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### **The Digital Servitization of Manufacturing Companies: the ASAP International Observatory**

**Giuditta Pezzotta, Veronica Arioli, Federico Adrodegari,  
Nicola Saccani, Mario Rapaccini**

September 2023 - RsR N. 1 Year 2023





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**Università degli Studi di Bergamo  
2023**

**The Digital Servitization of Manufacturing Companies: the ASAP International Observatory/ Giuditta Pezzotta, Veronica Arioli, Federico Adrodegari, Nicola Saccani, Mario Rapaccini – Bergamo:  
Università degli Studi di Bergamo, 2023.  
ASAP Research Reports, n. 1 – ISBN: 978-88-97413-77-6  
ISSN: xxxx-xxxx  
DOI: [10.13122/ASAP\\_RsR\\_1](https://doi.org/10.13122/ASAP_RsR_1)**

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## RESEARCH REPORT

# The Digital Servitization of Manufacturing Companies: the ASAP International Observatory



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## Executive summary

Over the last decades the world is radically changed thus bringing manufacturing companies to find new ways to be competitive in the market. In this direction, an increasing number of manufacturing companies are experiencing a transition from product-centric offerings to combinations of products and related services as integrated high-value solutions for customers, a phenomenon known as “**Servitization**” of production (Baines et al., 2007; Vandermerwe and Rada, 1988). Such a combination represents for manufacturing companies a possibility to instantiate new revenue streams, increase customer loyalty, optimise resource consumption in a sustainable fashion, and, thus, enable them to differentiate from competitors.

More recently, the industrial landscape has been affected by the growing interest in digital transformation. The digitalization path started to spread with the **Industry 4.0** revolution, following concepts such as the Internet of Things (IoT), machine learning, big data analytics, and so on, and becoming increasingly used in the industrial context. Indeed, one of the main advantages of Industry 4.0 technologies is that they not only make it possible to gather and analyze vast volumes of data from industrial assets and other sources but also use such data to support decision-making toward reaching process optimization and the needs of clients. In this context, the digital transformation of manufacturing firms is nowadays accelerating the deployment and adoption of product-service offerings. Although still prevalent, traditional services offered by companies cannot compete effectively in the Industry 4.0 environment, which forces them to “digitalize” their value propositions. This process/journey/phenomenon of manufacturing companies increasingly moving toward offering integrated product-service solutions using digital technologies to achieve growth and competitive advantages is defined as **Digital Servitization** (Favoretto et al., 2022).



The “Digital Servitization” journey is challenging, and companies often struggle to realise their expectations. Therefore, to shed light on the current state of Digital Servitization strategies in the manufacturing sector, the ASAP Service Management Forum and IFIP WG5.7 Special Interest group on Service Systems Design, Engineering and Management have instituted the “**Digital Servitization Observatory**” research. Specifically, the research

is focused on understanding the actual service offering of manufacturing companies and the digital technologies of Industry 4.0, mainly involved in providing these services.

Moreover, the research aims at capturing the challenges and best practices that businesses are dealing with in their Digital Servitization transformation process in five areas: strategy, design, knowledge management, assessment for decisions, and sustainability.

The analysis carried out on **more than 300 responses worldwide** showed that nowadays, servitization is embraced by companies expanding their business portfolios with service offerings. They mainly offer services (such as spare parts delivery, maintenance, upgrading, training, and consulting) on a transactional basis but also develop service contracts. However, the main source of revenue is still the sale of new products. Large and medium enterprises show a highly diversified service offerings portfolio with respect to small companies that, on the contrary, manage to obtain higher revenues from the sale of services. Among the digital technologies of the Industry 4.0, Internet of Things, Cyber Security, and Cloud Computing are the most adopted in enabling digital services. Large enterprises already have them in their service offering and are moving to more complex technologies, such as Big Data Analytics, Artificial Intelligence/Machine Learning, Simulation, and Mixed Reality.

Lastly, the research demonstrated a rising trend toward the use of technology for service delivery since multiple benefits are perceived from digital services, such as the increase in revenues, customer loyalty, differentiation from competitors, and sustainability. However, a focused strategy, coordination at the ecosystem level, data management efforts, and supporting tools for conscious decisions in the delivery of services are required to comply with the Digital Servitization process.

	Weaknesses		Strengths	
	Difficulty in value communication Ecosystem network development with competitors and IT providers		Increase in revenues Customer loyalty through services Differentiation from competitors	Digital Servitization strategy
	Difficulty in designing services from collected data Lack of supporting tools for service design			PSS design
	Difficulty in extracting and using knowledge from product and service to enable proper decision making		Agreement with the customer for data sharing and protection	Knowledge management
	Lack of metrics for risk assessment of services Lack of metrics for environmental assessment of services		Evaluation of the economic and service delivery performances	Assessment
			Sustainability achievement	Sustainability



## The research: Objectives and Methodology

The “Digital Servitization Observatory” research has three main goals:

- Understanding the actual service offering of companies and the extent of digital in their delivery;
- Understanding what are the main digital technologies of Industry 4.0 utilized in the service offering of companies;
- Capturing the challenges and best practices that businesses are dealing with in their Digital Servitization transformation process at strategic level, in the service design, in the knowledge management, assessment of performances, and sustainability concerns.

To answer these research questions, the ASAP Service Management Forum and IFIP WG5.7 Special Interest group on Service Systems Design, Engineering and Management developed an online survey from which they started collecting data from companies operating worldwide.

The survey was developed by a group of international experts from different universities and research centres (see section “ Who we are”) who defined the structure based on the Industry 4.0 and Product-Service System literature analysis. Once developed, the survey was validated and then disseminated among the network of manufacturing companies by e-mail and social media posts.

The survey was launched at the beginning of 2022 and collected responses until the end of 2022.

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The survey was structured in three parts:

1

**CONTEXT:** the first 13 questions were related to the respondent information (position, business function, professional experience time), companies' business, their size (number of employees and annual company turnover), and level of internationalization (belonging to an international group).

