvas is analyzed in the context of digital transformation, highlighting shifts and changes compared to the traditional settlement of ICI Caldaie's operational structure (described in the previous chapter).

Finally, to assess the firm's readiness for the implementation of the digital services and the consequent BM adaptation, this chapter will use matrices for comparing internal resources and competencies with those required to analyze a company's readiness for change. This analysis allows ICI Caldaie's managers to identify gaps, prioritize investments and develop a roadmap for the successful implementation of digital services.

Overall, this chapter illuminates the strategic direction and BM evolution of ICI Caldaie as it navigates the digital servitization landscape, aiming to stay ahead of market trends and deliver unparalleled value to its customers.

Consequently, this chapter is structured in the following way:

- Digital servitization goal and strategy to-be in ICI Caldaie S.p.A.;
- Identification of the new digital services to be included in the value proposition of the firm to offer industrial clients integrated and personalized solution;
- Description of the BM to-be;
- Assessment of the readiness of ICI Caldaie S.p.a. to the digital servitization paradigm.

## **4.1 Digital Servitization goal and strategy to-be in ICI Caldaie S.p.A.**

In an era dominated by rapid technological advancement and shifting market dynamics, traditional manufacturing companies are increasingly turning towards digital servitization as a strategic pivot to enhance value creation and competitive positioning (Baines et al., 2009). ICI Caldaie S.p.A., a stalwart in the production of industrial heating systems, stands at a critical juncture where integrating digital services into its core offerings is not



just an option but a necessity to align with contemporary market trends and drive profitability, as emerged from previous analyses performed in Chapters 2 and 3.

Specifically, the push towards digital servitization in ICI Caldaie is driven by several compelling factors, among which:

- **Alignment with market demands**

Today's industrial markets are characterized by rapid technological advancements and a strong push towards digitalization. Industries are increasingly looking for integrated solutions that not only perform their primary function but also contribute to operational efficiency and data-driven decision-making. Digital servitization meets these demands by transforming traditional products into smart, connected systems that offer significant added value through enhanced functionalities like real-time monitoring, predictive maintenance, and automated control<sup>82</sup>. This trend impacts ICI Caldaie by calling for a transformation from traditional manufacturing to providing smart, connected solutions that enhance operational efficiency, enable data-driven decision-making, and offer significant added value to customers. This approach is more aligned with current market trends compared to traditional strategies such as increasing physical production capacity or expanding product lines without adding digital capabilities. A strategic shift in this direction may foster a sustained competitive advantage and growth in ICI Caldaie and, hence, can support its better positioning in the modern industrial market.

- **Enhanced customer value**

Digital servitization transcends the provision of mere equipment by offering comprehensive solutions that improve customer operations. For example, through digital servitization, ICI Caldaie can offer systems that predict when maintenance is needed, thereby reducing downtime and repair costs for customers. This proactive service not only increases the lifespan and efficiency of the heating systems but also ingratiates customers to the ICI Caldaie brand, enhancing their loyalty and satisfaction. Such value creation is difficult to achieve through other strategies that focus solely on product features without considering the ongoing service relationship.

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<sup>82</sup> Industry 4.0: Building the digital enterprise. 2016 Global Industry 4.0 Survey by PWC. URL: <https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf>

- **Sustainable development goals**

Digital servitization provides a sustainable competitive advantage by creating barriers to entry and increasing customer commitment. Once digital service models are developed, they can be rolled out to new and existing customers with minimal additional cost. This scalability allows ICI Caldaie to expand its service offering more efficiently than if it were to expand through physical infrastructure or new product development alone. Moreover, once customers are integrated into a service-based ecosystem, the cost of switching increases due to the high degree of integration of ICI Caldaie's digital services with their day-to-day operations. This integration is not easily replicated by competitors. Finally, the constant flow of data from customers collected through cutting-edge technologies provides ICI Caldaie with valuable insights that allow it to continuously improve and personalize its offerings, thereby outperforming competitors who still rely on more traditional BMs.

- **Revenue growth and diversification**

Unlike strategies that rely heavily on one-time product sales, digital servitization opens diversified and stable revenue streams through subscriptions, usage-based models, and service contracts along the entire asset lifecycle. These recurring revenue models provide financial stability and predictability, which are advantageous during economic downturns when new product sales might decline.

While other strategies may provide incremental growth or temporary market advantages, digital servitization promises a comprehensive transformation of ICI Caldaie's BM. Given the above-mentioned factors and the company's need for change, digital servitization represents not merely a strategy but a critical evolution for ICI Caldaie in its pursuit to maintain leadership and relevance in the industrial heating market.

## **4.2 Identification of the new digital services to be included in ICI Caldaie S.p.A. value proposition**

In this chapter, we will present the analysis conducted by ICI Caldaie to test customers' interest in digital services and to understand their actual needs, ultimately aimed at

designing and proposing new valuable digital services. The analysis culminated with the identification of three new digital services – the most valued by customers – to be included in the company’s value proposition.

### **4.2.1 Methodology**

During a strategic meeting with the management of ICI Caldaie, we showcased the current BM through a detailed presentation and engaged discussion about the core functions of the company. Once they knew that digital servitization is a good strategy to adopt, the discussion centered on identifying opportunities for growth, ways to consistently deliver services to customers, and methods to enhance the value of these offerings. As an outcome of this session, we proposed several business modifications, reflecting on the potential enhancements of the current operational structure and activities as well as on the needs of the company's key customers. Specifically, the result of the strategic meeting led to the identification of possible digital services to propose to key customers for an overall assessment, which can entail a company’s competitive advantage. To test clients’ interest in digital services and their appreciation, an online survey was then elaborated, aiming at understanding their actual needs.

Specifically, we designed an anonymous Google Forms survey, comprising 128 structured questions and 4 open-ended questions, categorized into 6 thematic sections:

- General inquiries regarding the customer's user experience related to the current company’s value proposition (i.e., product and basic services, such as installation, repair, and spare parts);
- Evaluation of the three digital service offerings the firm would like to implement: predictive maintenance, optimal selection of the boiler according to environmental conditions and customers’ needs and optimal boiler setting and regulation;
- Evaluation of other potential digital services (i.e., monitoring of the level of emissions, bureaucratic management of emissions, and advice and training on use and treatment of the machinery) to test clients’ interest;
- Open-ended suggestions for service quality improvement.

The questionnaire was divided into two parts – a main part and a technical part. The objective of the main part of the questionnaire was to analyze ICI Caldaie's competences and capabilities from the customer's point of view, focusing on the services already available in the company's portfolio, and to gauge interest in the new digital services that ICI Caldaie intended to offer.

The second, more technical questionnaire was carried out to obtain clients' views on the possible structure of some elements of the three new digital services already presented to them in the first part of the questionnaire (e.g. willingness to pay, payment methods, whether to rely on in-house technical staff or external technical experts, and the appropriate timing for possible interventions).

The survey was distributed to 75 of ICI Caldaie's corporate clients, categorized into three distinct groups based on their relationship with the company: industrial and commercial enterprises (42), individual homeowners and residential property developers (30), and public organizations (3) categories. This stratified approach allows us not only to understand the interest in a particular service for the whole company's clientele, but also to analyze the preferences according to each specific customer category.

The questionnaire was mainly composed of closed questions aimed at assessing the level of satisfaction or interest in a scale from 1 to 5, where 1 is the lowest level and 5 is the highest. At the end, open-ended questions were included to give customers the opportunity to propose suggestions and improvements.

The received customers' responses were uploaded in Excel, where they were ranked according to the degree of importance among each group of customers. Building on the survey responses, we successfully quantified the average significance of and interest in the potential new digital services for the company's customers.

Drawing from the survey findings, we crafted a strategic development pathway. Results not only help in identifying the right digital service offerings but also serve as a roadmap guiding the future endeavors of the company, ultimately aiming to pinpoint the new optimal BM.

In particular, customers' answers and suggestions enable ICI Caldaie's management to analyze and identify:

- the services that customers currently use and the degree of satisfaction with the services already offered (i.e., spare parts, repair, and installation);
- an assessment of the degree of interest in expanding current services with additional functionality;
- new digital services that are of customers' interest and can represent a new offering in ICI Caldaie.