2

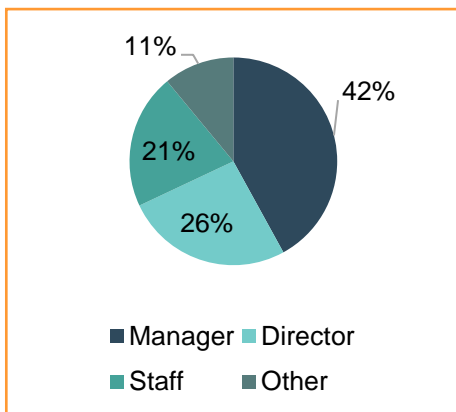
**SERVICE BUSINESS:** composition of the service portfolio of the company, relevance of services and integrated solutions business compared to the product one. 16 questions addressed these topics.

3

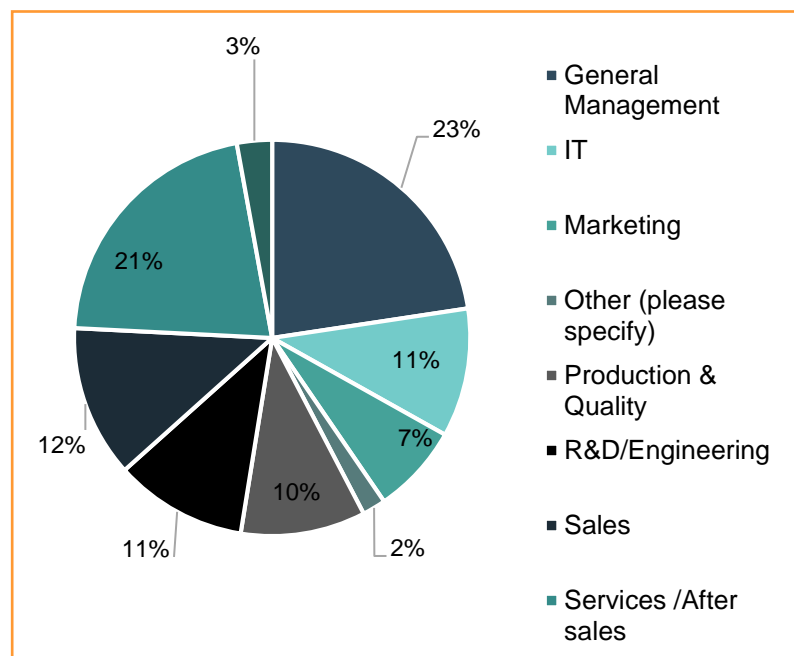
**DIGITAL SERVICIZATION JOURNEY:** how companies engaged in the digital servitization transformation. It includes 1 question related to Industry 4.0 technologies (i.e., level of adoption of such technologies in the service delivery) and 28 questions that look at the actions businesses take to comply with their Digital Servitization transformation process at the strategic, tactical, and operational levels.

## The sample

The responses collected are **314** in total. Respondents are mainly Directors, Managers, and Staff (Figure 1), with 20 years of experience on average. The respondents have very heterogeneous business functions, mainly they belong to General Management (23%), Service/After Sales (21%), Sales (12%), IT (11%), R&D/Engineering (11%), Production & Quality (10%), Marketing (7%), Supply Chain (3%), and Other (2%), as reported in Figure 2.



**Figure 1 - Position inside the company**



**Figure 2 - Business function**

From a geographical point of view, half of the sample (52%) is located in Western Europe, followed by East Europe (38%) and by Americas (11%).

## Industrial sector

The respondent companies were classified based on the **industrial sector** they operate. The Global Industry Classification Standard was used as the reference model for the classification of the industrial sectors. As shown in Figure 3, the respondent companies are mainly **Industrials**, followed by **Consumers** and **Information Technology & Communication Services**. Together these three sectors dominate the collected sample of responses. Industrial sector mainly includes companies operating in the **capital goods** sector (Aerospace & Defence, Construction, Machinery, Medical, Electronics, etc.) – 77% of this cluster is composed of companies in the Capital goods sector – and, to a lesser extent, **transportation** (Air Freight & Logistics, Airlines, Marine, Road & Rail, Transportation Infrastructure engineering & constructing), and **Professional Services** (Legal & Administrative Services, Tax Consultancy). Consumer sectors include both companies providing non-durable goods (food, beverage, tobacco, household products, etc.) and durable goods (consumer electronics, domestic appliances, etc.).

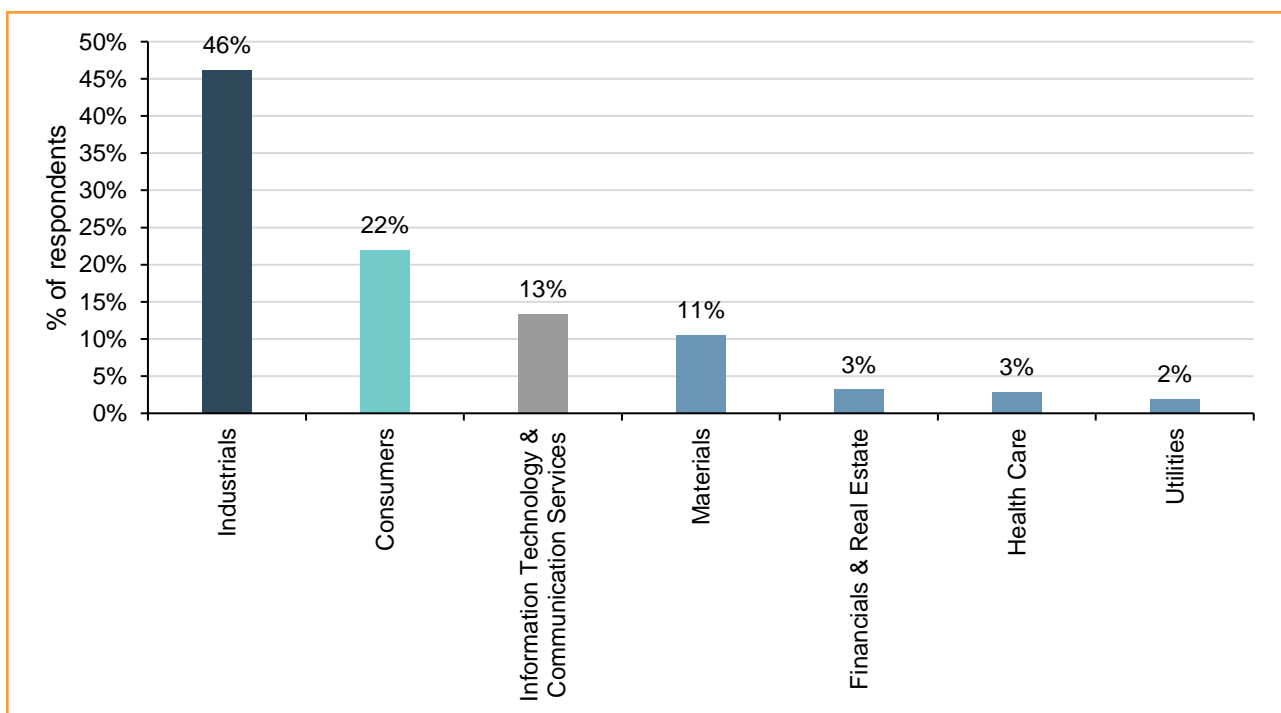


Figure 3 – Composition of the sample: industrial sectors

## Size

The sample is equally distributed between companies of different **sizes**, even if large companies are predominant (Figure 4). The size classification of companies is based on the guidelines developed by the European Commission for defining company categories, taking into account the threshold values for number of employees and annual turnover. In the report, companies are classified into three classes, and the following are described as reporting the main characteristics.

- **Large enterprises:**

Companies with 250 or more employees and an annual turnover of more than 50 million EUR. They are characterized mainly by an international market (76%), and 69% are part of a group.

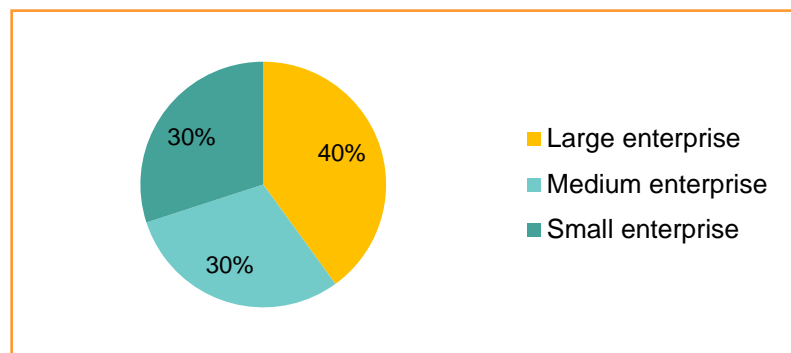


Figure 4 – Composition of the sample: company size

- **Medium enterprises:** Enterprises with 50-249 employees and an annual turnover between 10 and 50 million EUR. 49% have a national market, and 41% have an international market, only 10% have a local/regional market. 45% of the companies are part of a group.
- **Small enterprises:** Enterprises with 0-49 employees and an annual turnover of less than 10 million EUR. 52% of the respondent companies are characterized by a national market, 28% by an international market, and 20% by a local/regional market.

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## The results

To address the main three research questions driving the “Digital Servitization Observatory” research, the results obtained from the analysis of the collected answers are shown following the process described below.

### Service business relevance

Firstly, an overview of the revenue stream generation of the respondent companies is presented by focusing on the revenues generated by service sales.

### Service offering

The service offering portfolios of the respondent companies are presented.

The survey's parts devoted to the use of digital technology in service offerings were completed by only some of the respondent firms, and as a result, no process of Digital Servitization has been initiated. Therefore, the following analysis is based on a sub-sample corresponding to the 165 respondents that have declared to exploit technologies of Industry 4.0 in the service offering.

### Digitalization of the service offerings

The digitalization of the service offerings is explored by looking at the adoption of the digital technologies of Industry 4.0 for service delivery.

### Digital Servitization journey

The Digital Servitization journey actions and best practices are presented, highlighting the sources of weaknesses and strengths that characterize this transformation process.

## Service business relevance

A first analysis that can be made concerns the breakdown of the revenue stream composition of the companies in the sample. Respondents were asked to indicate the share of revenue (0-10%, 11-25%, 26-50%, 51-75%, and 76-100%) concerning the total revenues generated between the main lines of business in which their company is structured. The revenue streams can be generated by:

- **New Product Sales**, revenues generated by the sales of new products.
- **Transactional Service Sales**, revenues generated by the sales of transactional services are defined as services provided for customer-specific requirements for which the customer pays every time they are used.
- **Multi-year Service Sales**, revenues generated by the sales of services for which the customer pay based on specific contracts or fee.