To make the analysis more complete, the survey proposed an evaluation not only of the three potential digital services identified by the firm's senior management (i.e., predictive maintenance, optimal selection of the boiler, optimal boiler setting and regulation), but it also encompassed a range of other digital services to take into consideration other potential customers' needs. Overall, the evaluation refers to:

- **Predictive maintenance:** it involves using advanced technologies to monitor the condition and performance of boiler systems in real time, detecting faults or anomalies and, thus, predicting potential issues before they lead to failures. ICI Caldaie can utilize IoT sensors, machine learning, and data analytics to offer predictive maintenance services. IoT sensors embedded in the boilers can collect real-time data on critical parameters such as temperature, pressure, and vibrations. This data is then analyzed using machine learning algorithms, which can predict when a component might fail or require maintenance based on historical and real-time data. Data analytics tools process the vast amounts of collected data to identify patterns and anomalies, enabling timely interventions. This proactive approach reduces downtime, prevents unexpected failures, and optimizes maintenance schedules;

- **Optimal selection of the boiler:** it ensures that the chosen boiler system meets the specific needs of a customer in terms of both operations and environment in which it runs its business. This involves a detailed analysis of various factors to recommend the most efficient, cost-effective, and suitable boiler. To ensure that customers receive the most suitable boiler system for their specific needs, ICI Caldaie can employ IoT sensors, data analytics, simulation software, and AI-based recommendation systems. Data analytics can collect data on customer-specific operational data, environmental

conditions, and usage patterns through sensors and analyze them through data analytics to determine the best boiler model. Simulation software can simulate different scenarios and configurations to predict the performance of various boiler options under specific conditions. AI-based recommendation systems can then cross-reference customer requirements with boiler specifications to recommend the most efficient and cost-effective solution, ensuring optimal performance and customer satisfaction;

- **Optimal boiler setting and regulation:** optimizing boiler settings and regulation involves the use of IoT sensors, real-time monitoring systems, automated control systems, and data analytics. IoT sensors continuously collect data on boiler operations and environmental conditions. Real-time monitoring systems can, in turn, provide immediate feedback on boiler performance, enabling instant adjustments in case of necessity. Automated control systems can be exploited to adjust boiler's settings automatically based on real-time data to maintain optimal performance and efficiency, without the need of human intervention. Additionally, data analytics can analyze performance data to fine-tune settings, ensuring that boilers operate at peak efficiency while adhering to safety standards;

- **Monitoring of the level of emissions:** Like all fumes produced by burning hydrocarbons, boiler fumes are pollutants and therefore need to be controlled. Analyzing flue gases is not only useful for understanding their toxicity levels; through this analysis it is also possible to determine the dynamics of boiler performance. Continuous checking should confirm not only that the parameters comply with the regulations in force in the field, but mainly that they reflect the manufacturer's conditions of use. ICI Caldaie can leverage IoT sensors, emission monitoring software, and data analytics to monitor emissions continuously. IoT sensors can track emissions such as CO<sub>2</sub>, NO<sub>x</sub>, and other pollutants in real-time. Emission monitoring software aggregates and processes this data, providing insights and alerts if emission levels exceed set thresholds. Data analytics can further analyze emission trends to identify areas for improvement, ensuring compliance with environmental regulations and helping customers meet their sustainability goals;

- **Bureaucratic management of emissions:** it involves handling the administrative and regulatory processes related to controlling and reporting emissions. This service ensures that all necessary paperwork, compliance requirements, and interactions with regulatory bodies are managed successfully. To manage the bureaucratic aspects of emissions, ICI Caldaie can use compliance management software, automated reporting

tools, and blockchain technology. Compliance management software can track all regulatory requirements and deadlines, ensuring that the company stays compliant. Automated reporting tools can generate and submit the necessary reports to regulatory bodies based on real-time emission data. Finally, blockchain technology can enhance transparency and immutability of compliance records, building trust and reliability in the reporting process;

- **Advice and training on use and treatment of the machinery:** this service is designed to educate the customers' personnel responsible for operating and maintaining boiler systems. It encompasses various aspects aimed at ensuring the safe and optimal functioning of the boilers. Also, ICI Caldaie can offer comprehensive advice and training on the use and treatment of machinery through e-learning platforms and knowledge management systems. E-learning platforms can provide online courses and training modules on boiler operation and maintenance. Knowledge management systems can store and organize instructional videos, manuals, and best practice guidelines, making them accessible to customers for self-service learning.

For the purposes of this work, we have selected questions for the survey that allow us to understand which of the new digital services would be interesting to customers the question looked like this: *According to you, how interesting is the following digital services in a scale from 1 (lowest interest) to 5 (highest interest)?*. The questions included in the main part of survey emerged from a brainstorming session with team members and were then reworded and adapted at a second ad hoc meeting to produce a final version. The questionnaire, proposed to the clients, is provided in Appendix B. Each of the 75 participants gives an assessment of the various digital services proposed. For each section, questions were also asked about different formulas, affordability, and payment methods to capture customer preferences from an economic and investment perspective.

The collected insights on all the potential digital services described above allow us to understand the value customers place on each of them, guiding future enhancements and prioritization.

## 4.2.2 Results of the analysis

Based on the answers collected from the key clients of ICI Caldaie S.p.A., we crafted a strategic development direction for the company path toward digital servitization through a graphical representation. The results of the analysis are shown in *Figure 12* below.

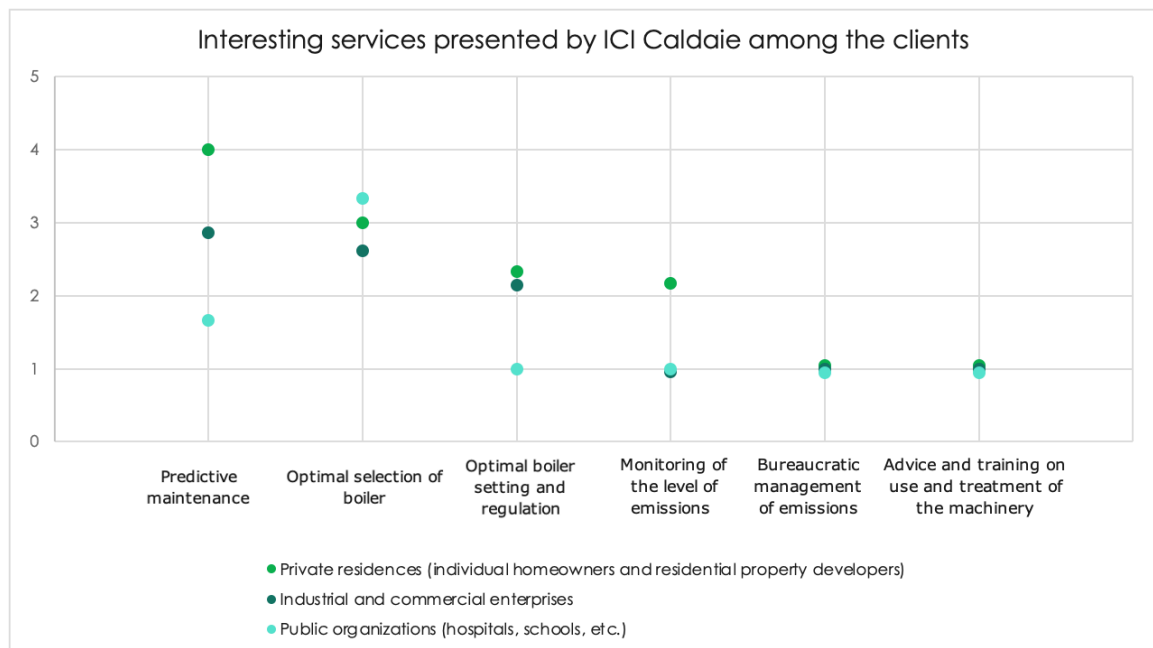


Figure 12. Results of the survey proposed to ICI Caldaie’s clients. Source: Personal elaboration of the author.

The results show different levels of interest for the proposed services among the different groups of clients, as reported in the figure above. A more detailed description of the survey’s results is reported below.

### 1. Predictive maintenance

The results of the survey show that private residences have the highest interest in this service (4/5); industrial and commercial enterprises occupy the second place in terms of interest in this service, which on average stands at 2.9/5; and public organizations are least interested in this service, with an average evaluation of 1.7/5. Generally speaking,



the proposal of this new digital service is positively welcomed by the key customers involved in the survey.

We can identify several reasons why most of the respondents appreciate this digital service. First, it minimizes downtime, ensuring the uninterrupted operation of assets that are critical for the customers' production activities. Second, it leads to cost savings by averting emergency repairs and prolonging equipment lifespan. Moreover, it enhances safety and compliance with regulatory standards, promoting a secure work environment: this digital service indeed enables an early detection of potential failures, preventing hazardous situations and minimizing unplanned downtime through timely interventions. Additionally, it boosts energy efficiency, reducing utility costs and environmental impact by ensuring boilers operate at peak efficiency through continuous monitoring and real-time data analysis. It detects inefficiencies and allows immediate adjustments, schedules predictive maintenance to prevent equipment degradation, and ensures optimal operation. This reduces fuel consumption and utility costs while avoiding costly emergency repairs. Finally, it helps maintain product quality, vital for industries reliant on consistent manufacturing processes and thus on assets' optimal functioning.

In essence, predictive maintenance of boilers ensures operational continuity, cost-effectiveness, regulatory compliance, safety, efficiency, and product quality for enterprises.

## 2. Optimal selection of boiler

The survey results indicate that public organizations have the highest interest in this service, scoring 3.3 out of 5. Private residences rank second with an interest level of 3/5, while industrial and commercial enterprises show the least interest, scoring 2.6 on a 5-point scale. However, the level of interest among all surveyed customer segments in this service is approximately the same and it is positive for all the involved clients.

Companies are increasingly interested in optimal boiler selection in accordance with enhancing their own operational efficiency and competitiveness. The main benefits for customers include a significant reduction in energy costs, optimization, and increased efficiency of the industrial heating system: this guarantees lower fuel consumption and, as a result, a significant reduction in pollutant emissions and environmental impact. In

addition, the service allows the system to be adapted to the specific needs of the company, ensuring continuity and reliability of production.

### 3. Optimal boiler setting and regulation

The survey results reveal that private residences exhibit middle interest in this service, scoring 2.3 out of 5. Industrial and commercial enterprises come next with a score of 2.1, while public organizations don't show the interest with the score 1.

Companies are increasingly interested in services with an automation for boiler operating parameters, aligning with the ever-changing environmental conditions and customers' needs and business activity characteristics. As industries adopt Industry 4.0 principles, there's a growing emphasis on leveraging digital technologies to enhance operational efficiency and competitiveness. Optimal boiler setting and regulation service fits into this trend by providing real-time plant monitoring with specific sensors, optimization, and management of boiler systems using internet-connected devices and software. This trend reflects a broader shift towards smart, connected factories and underscores the importance of remote monitoring and control solutions in the evolving industrial landscape.

Optimal boiler setting and regulation is increasingly popular due to its convenience, energy efficiency, comfort benefits, and peace of mind it offers. Users can optimize energy usage, ensure comfort upon returning home; this reflects a broader trend towards home automation and smart technology.

### 4. Monitoring of the level of emissions

According to the survey, private residences show a level of interest to this service equal to 2.2 out of 5; industrial and commercial enterprises and public organizations follow with a rating of 1/5. Clients of boiler companies may not prioritize emissions monitoring due to the high costs and technical complexity involved, as well as a lack of awareness about its importance. Weak regulatory enforcement and a focus on immediate economic benefits over long-term sustainability further diminish interest. This explain why this category of clients are interested in this service. However, for the other categories of customers this service does not represent an appealing offering.

#### 5. Bureaucratic management of the level of emissions

Also, this digital service has received low or no interest. Indeed, the results shows an interest of around 1/5 for all categories of the respondents. Clients of ICI Caldaie can show low interest in bureaucratic emissions services due to their complexity, high costs, perceived lack of immediate benefits, and a general lack of awareness or urgency regarding regulatory compliance.

#### 6. Advice and training on the use and treatment of the machinery

This service aims to help ICI Caldaie clients operate and maintain their machinery effectively and safely, enhancing operational efficiency, safety, and longevity. It includes customized training sessions on usage, maintenance, troubleshooting, and safety, delivered through on-site training, online courses, and workshops. Additional resources such as user manuals and instructional videos are provided. Ongoing support is available from experts. Benefits include improved machinery maintenance, increased safety, extended machinery lifespan, and reduced operational costs, empowering clients with valuable knowledge and skills for proactive machinery management. Notwithstanding the above-described advantages, private residences, industrial and commercial enterprises and public organizations indicate a low interest rate of approximately 1/5 on this digital service proposal. This suggests that the majority of customers are not yet prepared to adopt the service, likely due to a lack of understanding regarding its potential impact on their productivity and cost-efficiency. To address this issue, it's important to focus on educating clients about the benefits of the service, providing personalized consultations, sharing success stories, offering free trials or demos, and gathering feedback to refine the approach. By taking these steps, you can increase the likelihood of adoption and better align the service with client needs.

Based on the analysis of the survey conducted and, thus, according to customers' preferences, it can be concluded that ICI Caldaie should focus on the implementation of predictive maintenance, optimal selection of the boiler and the optimal boiler setting and regulation, as they represent the digital service proposals most valued by customers.

An in-depth and detailed description of each of the three selected digital services is reported below, offering major insights on their key characteristics and their functioning.

### **Service 1: Predictive maintenance**

Predictive maintenance is a sophisticated maintenance strategy that leverages advanced digital tools and condition monitoring of specific components to track the normal operation of equipment, enabling the immediate detection of anomalies. This approach surpasses traditional reactive maintenance, where actions are taken only after a problem arises, and preventive maintenance, where actions are scheduled based on predefined usage thresholds.

By intervening before failures or accidents occur, predictive maintenance ensures the optimal number of maintenance activities, enhancing the reliability and efficiency of industrial equipment.

#### *Customer value of the service*

Since this service allows resources to be planned and directed only when they are needed, an optimal number of activities can be carried out, which is certainly less than in the case of preventive maintenance. It also allows ICI Caldaie to manage its internal staff more efficiently and improve plant productivity. In addition, the ability to anticipate inevitable breakdowns and potential downtime makes the equipment more reliable and the working environment safer for the customer. Finally, it typically results in lower costs and reduced environmental impact.

#### *Digital technologies used for service delivery*

This service employs cutting-edge technologies to monitor and optimize the performance of boilers, to detect anomalies and thus being able to intervene before failures occur. By integrating IoT sensors, cloud computing, and data analytics, this service is based on the continuous gathering of real-time data on the assets' conditions. Specifically, IoT sensors are installed on critical components of boilers to continuously collect data on operational metrics such as temperature, pressure, and flow rates. The collected data is transmitted to a centralized cloud-computing system where they are stored. Then, data analytics technologies and algorithms are employed to transform the collected data into insightful

and user-friendly information on the boilers' status, signaling anomalies or faults on the product performance before failures occur. Utilizing predictive analytics, potential issues are forecasted: maintenance teams receive automated alerts and notifications when potential issues are identified, allowing for timely intervention.

The technological system continues to work also after the technicians' intervention, to monitor equipment performance to ensure that interventions were effective.

By implementing this digital predictive maintenance service, ICI Caldaie can minimize unplanned downtimes, optimize maintenance schedules, and extend the lifespan of their boilers, ultimately improving operational efficiency and reducing costs.

## **Service 2: Optimal selection of the boiler**

Optimal boiler selection is a critical aspect of energy efficiency and resource management for industrial plants.

The aim of this service is to identify the most appropriate thermal solution for an organization's specific needs, taking into account key parameters such as size, energy efficiency, fuel type and integration into the industrial plant. Optimal selection of an industrial boiler involves a thorough assessment of the plant's thermal energy requirements, considering factors such as production volumes, industrial processes, and seasonal variations in energy demand.

In addition, this service can include the evaluation of advanced technologies such as combined heat and power, which allows waste heat to be used to generate additional energy. The main objective of industrial boiler optimization is to maximize energy efficiency and reduce operating costs for customers, while minimizing environmental impact. Achieving this goal and developing customized solutions that make a significant contribution to the sustainability and competitiveness of the business requires in-depth knowledge of the customer's specific needs and available technologies. In particular, the company uses contextual data collected by special sensors and analyses it with its own software, exploiting the potential of IoT and data analysis technologies.

The service culminates in a detailed recommendation report that outlines the best boiler options along with an implementation plan. This plan details the steps required to

integrate the new boiler into the client's operations, including installation, commissioning, and training.

#### *Customer value of the service*

The benefits of such service are manifold. Clients benefit from improved decision-making, as they receive recommendations tailored to their specific needs and constraints. Moreover, optimally selected boilers enhance operational efficiency, leading to lower energy consumption and operational costs. The service also ensures environmental compliance by helping clients choose boilers that reduce emissions and support sustainability goals. Additionally, by selecting the most suitable boiler, clients can achieve significant cost savings in terms of fuel consumption, maintenance, and total cost of ownership. This comprehensive support and expert guidance throughout the decision-making process enhance client satisfaction.

#### *Digital technologies used for service delivery*

To implement the optimum boiler selection service, it is necessary to determine what energy and steam the customer's business requires and then size the solution correctly. The service is based on a thorough needs assessment process, that begins with collecting detailed information about the customer's operational requirements, energy consumption structure, facility layout and any specific constraints that they may have. This would be followed by data collection and analysis: ICI Caldaie uses contextual data collected by specific sensors and analyses them with a dedicated software, thereby exploiting the potential of data analytics technologies, and then generate a shortlist of suitable boiler options.

### **Service 3: Optimal boiler setting and regulation**

The optimal boiler setting and regulation service is designed to maximize boiler efficiency, minimize energy consumption, reduce emissions, and extend the equipment's lifespan through advanced digital tools and precise regulation techniques. This process aims to maximize the energy efficiency and performance of the boiler while minimizing the environmental impact. Constant monitoring of elements such as temperature, pressure, fuel consumption and output is essential to optimally regulate the operating

parameters of the equipment. This data is analyzed in real time (using data analysis technology) to systematically adapt heat production to the specific needs of the company and minimize energy losses.

In addition, this service considers factors such as fluctuations in heat load and changes in heat demand, allowing the boiler to respond flexibly to customer needs. This approach not only improves the efficiency and life of the equipment but as mentioned above, also helps to reduce operating costs and environmental impact, giving the company a strategic advantage.

#### *Customer value of the service*

The benefits of this service include enhanced boiler efficiency, resulting in reduced energy consumption and lower operational costs; improved performance, ensuring boilers operate at their optimal settings; decreased emissions, supporting environmental sustainability; and extended equipment lifespan, reducing the need for frequent replacements. The service also provides clients with valuable data-driven insights for informed decision-making and proactive maintenance strategies, minimizing downtime and maintenance costs.