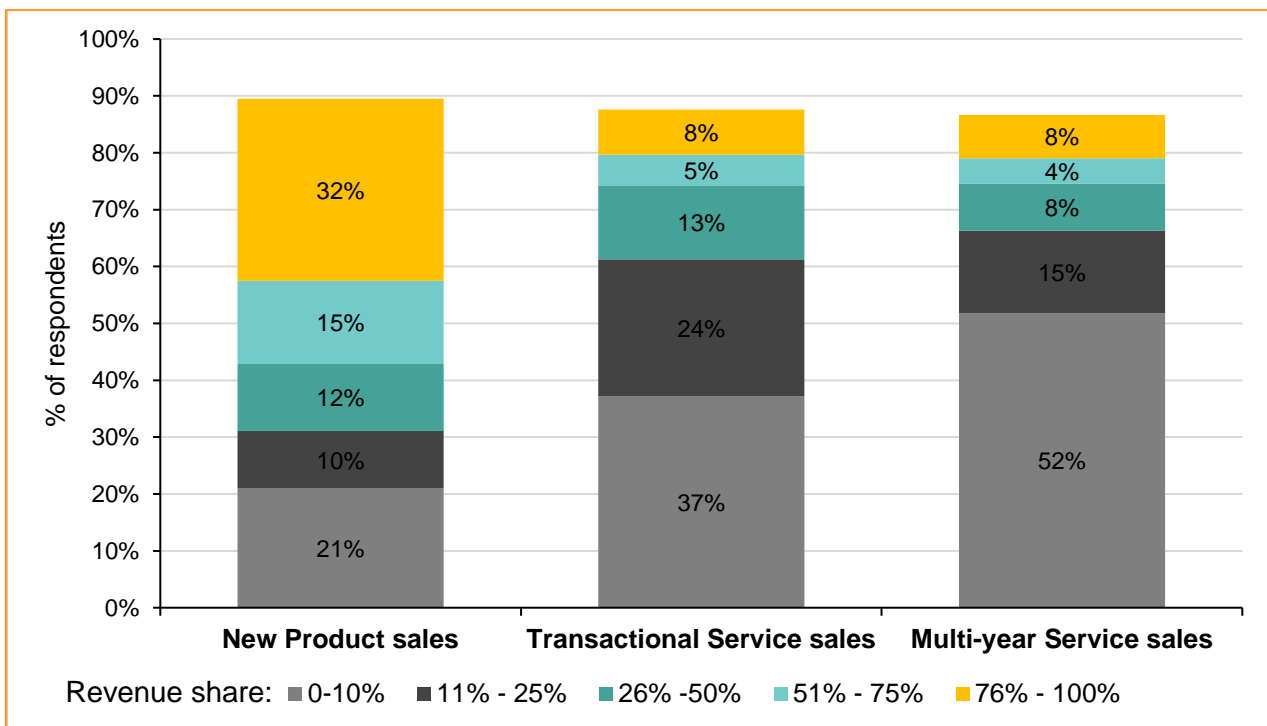


Figure 5 - Actual revenue generation of the responding companies

Figure 5 shows:

- 59% of the sample generate at least 25% of revenues from product sales – specifically, 12% of the companies generate 25-50% of the total revenues from

product sales, 15% of the companies generate 51-75% of the total revenues, and 32% generate 76-100% of the total revenues.

- (only) 26% of the sample generate at least 25% of their total revenues from transactional service sales.
- (only) 20% of the sample generate at least 25% of their total revenues from multi-year service sales.

Almost 10% of the respondents did not provide any information about the company revenue stream for confidentiality reasons.

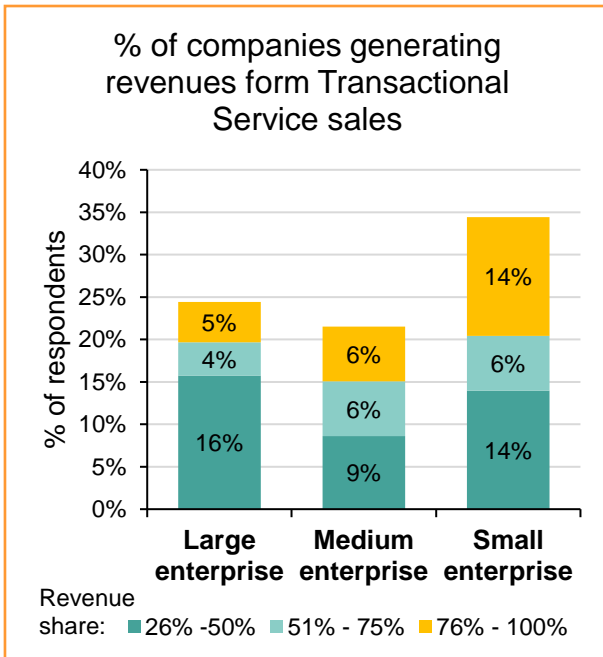
From the analysis of the results, it is possible to assess that businesses are still product-oriented. The **revenue generated by services is still limited**. For most of the sample, the revenue generated by the service is less than 25% of the total revenue. However, some companies have made services their core business, even if they represent a minimal part with respect to the totality.

Focusing on these companies that generate at least 25% of their total revenues, it results that small enterprises (Figure 6) and companies operating in the IT&Communication services sector (Figure 7) are the best performing in revenue generation from service sales.

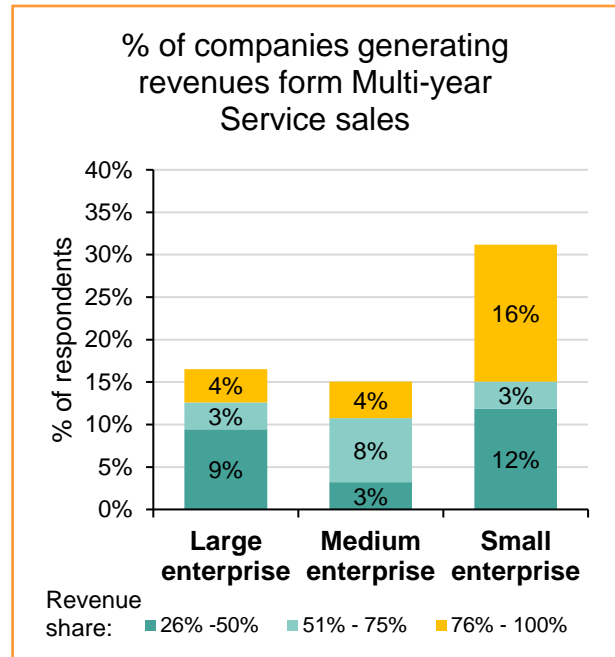
Specifically, 34% of the respondents among small enterprises generate at least 25% of the total revenues from Transactional service sales, while this percentage does not exceed 25% among large and medium enterprises. This difference is even more evident when looking at Multi-year services where 31% of small enterprises generate at least 25% of the total revenues while only 16% of large and 15% of medium enterprises are able to generate that revenue share. Therefore, the impact of the service revenue is higher than in medium and large enterprises.

While when looking at the three main industrial sectors dominating the sample of responses (Figure 7), the IT&Communication services sector generates the highest revenues from service sales. Moreover, it results that Consumer (B2C) sector gets more revenues from service sales (mainly Transactional services) than Industrials (B2B) sector.