#### *Digital technologies used for service delivery*

This service encompasses several key features, including real-time performance monitoring, where IoT sensors are installed on boilers to continuously track critical parameters such as temperature, pressure, and fuel usage. The data collected is transmitted in real-time using IoT technology to a software for continuous analysis. Advanced data analytics play a crucial role in processing these data, providing insights into boiler performance, and identifying opportunities for improvement. The service also incorporates automated control systems that allow the visualization and storage of operational data, their analysis with software designed and adapted to the specific case, and the use of data analysis technologies to process the collected data and to remotely modify detected sub-optimal operational values.

ICI Caldaie's upcoming introduction of three digital services – predictive maintenance, optimal selection of the boiler and optimal boiler setting and regulation – represents a

forward-thinking approach to comprehensive digital servitization. By strategically integrating these services, benefits for both the company and the industrial clients can arise. From the customers side, by expanding its value proposition, ICI Caldaie can offer integrated solutions that enhance operational efficiency, reduce downtime, and improve the overall clients' satisfaction. From the company side, this providing customers with new digital services into the offering not only streamlines internal processes; but it also leverages data-driven insights to deliver superior customer value.

### 4.3 ICI Caldaie S.p.A. business model *to-be*

To include the selected digital services in its value proposition, the company must revise its configuration in terms of structure and operational activities, while maintaining an alignment with its core values, vision, and mission. Ultimately, ICI Caldaie must redesign its BM (i.e., business model *to-be*), that has to:

1. Enhance customer engagement: the company must evolve to offer more compelling value to its customers, enriching the customer-company relationship;
2. Embrace digital transformation: there is a critical need to integrate digital technology-driven services. This evolution will streamline operations, enabling rapid response to customer inquiries;
3. Optimize financial performance: the new model should refine the company's financial operations, ensuring long-term competitiveness by reducing costs and amplifying profits;
4. Align the product operational activities and goals with those related to the newly introduced digital services.

Considering all the elements above described, together with the senior management of ICI Caldaie we depicted the structure of the BM *to-be*. For enhanced clarity and to facilitate understanding of the transformation, we highlighted the changes to be implemented from the current BM as-is to the future *to-be* one through a comparative visualization, as shown in *Figure 13* below. This illustration divides the BM's attributes into two categories: the existing characteristics of the company (as-is) and the factors to be implemented following the implementation of digital servitization (to-be).



Accordingly, for each of the nine BM dimension it is possible to easily identify the ‘as-is’ state (represented in purple), and the ‘to-be’ characterization (highlighted in green). This comparative framework not only simplifies the visualization of the impending changes, but it also allows for a methodical examination of the transformative steps the company needs to undertake, ensuring a thorough understanding of the strategic shift towards digital servitization and its implications for the company's trajectory.

### **ICI CALDAIE BUSINESS MODEL**

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITION	CUSTOMER RELATIONSHIP	CUSTOMER SEGMENTS
1. Producers (ESCO); 2. European community or other institutions; 3. CAT (technical assistance);	1. Production and selling of boilers; 2. Research & Development of new solutions and prototypes. <b>TO BE:</b> <ul style="list-style-type: none"> <li>Development and implementation of the new services and IT infrastructure</li> </ul>	Services: 1. High quality products; 2. Basic after sales services; 3. Consultancy; 4. Training of the customers.	1. Transactional relationships.  <b>TO BE:</b> <ul style="list-style-type: none"> <li>Long-term partnerships</li> </ul>	1. Final customers (industrial companies = 40%); 2. Private residences 3. Organizations (hospitals, schools, etc.)  <b>TO BE:</b> <ul style="list-style-type: none"> <li>Same customer segments but stronger relationships</li> </ul>
<b>TO BE:</b> <ul style="list-style-type: none"> <li>Distributors</li> <li>Technology providers</li> <li>Service providers</li> <li>Other stakeholders</li> </ul>	<b>KEY RESOURCES</b> 1. Tangible: <ul style="list-style-type: none"> <li>Production spaces and equipment</li> <li>Software for data</li> <li>People and Soft skills</li> </ul> 2. Intangible resources: <ul style="list-style-type: none"> <li>Experience and technical knowledge.</li> </ul> <b>TO BE:</b> <ul style="list-style-type: none"> <li>Employees with unique skills</li> </ul>	<b>TO BE:</b> <ul style="list-style-type: none"> <li>Predictive maintenance</li> <li>Optimal selection of boiler</li> <li>Optimal boiler setting and regulation</li> </ul>	<b>CHANNELS</b> 1. Direct: - personal sales - web sites - phone and e-mails 2. Indirect: - distributors (Italy) - dealers (abroad).	
<b>COST STRUCTURE</b> 1. Operational costs (raw materials, employees, logistics, marketing); 2. Investments (R&D projects). <b>TO BE:</b> <ul style="list-style-type: none"> <li>Software</li> <li>Shift from CAPEX to OPEX</li> <li>Data-driven business decisions</li> <li>Training</li> </ul>		<b>REVENUE STREAM</b> 1. Product; 2. Basic services; <b>TO BE:</b> <ul style="list-style-type: none"> <li>Recurrent revenue registration for the sale of new digital services</li> </ul>		

Figure 13. ICI Caldaie's business model transformation. Source: Personal elaboration of the author.

For completeness of analysis, a brief description of the major changes in each of the BM dimensions is provided below.

#### Key partners:

Adopting a strategy for digital servitization necessitates the collaboration with new partners to enhance the company's service delivery. Specifically, the following partnerships are critical in supporting the transformation and ensuring a seamless integration of digital services into the company's offerings:

1. *Distributors* – this category encompasses companies that facilitate the operational aspects of service delivery to customers. These are partner companies responsible for marketing and selling ICI Caldaie's products and services to end users. Distributors play a pivotal role in customer acquisition – their direct interaction with consumers expands beyond the sale of boilers to include the promotion, contractual arrangement, and after-sales support of digital services. This approach significantly broadens the company's market reach and customer accessibility, making the use of ICI Caldaie products and services more convenient through an increase in service touchpoints.

New partners will include distributors abroad not only for boilers selling but also for maintenance and repair services proposed by ICI Caldaie. It can be proposed as training for distributors staff organized by ICI Caldaie engineering team with final goal to increase qualifications of partners abroad which can be resulted in digital services development and improvement.

2. *Technology providers, service providers and other stakeholders.* In the context of ICI Caldaie's new BM focused on digital servitization, these new partners play pivotal roles. Specifically, technology providers are critical in the digital transformation journey of ICI Caldaie since they supply the necessary software, hardware, and platforms that enable the integration of digital services into existing product lines. This may include IoT devices for remote monitoring and collection of field data, advanced data analytics and algorithms systems for data processing, and cybersecurity solutions to protect connected devices and customer data. The service providers category includes companies that are specialized in the support and maintenance services, with whom ICI Caldaie collaborates to guaranteeing a prompt intervention in the customers' location in case of necessity. Finally, other stakeholders that encompass a variety of entities are essential to the success of the new BM. This category may include regulatory bodies, educational institutions for training and development, and even competitors involved in collaborative innovation efforts.

Through these strategic partnerships, ICI Caldaie aims at bolstering its service ecosystem, enhancing customer satisfaction, and extending its market footprint by making its offerings more accessible and appealing to a wider audience.

### Key activities:

To fulfill its primary objectives, ICI Caldaie will continue to prioritize its established core activities: the production and sale of boilers, and the activities of research and development. However, the incorporation of digital services will also play an increasing crucial role in the company's strategy. This entails a profound transformation of the company's internal operations, requiring the implementation of the following activities related to the development of the new digital services.

First, the company needs to build or upgrade its IT infrastructure to support and deliver innovative digital services. This includes developing IT and software solutions for collecting field data and for the remote control and monitoring of the assets, the development of data analytics tools for assessing the gathered data and cloud-computing systems for data storage. Developing such technologies to collect, store, and analyze data from these systems is essential, as well as being able to leverage those analytics to improve service quality.

Those activities are at the basis of the development of the new digital services offerings.

### Key resources:

ICI Caldaie's strategic advantage stems from a robust mix of tangible and intangible key resources, each contributing to the company's capacity to innovate, compete, and deliver value to its customers. In the new BM, the company will leverage its existing resources to develop the new category of offerings: digital services.

In addition to the existing resources, the development of the new digital services requires the involvement of employees with unique skills. They should possess specialized capabilities related to software development, data analytics, cybersecurity, user experience design, CRM, service innovation, strategic planning, agile project management, change management, and cross-disciplinary collaboration.