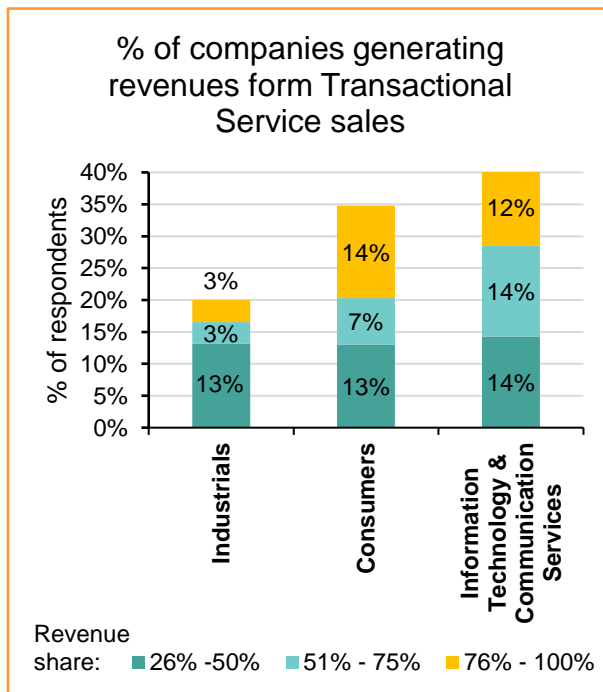


(a)

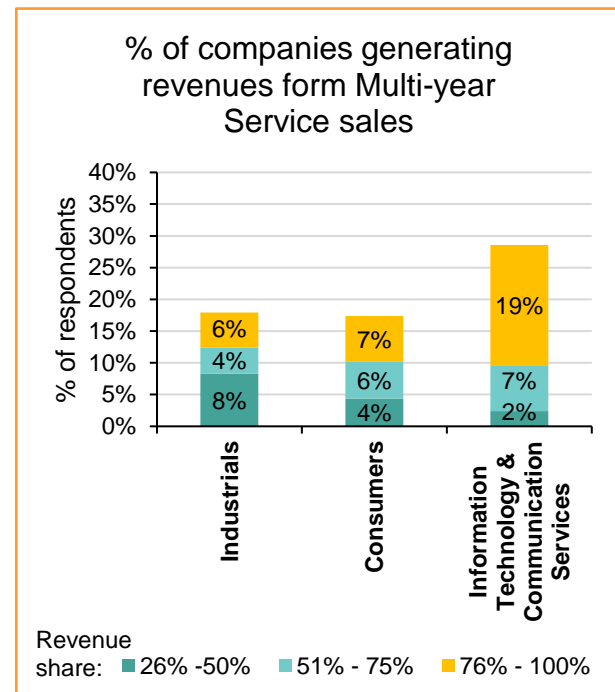


(b)

Figure 6 - Actual generation of almost 25% of the total revenues from the service sales (a- transactional and b) multi-year services) of the responding companies divided by company size



(a)



(b)

Figure 7 - Actual generation of almost 25% of the total revenues from the service sales (a- transactional and b-multi-year services) of the responding companies divided by the main three industrial sectors dominating the sample

## Service offering

Although companies appear to be product-centric, their portfolios show the presence of different service offerings. Thus, focusing on the **Service Offerings** provided by the companies, the results are shown in Figure 8.

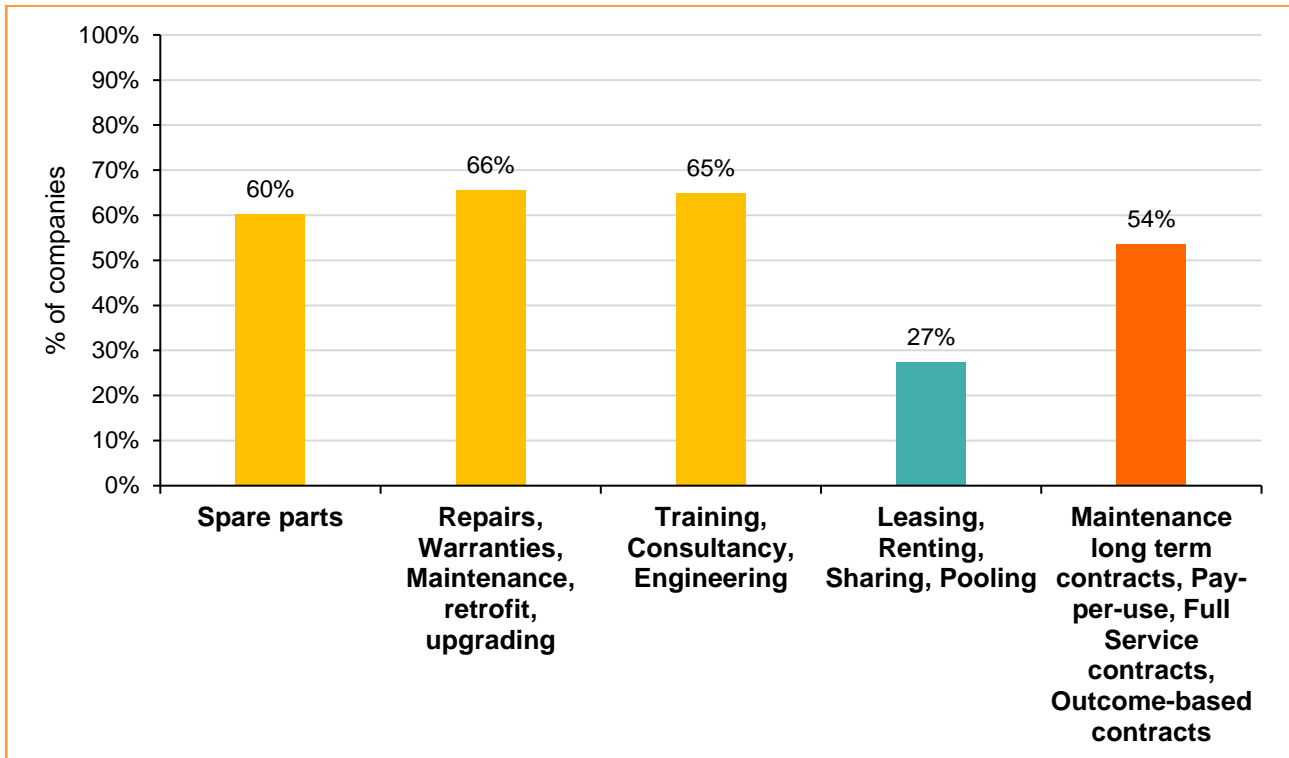


Figure 8 – Service offering portfolio of the respondent companies

It is possible to classify the reported services into these three categories:

Transactional services	Use-oriented services	Multi-year services
Spare parts Repairs, Warranties, Maintenance, Retrofit, Upgrading Training, Consultancy, Engineering	Leasing, Renting, Sharing, Pooling	Maintenance long term contracts, Pay-per-use, Full service contracts, Outcome-based contracts

From the collected results, Transactional services are the most offered by companies, followed by multi-year services. While Use-oriented services are still not spread.