### Value proposition:

In addition to the core products – the boilers - that have made ICI Caldaie a preferred choice for thousands of customers worldwide, the introduction of new offerings will bring forward additional values. Hence, according to the survey results, the new value proposition also includes:

- *Predictive maintenance*: this service aims at anticipating equipment failures, reduce downtime, and optimize maintenance schedules, thereby improving customer satisfaction and providing valuable data insights;
- *Optimal selection of boiler*: this service ensures enhanced efficiency, cost savings, reliability, safety, and environmental responsibility, along with customization options, expert guidance, and long-term satisfaction;
- *Optimal boiler setting and regulation*: this digital service prioritizes efficiency, cost savings, reliability, safety, environmental responsibility, comfort, and energy management, backed by expert support.

Collectively, these offerings emphasize efficiency, cost-effectiveness, and product safety, enhancing the overall customer experience.

#### Customer relationship:

The shift in the company's policy will significantly alter its approach to customer engagement. Under the new paradigm, the company aims to evolve these interactions into sustained partnerships, positioning itself as an indispensable supplier for its customers: *'it's a more long-term relationship where there is a kind of, community between the company and the client'* (Sales Manager). By offering advanced digital services, the company seeks to foster a deeper, more meaningful connection with its customers, shifting from transactional exchanges to a model rooted in mutual growth and long-term cooperation.

#### Customer segments:

The company will persist in delivering its updated value proposition to the three primary customer segments, which encompass:

1. Industrial and commercial enterprises;
2. Private residences (individual homeowners and residential property developers);
3. Public organizations (hospitals, schools, etc.);

By providing personalized offers tailored to the end-users' requirements thanks to the newly developed digital services, the company will not only maintain but also significantly strengthen its relationships with its customers. Moreover, this strategic approach will also attract new customers: *'it will increase the company's accessibility to customers'* (Head of Management Office and Program Management Office). This is achieved through faster service interventions and reduced transportation costs, thus broadening its market reach, and fortifying its competitive advantage.

#### Channels:

ICI Caldaie reaches its customers exploiting both direct and indirect channels.

As described in the BM *as-is*, the company engages with its customers directly via its own communication platforms, such as a hotline, email, newsletters, or its website, and physically through its sales offices located across six countries.

In the alternative approach, the company's interests are championed by official distributors and representatives, who serve as the link between the company and the customer. With the advent of ICI Caldaie's new development strategy, these distributors will have the capability not just to supply physical products or components but also to function as intermediaries for services, thereby comprehensively addressing the needs of the customers.

To ensure an accurate and objective selection, ICI Caldaie should evaluate potential distributors on a market-by-market basis using the following three core criteria:

1. Client connections. What is the market share of the distributor relative to its competitors in the local area? How well positioned is it to access the long tail market? What growth has it demonstrated over the past years?

2. Service level. Is the wholesaler perceived by local customers as a leader in the category? Can it provide expert technical support for both its current and potential future portfolio?
3. Sales capabilities. Have the manufacturers associated with the distributors achieved strong sales in the region? Does the merchant possess the ability to deliver the required levels of customer outreach and relationship management?

Cost structure:

Digital services significantly impact the cost structure of a business in several ways, often leading to both cost savings and shifts in how resources are allocated.

In the specific context of ICI Caldaie, incorporating digital services into the new BM implies higher costs related to specific software development. These costs include:

1. Installation of new software and digital technologies: this includes initial consultation and planning fees, software and licensing costs, hardware and infrastructure expenses, installation and configuration charges, data migration and system integration costs, testing and quality assurance fees, user training and documentation expenses, go-live support, and ongoing maintenance and technical support fees. These components collectively ensure a smooth and effective implementation of new digital solutions within an organization.
2. Shift from CapEx (capital expenditure) to OpEx (operational expenditure): by integrating software solutions into its product offerings, ICI Caldaie may shift some of its business expenses from capital expenditures (such as physical manufacturing equipment) to operational expenditures (such as software subscriptions and cloud services). This transition can provide more flexibility in financial planning and may lower upfront costs.
3. Data-driven business decisions: digital services enable more effective data collection and analysis, providing ICI Caldaie with insights into production efficiency, customer usage patterns, and market trends. These insights can lead to cost savings by optimizing production schedules, reducing inventory costs through just-in-time manufacturing, and tailoring product development to meet market demands more precisely.

4. Training: The implementation of digital services and the use of advanced digital technologies require the development of specific competences and skills. Activities for training the workforce must be organized to ensure the seamless operativity. This represent an additional cost compared to the previous situation (i.e., BM as-is).

#### Revenue stream:

Digital services represent an additional source of revenue, providing significant opportunities in the new BM.

Indeed, the digital servitization strategy transcends conventional sales approaches, fostering enduring partnerships with customers and ensuring their needs are met with unparalleled expertise and support. Beyond the enhancement of customer loyalty and, hence, of the competitive advantage, the new digital services value proposition unlocks new revenue streams. Specifically, digital services guarantee recurrent income registration throughout the asset lifecycle. Next to the product sales, ICI Caldaie now receives regular fees for the provision of digital services, which ensures a stronger financial stability in the long-term.

In essence, ICI Caldaie's shift to a service-oriented business model is a strategic move that not only anticipates the future of industrial commerce but also actively shapes it. This transition marks a significant milestone in the company's journey, promising to redefine success in the sector and establish ICI Caldaie as a leader in the digital and service-driven industrial era.

## **4.4 Assessment of the readiness of ICI Caldaie S.p.a. to the digital servitization paradigm**

The implementation of the three selected digital services and the consequent BM adaptation requires specific resources and competences to be developed. The purpose of this paragraph is to determine the necessary resources and competencies that the company

must possess in order to provide the three new digital services efficiently and to compare them with the those that the company already owns. Specifically, conducting this analysis for each of the three identified digital services, this examination will lead to the construction of a matrix in which it will be clearly presented what resources and competencies are already available and which need to be further developed or improved.

### Methodology

To identify each and every resource and capability for all the new value offerings, ICI Caldaie deeply analyzed the characteristics of each digital service and examined the experience of other companies that have developed similar value propositions. Moreover, the company assessed whether the identified resources and competencies are already present in the current structure of the company. Through this internal analysis, we built matrices that can serve to the company as a basis to efficiently plan the successful deployment of the three digital services.

### Definition the necessary resources and competencies for the three selected digital services

As anticipated, any changes within the organization, including the launch of new digital services, should be supported by a study of the readiness of the organizational structure to cover the needs that will be required to implement these changes.

Considering the digital servitization path undertaken by the company, we will examine the resources and competencies required for the successful implementation of the new value proposition and those that ICI Caldaie already owns, looking at the three digital services separately to ensure a deep analysis. Specifically, for each offering, the analysis considers technological resources, human resources, operational competencies, and financial resources.

### **Predictive maintenance**

Predictive maintenance enhances operational efficiency and reduces costs by anticipating equipment failures, minimizing downtime, and optimizing maintenance schedules. This



proactive method improves customer satisfaction, builds loyalty, and differentiates the company from competitors. Additionally, the data-driven insights from predictive maintenance can guide product development and strategic decisions.

## 1. TECHNOLOGICAL INFRASTRUCTURE

As the company is introducing a service involving modern digital technologies, it is necessary to provide all the relevant equipment through which the service will be delivered to customers.

### 1.1 Hardware:

- a) Sensors and IoT devices for the continuous gathering of field data. They are applied on the critical components of the boiler for their constant monitoring, controlling the parameters of the equipment;
- b) computers to work with data that is collected by sensors and IoT devices;

### 1.2 Software:

- a) Software with data analytics and machine learning tools for the real-time analysis of collected field data able to detect any anomaly or, deviation from the specified parameters and thus to elaborate recommendations or implement corrective actions;
- b) Cloud Computing: is required for scalable computing power and data storage (e.g., Google Cloud). The company needs a virtual place to store large amounts of data that is constantly being transferred from devices, and cloud storage is the best option for this, as it is more accessible and just as secure as physical storage;

### 1.3 Reliable internet connectivity:

This is required to ensure continuous data transmission. Uninterrupted data transfer requires a stable network connection for both the devices collecting the data and the devices receiving the data;

## 2. HUMAN CAPITAL

As the company provides a digitally based service to its customers, it will need to recruit new staff with specific skills and/or upgrade the skills of existing staff if the company has specialists in any of the following areas.

#### 2.1 Technical Expertise:

- a) Data scientists and analysts: the firm has to widen the technical staff with employees that analyze the huge amount of data coming from IoT devices. These data-driven specialists will model and predict the condition of the boilers, and based on their analysis, other specialists will carry out the maintenance;
- b) IoT specialists: such specialists are needed to manage and maintain the IoT devices in use so that they work correctly and transmit the actual information from the customer's boiler;
- c) IT support: such specialists are needed to develop and customize the maintenance software for it to work properly, and for managing the technological infrastructure created for the service.

#### 2.2 Maintenance Experts:

- a) Engineers and technicians: These employees will receive reports from the boiler data analysts and based on the reports, will provide timely and necessary maintenance to prevent boiler breakdowns;
- b) Reliability engineers: this workforce is essential to design and improve maintenance processes. Specifically, these specialists are necessary to ensure the smooth running of the service and to improve its quality. The task of these specialists is to organize the boiler service procedure so that there is a uniform standard for the service performance.

#### 2.3 Training & development:

- a) Technical training: technical experts may provide training activities for the staff to effectively use new technologies and software.;
- b) Process training: to ensure employees understand and can execute new predictive maintenance processes. Such trainings are conducted with senior experts in the required field who can clearly explain some non-obvious aspects of the work;

- c) Workshops and seminars: to keep the team updated on the latest trends and technologies;
- d) Certifications: relevant certifications for staff to stay competitive and knowledgeable.

### 3. OPERATIONAL CAPABILITIES

Operational capabilities are needed to organize the handling of large amounts of data, which is an important part of the new digital service. Correct and fast data processing ensures a high-quality predictive service for boiler customers.

#### 3.1 Data Management:

- a) Data collection and integration: setting up processes for consistent data gathering from various sources.
- b) Data cleaning and preprocessing: ensuring the data is accurate and usable by the data analytics and the artificial intelligence algorithms for their analysis and elaboration into suggestions, feedback, and recommended actions.
- c) Scheduling Systems: To efficiently plan and execute maintenance tasks, activities must be scheduled. Dedicated and proper systems are often used to organize internal processes in companies, as it is convenient for employees to work in a single space and clearly understand the stages and processes of ongoing projects.

### 4. FINANCIAL RESOURCES

The provision of the predictive maintenance service requires investment for its development and launch. This is why ICI Caldaie should think about further points related to financial resources:

- a) Investment in technology: for purchasing hardware, software, and setting up the infrastructure needed to launch the service;
- b) Investment in human resources: training staff on new tools, technologies, and best practices in boiler setting and regulation.

## **Optimal selection of the boiler**

The goal of this service is to identify the most suitable thermal solution for an organization's unique needs, considering key factors such as size, energy efficiency, fuel type, and integration into the industrial plant. Choosing the optimal industrial boiler requires a comprehensive assessment of the plant's thermal energy requirements, factoring in production volumes, industrial processes, and seasonal energy demand variations. Implementing this service requires a variety of company's resources to ensure its effectiveness and success. Below a detailed breakdown of the necessary resources for the optimal selection of the boiler service is provided.

### **1. TECHNOLOGICAL INFRASTRUCTURE**

As the company is introducing a service involving modern digital technologies, it is necessary to provide all the relevant equipment through which the service will be delivered to customers.

#### **1.1 Hardware:**

- a) Sensors and IoT devices: for real-time data collection on energy usage, load variations, and environmental conditions of the customer the space where the boiler needs to be installed;

#### **1.2 Software:**

- a) Data analytics software: advanced analytics platforms and software for processing and analyzing the collected data and visualization;
- b) Simulation and modeling software: software tools to create and analyze different operational scenarios and their impacts.
- c) Cloud computing: company needs a place to store large amounts of data that is constantly being transferred from IoT devices;
- d) User interface platform: a user-friendly online platform for the clients to explore options, compare specifications, and understand performance metric.
- e) Network infrastructure: reliable internet connectivity that ensures continuous data transmission between IoT devices and computers;

## 2. HUMAN CAPITAL

As the company provides a digitally based service to its customers, it will need to recruit new staff with specific skills and/or use the skills of existing staff if the company has specialists in any of the following areas.

### 2.1 Technical experts:

- a) Boiler engineers: experts in boiler technology, energy efficiency, and system optimization. Such experts know many aspects of boiler operation and technical specifications and hence are needed to advise and support the customers after getting contextual information about their needs;
- b) Data analysts: skilled in data collection, processing, and advanced analytics, these experts will analyze the data obtained about the client's space and generate reports with specifications for boiler operation;
- c) Simulation and modeling specialists: company needs a staff proficient in using software to model and simulate various customer's production scenarios. These experts will be able to predict the production scenarios of the company's client, and their reports will provide engineers with an in-depth understanding of the environment and capacity required in the boiler's operation;

### 2.2 Experts:

- a) Energy consultants: experts in energy management and sustainability. Such specialists can also be engineers who have been working with the company's boilers for many years. They should be able to understand the customer's energy requirements for the boiler;
- b) Environmental compliance specialists: knowledgeable about environmental regulations and compliance requirements staff, such specialists should gather information on all necessary operating regulations in the area where the company's client is located and ensure that the selected boiler meets these requirements;
- c) Sales and marketing professionals: these experts are needed to promote the service, engage potential clients, and manage client relationships;
- d) Customer support staff: consultants that provide ongoing support and address client inquiries during and after the service implementation are essential;

### 2.3 Training & development:

- a) Technical training: in-depth training on different types of boilers, their operational principles, energy efficiency metrics, emissions standards, and maintenance requirements.
- b) Training staff: training employees on new tools, technologies, and best practices in boiler selection and energy management.

### 3. OPERATIONAL CAPABILITIES

These resources are needed to organize the operational processes in company in accordance with this service.

3.1 Data Management: tools and equipment needed for on-site boiler analysis, such as portable diagnostic tools and safety gear. Software and templates for creating detailed recommendation reports and implementation plans. Such tools are needed to create recommendations, which should be prepared in a uniform template and sent to clients at the time of consultation;

3.2 Documentation and standards: documentation and materials required for client consultations, including checklists, questionnaires, and informational brochures about the selected boilers;

### 4. FINANCIAL RESOURCES

Also this digital service requires investment for developing and offering it to customers. Hence, ICI Caldaie should think about further points related to financial resources:

- a) Investment in technology: for purchasing hardware, software, and setting up the infrastructure needed to launch the service;
- b) Investment in human resources: training staff on new tools, technologies, and best practices in boiler setting and regulation.

#### **Optimal boiler setting and regulation**

The aim of this service is to optimize the performance of the equipment to meet the customer's needs and to comply with existing regulatory standards. Monitoring is carried out using sensors and detectors installed on the customer's equipment, and the information

obtained is then processed by technicians using special software. Based on the reports received, remote control of the boiler operation is established and, if necessary, timely maintenance is carried out.

## 1. TECHNOLOGICAL INFRASTRUCTURE

As the company is introducing a service involving modern digital technologies, it is necessary to provide all the relevant equipment through which the service will be delivered to customers.

### 1.1 Hardware:

a) Sensors and IoT devices: for real-time monitoring of boiler performance, energy usage, and environmental conditions. This data will be transmitted to computers in the company's office, and then analytical reports on boiler operation will be prepared based on the data obtained, so that the operation of the equipment can be automatically adjusted since the technical indicators;

b) Diagnostic equipment: tools for assessing boiler health and identifying optimization opportunities. This equipment will allow engineers on site to provide technical support and make improvements during routine inspections;

### 1.2 Software:

a) Data analytics software: advanced tools for processing and analyzing performance data to optimize settings. This software is a workplace for data analysts that will perform reports and forecast production scenarios for the equipment. Over time, some of the indicators transmitted by the sensors from the boilers could be systematized and the response to similar problems and changes in equipment operation automated, thereby relieving the workload of analysts and engineers.

b) Digital database: company needs a place to store historical data, performance metrics, and regulatory requirements;

1.3 Network Infrastructure: the company needs a reliable internet connectivity that ensures continuous data transmission between IoT sensors and computers, including security measures to avoid data loss.

## 2. HUMAN CAPITAL

As the company provides a digitally based service to its customers, it will need to recruit new staff with specific skills and/or use the skills of existing staff if the company has specialists in any of the following areas.

### 2.1 Technical experts:

- a) Data analysts: skilled in data collection, processing, and advanced analytics, these experts will analyze the data obtained about the client's boiler and generate reports with specifications for boiler operation;
- b) IoT specialists: experts in boiler operation, settings optimization, and system performance will be able to make recommendations for remote boiler adjustments based on analytical reports;
- c) Software developers and IT support: skilled in boiler control systems, automation, and calibration, working together with engineers, this staff will adjust boiler operation remotely according to technical recommendations. Over time, the regulation process will become automated, but specialist supervision will always be necessary;

### 2.2 Experts:

- a) Energy consultants: experts in energy management and sustainability, these specialists can recommend to the client various options for operating the equipment based on the customer's work processes to optimize production and boiler operation (in addition to technical advice from the company's engineers);
- b) Compliance and regulatory specialists: experts knowledgeable about environmental regulations, safety standards, and compliance requirements specific to boiler operations, these professionals will ensure that boiler adjustments comply with all current regulatory standards in the area where the company's client is located;
- c) Sales and marketing professionals: to promote the service, engage potential clients, and manage client relationships;
- d) Customer support staff: To provide ongoing support and address client inquiries during and after service implementation.

### 2.3 Training & development:



a) Technical training: in-depth training on boiler technologies, control systems, energy efficiency metrics, emissions standards, and maintenance requirements are necessary for all staff involved in the provision of the service. Specifically, – it is necessary to increase the specialization of data analysts, control specialists. Such trainings can be conducted by consultants from *point 2.2 above*;

b) Workshops and Seminars:

Training for employees on new tools, technologies, and best practices in boiler setting and regulation and energy management;

- Customer service and communication: training on consultation skills, reporting, presentation, and client relationship management;
- Professional development: opportunities for team members to attend industry conferences, workshops, and seminars to further their professional knowledge and skills.