Also, it was analysed the adoption of the same services inside the three clusters determined by the company's dimension. The results show that large and medium enterprises have a greater range of services than small companies (Figure 9). Looking at multi-year service, it is evident the difference between large and SMEs. While looking at the service portfolio of small enterprises it is clear that they are more limited in terms of both service quantity and type.

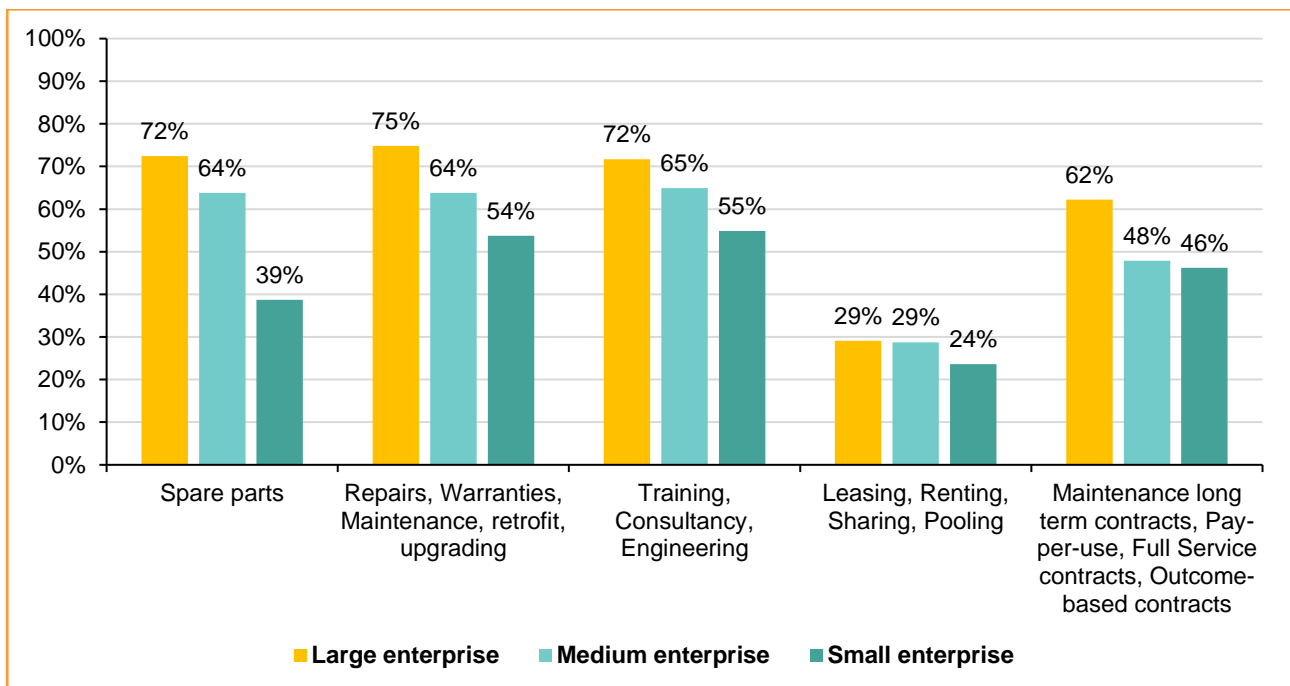


Figure 9 – Service offering portfolio among the small, medium, large enterprises of the sample

Figure 10 shows the service offering portfolio of the companies divided into the main industrial sectors dominating the sample (i.e., Industrials, Consumers, and IT&Communication Services). It is possible to observe that companies operating in the Industrials sector have a very diversified service offering portfolio: considering the total average values (Figure 8), they outperform in each service category. They represent the leading companies of product-oriented services (i.e., Spare parts, Repairs, Warranties, Maintenance, Retrofit, Upgrading). IT & Communication Service sector shows to provide mainly training, consultancy, and engineering services, and in particular, service contracts to clients. While companies belonging to the Consumer sector are beginning to add services to their product offers.