### 3. OPERATIONAL CAPABILITIES

These resources are needed to organize the operational processes in company in accordance with this service.

3.1 Data management: Tools for on-site analysis, such as portable diagnostic tools, calibration instruments, and safety gear. Software for creating detailed performance and compliance reports. Such tools are needed to create recommendations, which should be prepared in a uniform template and sent to clients at the time of consultation;

3.2 Documentation and standards: documentation and materials required for client consultations, including checklists, questionnaires, and informational brochures. These materials will raise the client's awareness;

### 4. FINANCIAL RESOURCES

The optimal boiler setting and regulation needs high investment too. For developing and providing it efficiently, ICI Caldaie should think about further points related to financial resources:

- c) Investment in technology: for purchasing hardware, software, and setting up the infrastructure needed to launch the service;
- d) Investment in human capital: training staff on new tools, technologies, and best practices in boiler setting and regulation.

As the analysis demonstrate, to successfully launch the new digital services, a variety of resources and capabilities are essential. Not all of them are already owned by ICI Caldaie and, therefore, they need to be developed, acquired, or improved. To fully analyze the available resources, it is necessary to conduct several detailed studies under the guidance of the project team for the launch of services with the participation of leaders from the relevant departments. However, for the purposes of this work, a preliminary analysis can be carried out based on information received during the internship and from the company's website. A synthesis of the analysis is presented in Figure 14 below, that graphically highlights what are the resources and competencies already possessed by the firm (i.e., green boxes), those that the firm must develop further (i.e., yellow boxes) and those ICI Caldaie must implement or acquire (i.e., red boxes). It is important to acknowledge that not all competencies were assessed during the internship and the preparation of this work, due to constraints in time and information access. For instance, evaluating the financial competency of "external fundings" requires additional calculations to determine the total investment needed for launching new digital services, the portion that can be funded by existing investors, and the amount that will need to be raised from additional sources. These competencies are marked as "to be defined/TBD" in the table and can be assessed by the company in future research.

Category	Resources	Readiness of ICI Caldaie	Explanation
<b>Technological Infrastructure</b>			
Hardware:	Sensors and IoT Devices		Already exists products with sensor and IoT devices like: Self Monitoring High Level Alarm Kit, Tre Vapor
Software:	Diagnostic equipment		Necessary for storing and managing the extensive data produced by current sensors
	Software for data analytics and Machine learning tools		Company already uses Stabacad, EKR and has opportunity to download data in Excel about boiler efficiency and parameters
Network infrastructure:	Digital database		Most part of received data from boilers downloaded in Excel to be improved for the future to provide with more efficiency in use
	Reliable Internet Connectivity Security Measures		There were not identified problems via interview conducted for this research To be defined in further researches
<b>Human capital</b>			
Technical Expertise:	Data Scientists and Analysts		Presented by RnD and engineering department in current structure
Experts:	IoT Specialists		To be defined in further researches
	Software Developers		To be defined in further researches
	IT Support		Presented as customer support service which perform connection with engineering specialist
Training & development	Engineers and Technicians/ Reliability		Present in Engineering department, to be re-evaluated number of employees and re-organisation of responsibilities in accordance to new services support
	Compliance and regulatory specialists		To be defined in further researches
	Sales and marketing professionals		Present in company, to be re-evaluated number of employees and re-organisation of responsibilities in accordance to new services support
Training & development	Customer support staff		Present in company, to be re-evaluated number of employees and re-organisation of responsibilities in accordance to new services support
	Technical/ Process Training		To be adopted to knowledges about new services and guarantee replacement and transmission of necessary knowledges
	Workshops and Seminars/ Certifications		There are not current tools and processes providing with new knowledges related to new services
<b>Operational Processes</b>			
Data management:	Data Collection and Integration		Current data downloaded in Excel format and save in xls format to be optimised because number of data will be increased
Documentation and standards:	Data Cleaning and Preprocessing		To be organised (place, responsables, tools etc.)
	Standard Operating Guidelines		ICI Caldaie has a strong Quality culture, based around continual improvement resulting in obtaining system and product certifications such as ISO 9001 certification, CE certification and marks, the construction according to Directives on gas equipment and pressurised tanks, and by several national certifications on the export to Countries that require specific mechanical and hydraulic tests, such as the ASME – American Society for Mechanical Engineers – certificates. Beside these certifications, the company policy of ICI Caldaie S.p.A. sets further objectives in terms of low environment impact and workers' health and safety.
<b>Financial Resources</b>			
Budget allocation	Initial Investment		It is necessary to evaluate costs and update budget in accordance to them
Funding Options	Ongoing Costs		It is necessary to evaluate costs and update budget in accordance to them
	Internal Funding		It is important to update price list for the services to include CAPEX and OPEX investment to increase profitability and reach breakeven point
	External Funding		One of current investor is European comission, it could be useful for additional financial support, enhancing research capabilities

THE COMPANY ALREADY POSSESSES THE RESOURCE/COMPETENCE  
 THE COMPANY MUST REFINE THE RESOURCE/COMPETENCE  
 THE COMPANY DOES NOT OWN THE RESOURCE COMPETENCE

Figure 14. Assessment of resources and competencies needed for the new digital services VS those already owned by ICI Caldaie. Source: Personal elaboration of the author.

Based on the proposed investigation, further steps can be undertaken to develop the resource base and competencies the company misses for the successful implementation of the new value proposition and the consequent BM adaptation.

Therefore, the analysis represents the starting point for the company's future operational trajectory and development towards the comprehensive and effective deployment of the digital servitization paradigm and, hence, for reap the benefit.

## Conclusion

The aim of this thesis was to analyze one of the emerging topics in recent literature: digital servitization. In particular, the thesis strives to elucidate how industrial manufacturers embrace the new trend of digital servitization in their strategic approach by deeply investigating the case of ICI Caldaie S.p.A., an Italian manufacturing firm of industrial boilers and thermal solutions.

As deeply described in the first chapter dedicated to the literature review on the topic, digital servitization represents a new strategic approach based on the transformation of manufacturing firms to create, deliver and capture value from new and advanced digital product-service systems (PSSs) and solutions based on the exploitation of cutting-edge technologies that allow the constant collection of field data needed for physical assets' monitoring and settings and for guaranteeing their optimal performance. Hence, the implementation of digital servitization offers a beacon of innovation and growth for manufacturing firms, representing a source of competitive advantage and differentiation. To reap those benefits, the full and effective transition towards this new value proposition and strategic approach requires an overall internal transformation in terms of capabilities, skills, cultural mindset, and business model (BM), which is far from being easy. Thus, the thesis deeply examined how industrial firms in the manufacturing sectors should assess the possibility to implement digital servitization in their business approach. Specifically, by considering the case of ICI Caldaie S.p.A., that is effectively developing its new digital services, the thesis describes the preliminary analyses performed by the company before practically embarking on the transformation, investigating the external and internal context in which the firm runs its business activities with the aim of guaranteeing it is the proper scenario for digital servitization implementation. Moreover, the thesis described the process for the identification of the potential new digital services to be included in the company's value offerings considering the customers' needs and interest. Furthermore, the thesis performed the analysis of the changes to be executed in the different areas of the BM for guaranteeing a successful development and delivery of the new value proposition as well as the registration of income deriving from it. Finally, the thesis assessed what are the required resources and capabilities, identifying those that still need to be developed or acquired.

Those analyses performed throughout the thesis constitute the basis for the development of the future strategic path of the firm to achieve the actual and full implementation of digital servitization, arriving at offering the new digital services in the market. In particular, the analysis of the BM to-be and of the resources and competencies needed reveal the next steps ICI Caldaie needs to carry out.

Overall, by presenting in detail the case of ICI Caldaie S.p.A., the thesis suggests the avenue for companies' strategic evolution towards digital servitization and highlights the need for companies to adapt and innovate their structure and operations to respond to personalized customers' needs. In conclusion, this thesis underscores the transformative potential of digital servitization in industrial manufacturing, advocating for a proactive, strategic, and customer-centric approach to navigating this paradigm shift. As firms like ICI Caldaie S.p.A. illustrate, the journey towards digital servitization, while challenging, is replete with opportunities for growth, differentiation, and sustainable success in the digital era.



# Appendices

## Appendix A

### Interviews

Below are the questions relating to the interviews conducted with the staff of ICI Boilers:

#### SALES MANAGER

- What is your role within ICI and what are your main responsibilities?
- Which companies are among your competitors?
- Do you also consider companies that are not part of the heating industry? What are their strengths?
- What elements and characteristics of competitors do you analyze?
- Are there any products or services proposed by competitors that you think could fit into ICI's value proposition?
- Are there any products or services proposed by competitors that ICI is not currently able to offer?
- What are your customer segments?
- Which distribution channels do you use to reach your customers?
- Referring to ICI's value proposition, what do you think the customer is most interested in?
- What kind of purchases do customers make?
- Are the different customer segments most interested in the products or services offered by ICI?
- Are there customers that belong to your competitors that you would like to reach as well?