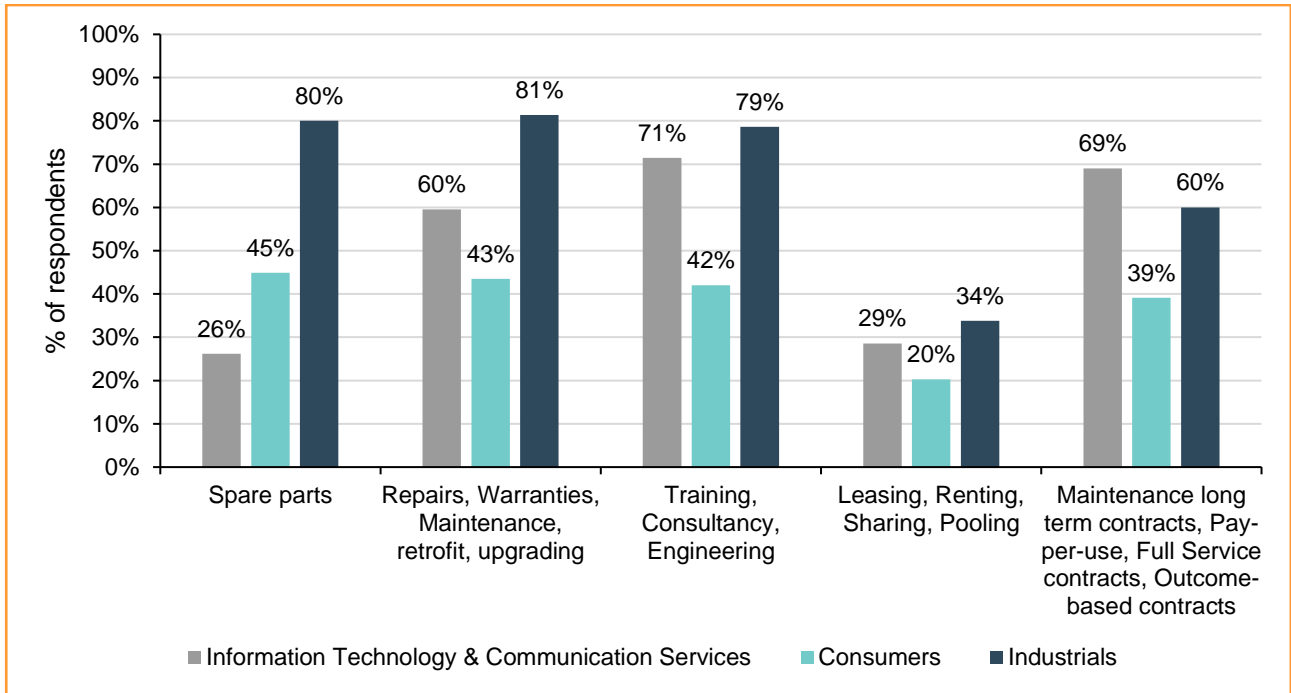
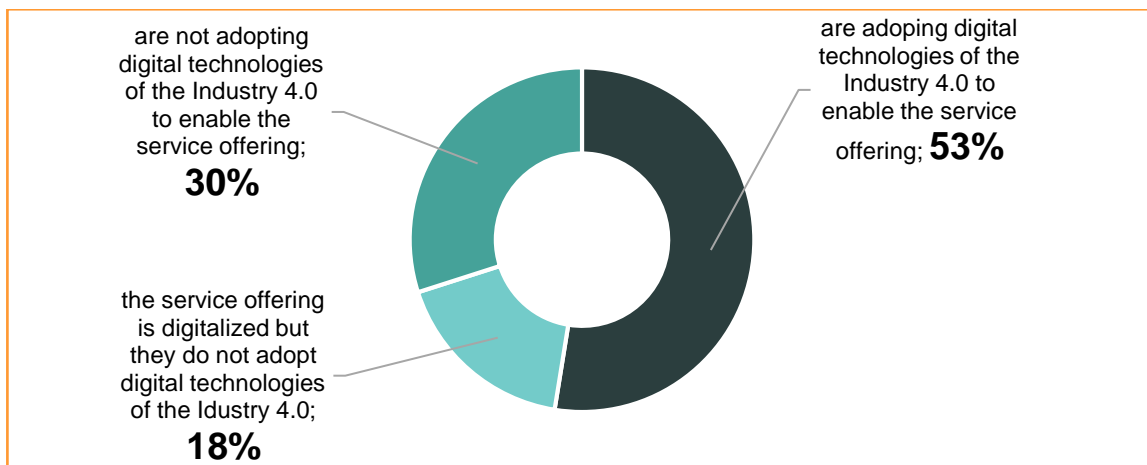


Figure 10 - Service offering portfolio among the main three industrial sectors dominating the sample

## Digitalization of the service offerings

**165 survey respondents** (53%) have declared to adopt Industry 4.0 technologies to enable their service offerings (Figure 11). We have also asked these respondents to complete the second part of the survey. This sub-sample is composed as follows:

- 47% by large enterprises, 27% by medium enterprises, and 26% by small ones.
- 56% by companies of the Industrials sector, 16% by companies of IT&Communication, and 15% by Consumers.



**Figure 11 – Composition of the sample: adoption of digital technologies to enable the service offering**

Among these companies (**Industrial**) **Internet of Things**, **Cloud Computing**, and **Cyber Security** appear to be the most widely used and established for service delivery. While **Artificial Intelligence/Machine Learning**, **Mixed Reality**, **Big Data Analytics**, and **Simulation** have the most potential for adoption (Figure 12).

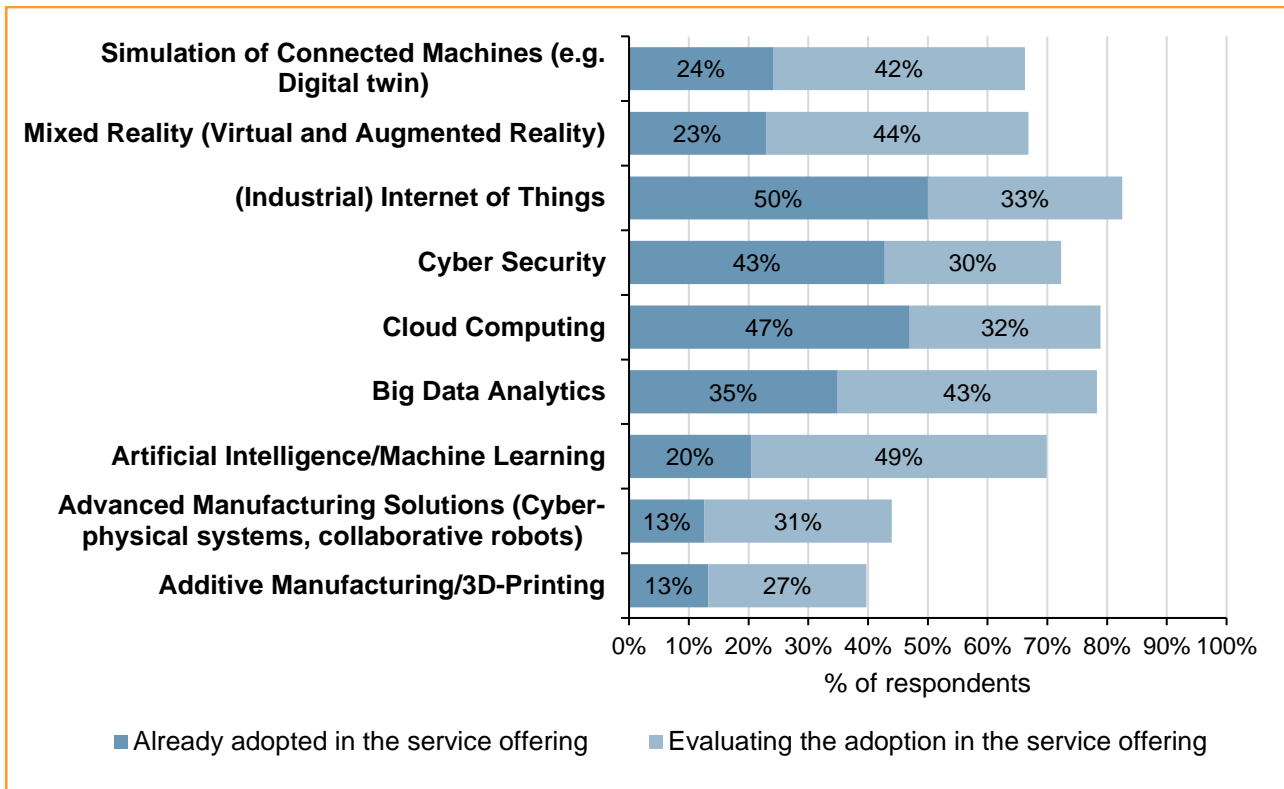


Figure 12 – Level of adoption of the digital technologies in the service offering