- What do you consider to be ICI's strengths and weaknesses?
- What are the key partners?
- Do you think there is a link between the company's economic revenues and customer satisfaction?
- Do you make use of any KPIs to analyze and evaluate customers and competitors?
- What do you think could be an interesting new service to introduce in ICI's value proposition?

## PROJECT MANAGER

- What is your role within ICI and what are your main responsibilities?
- Which companies are among your suppliers?
- Which companies are among your competitors?
- What kind of relationship does ICI Boilers have with its suppliers and partners?
- During negotiations, who has the greatest decision-making power?
- Where is ICI Caldaie positioned within the supply chain?
- How dependent is ICI Caldaie on its partners and suppliers? And vice versa?
- What do you consider to be ICI's strengths and weaknesses?
- Which economic and political factors are important for ICI to establish a relationship with suppliers?
- Have you found a link between the types of relationships ICI has with its partners and suppliers and their satisfaction?
- Do you make use of any KPIs to analyze and evaluate customers and competitors?
- What do you think could be an interesting new service to introduce in ICI's value proposition?



## PROJECT MANAGEMENT OFFICE MANAGER

- What is your role within ICI and what are your main responsibilities?
- What do you consider to be the main strengths, weaknesses, opportunities, and threats for ICI?
- What are the main economic and political factors impacting on the company's business?
- Who are ICI's main competitors and suppliers?
- Do you use any particular KPIs?
- What do you think would be an interesting new service to introduce in ICI's value proposition?
- What is the current strategy used by ICI?
- What is ICI's mission statement?

## FINANCIAL MANAGER:

- What is your role within ICI and what are your main responsibilities?
- Which of the products and services are most profitable for the company?
- Which of the products and services are most costly for the company?
- What types of costs are involved in ICI's value proposition?
- Where does ICI position itself in relation to competitors in terms of price?
- How often are new products or services developed and launched?
- How long does it take for services to start generating revenue and become profitable?
- Which products or services are more economically risky?

- Do you think there is a link between the company's economic revenues and customer satisfaction?
- Do you use certain KPIs to evaluate products and services?
- What do you think could be an interesting new service to introduce in ICI's value proposition?

#### AFTER-SALES MANAGER

- What is your role within ICI and what are your main responsibilities?
- What types of products and services make up the ICI value proposition?
- How have services evolved over the last 5 years?
- Do you think there is a link between the company's economic revenues and customer satisfaction?
- Do you consider ICI to be a flexible company?
- How complicated do you think it would be for ICI to adapt to the new situation if it were to undertake the transition to digital servitization?
- Has ICI's business model changed in the last 5 years? If yes, which way?
- Has ICI's business strategy changed in the last 5 years? If yes, which way?
- What correlation is there between ICI Caldaie's sales volumes and the size of the market where it operates?
- What do you think might be an interesting new service to introduce in ICI's value proposition?
- What is ICI's mission?

#### TECHNICAL MANAGER

- What is your role within ICI and what are your main responsibilities?
- What kind of relations does this company have with partners?
- What do you consider to be the main strengths, weaknesses, opportunities and threats for ICI?
- What do you consider to be the most critical supply elements for ICI Boilers?
- Do you make use of any particular KPIs?
- What do you think would be an interesting new service to introduce in ICI's value proposition?

## RESEARCH AND DEVELOPMENT

- What is your role within ICI and what are your main responsibilities?
- How often are new products or services developed and launched?
- How long does it take for services to start generating revenue and become profitable?<sup>217</sup>
- Which products or services are more economically risky?
- In your opinion, which service do customers need?
- Is it possible for customers to speak directly with the technician?
- Has ICI's business strategy changed in the last 5 years? If yes, which ones?
- What services are currently part of ICI's value proposition?
- Are there any products or services proposed by competitors that you think could be part of ICI's value proposition?

- Are there any products or services that competitors propose but that ICI is not currently able to offer?
- Are training services available?
- What do you think could be an interesting new service to introduce in ICI's ICI's value proposition?

## **Meeting**

Below are the questions relating to the reconstruction meeting of the Business Model Canvas as-is of the company:

- What are ICI's customer segments?
- What is ICI's value proposition?
- Through which channels does ICI operate?
- What kind of customer relationships does ICI have?
- What is ICI's revenue structure?
- What are ICI's key resources?
- What are ICI's key activities?
- Who are ICI's key partners?
- What is ICI's cost structure?

## Appendix B

Below is the first customer questionnaire.

1. In relation to ICI Boilers, which customer category do you represent?
    - ◆ Heat manager
    - ◆ Installer
    - ◆ Industry - end user
    - ◆ Reseller
    - ◆ Industrial plant manufacturer
    - ◆ Cogeneration plant manufacturer
  
  2. Which of the following activities characterize your customer relationship with ICI Boilers?
    - ◆ Material supply
    - ◆ Maintenance contracts
    - ◆ Plant design
    - ◆ Plant installation
- Please express your judgement by a rating from 1 to 5.
3. How important to you is the customization of the product offered by ICI Boilers?
  4. How do you rate the level of product customization offered by ICI Caldaie?
  5. How attentive is ICI Caldaie to the needs of its customers?
  6. How important is technical advice from ICI Caldaie to you?
  7. How do you rate the level of technical advice offered by ICI Caldaie?  
technical advice?
  8. How important is it for you to rely on a single point of contact for choosing and implementation of the right technical solution (turnkey project)?
  9. What do you consider to be the level offered by ICI Boilers compared to the “turnkey project”?
  
  10. Which of the following phases of the turnkey project are for you important and/or interesting?
    - ◆ Preliminary consultation with verification of plant requirements
    - ◆ Thermal power plant design
    - ◆ Generator supply
    - ◆ Supply of central plant accessories
    - ◆ Installation
    - ◆ Work direction
    - ◆ Certification
    - ◆ Plant maintenance and management

11. As a customer of ICI Boilers, how satisfied are you with the relationship you have with the company?
12. Do you consider yourself an ICI Caldaie customer with a longstanding relationship?
13. How much do you consider ICI Caldaie to be an environmentally aware and sustainability?
14. How do you rate the waiting times on occasional interventions (accidents) requested to the company ICI Caldaie?
15. How satisfied are you with the solutions proposed by ICI Caldaie?
16. Do you think that the company ICI Caldaie should implement more services related to boiler performance monitoring?
17. Do you think that the company ICI Caldaie should implement more of services related to post-implementation consultancy?
18. Do you think that the company ICI Boilers should implement more of services related to training in the use and setting of boilers?
19. How important do you consider monitoring the performance of the boiler used?
20. Which of the following types of performance do you consider important and should be monitored?
  - ◆ Impact of performance on energy consumption
  - ◆ Impact of performance on the level of emissions
  - ◆ Impact of the boiler productivity during its use
  - ◆ Impact of boiler performance on system productivity
  - ◆ None of the above
21. Which types of services do you find interesting?
  - ◆ Preventive maintenance to avoid production stoppages
  - ◆ Remote monitoring of boiler performance
  - ◆ Remote monitoring of the boiler utilization status for predictive maintenance
  - ◆ Remote modification of boiler operating parameters
  - ◆ 24/7 remote assistance
  - ◆ Advice and training on the use and handling of the machinery
  - ◆ None of the above

With reference to the services, you currently use (offered by ICI), what do you consider to be the level of service provided?

Please express your opinion using a rating from 1 to 5.

- ◆ Preventive maintenance to avoid production stoppages
- ◆ Remote control of boiler performance

- ◆ Remote monitoring of boiler usage status for predictive maintenance
- ◆ Predictive maintenance
- ◆ Remote modification of boiler operating parameters
- ◆ 24/7 remote assistance
- ◆ Advice and training on the use and handling of the machinery

22. Of the services proposed below, which do you think are interesting and could be of interest to you?

- ◆ Remote monitoring of the operation of the boiler to know its
- ◆ Actual performance
- ◆ Remote monitoring of boiler operation to allow preventive maintenance
- ◆ Advice on better utilization of the boiler, aimed at reducing the energy consumption
- ◆ Remote boiler management by ICI Boilers for optimized boiler utilization
- ◆ Monitoring of the level of the atmospheric emissions
- ◆ Bureaucratic management of permits for monitoring the level of emissions
- ◆ Into the atmosphere
- ◆ Training for boiler use and setting
- ◆ We only do installation
- ◆ Reinstallation of high-water content steel boilers for blown air burners

23. Of the services offered below, which do you consider unnecessary or superfluous?

- ◆ Remote monitoring of boiler operation to know the actual performance
- ◆ Remote monitoring of boiler operation to enable preventive maintenance
- ◆ Advice on better utilization of the boiler, aimed at reducing the energy consumption
- ◆ Training for boiler use and setting
- ◆ Remote boiler management by ICI Boilers for optimized boiler utilization.
- ◆ Monitoring of atmospheric emission levels
- ◆ Bureaucratic management of permits for monitoring the level of atmospheric emission
- ◆ We only do installation

24. In terms of services available and proposed by ICI, what could be improved or introduced?

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