Large enterprises are widely adopting the three most in-demand digital technologies (IoT, Cloud Computing, and Cyber Security) and are now shifting their interest toward more complex digital technologies. On the contrary, small enterprises seem to delay the adoption of digital technology since they appear to be in the "first wave" of digitization and are largely investing in the three most widely used ones. Figures 13 and 14.

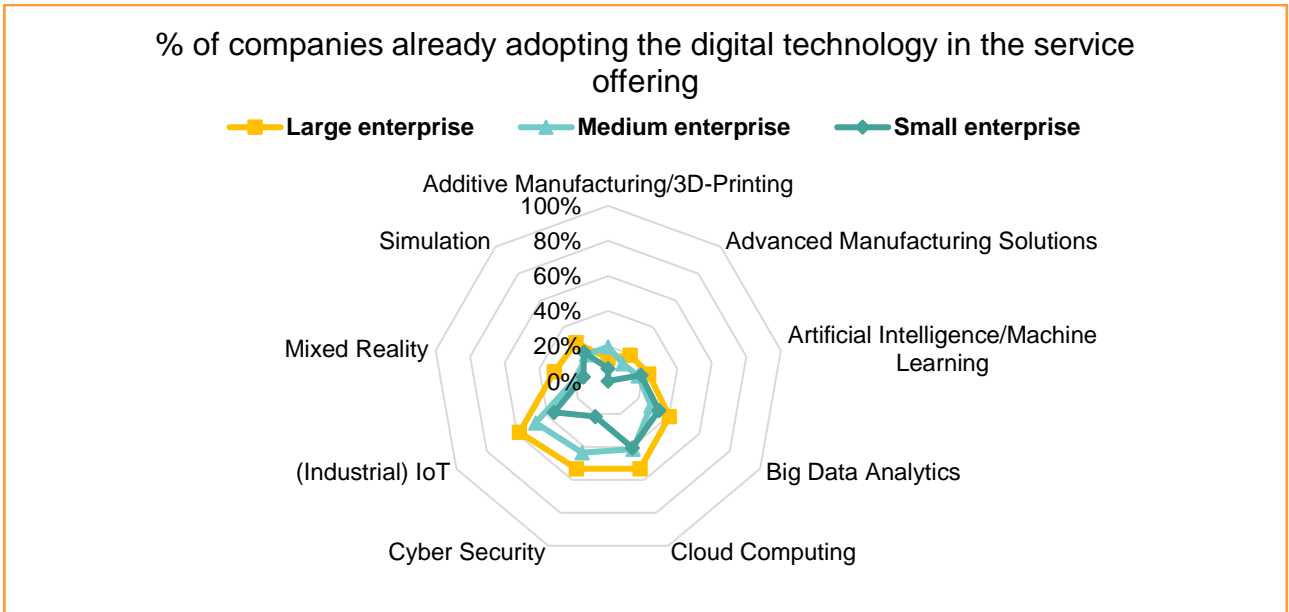


Figure 13 – Adoption of the digital technologies in the service offering among the small, medium, and large enterprises of the sample

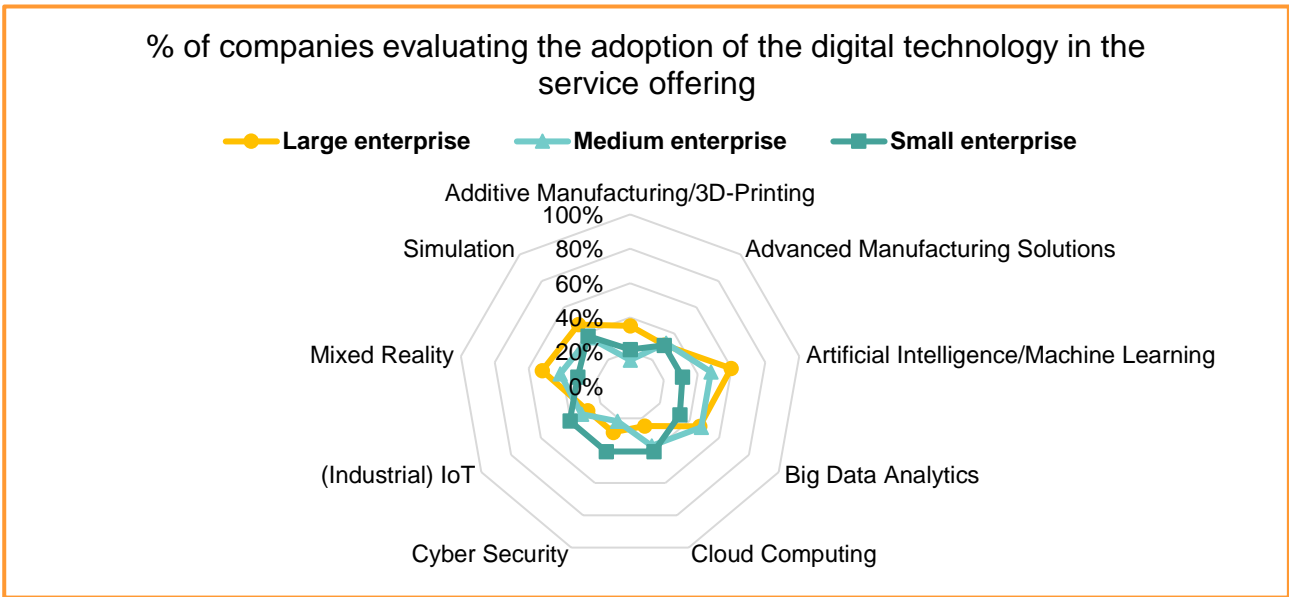


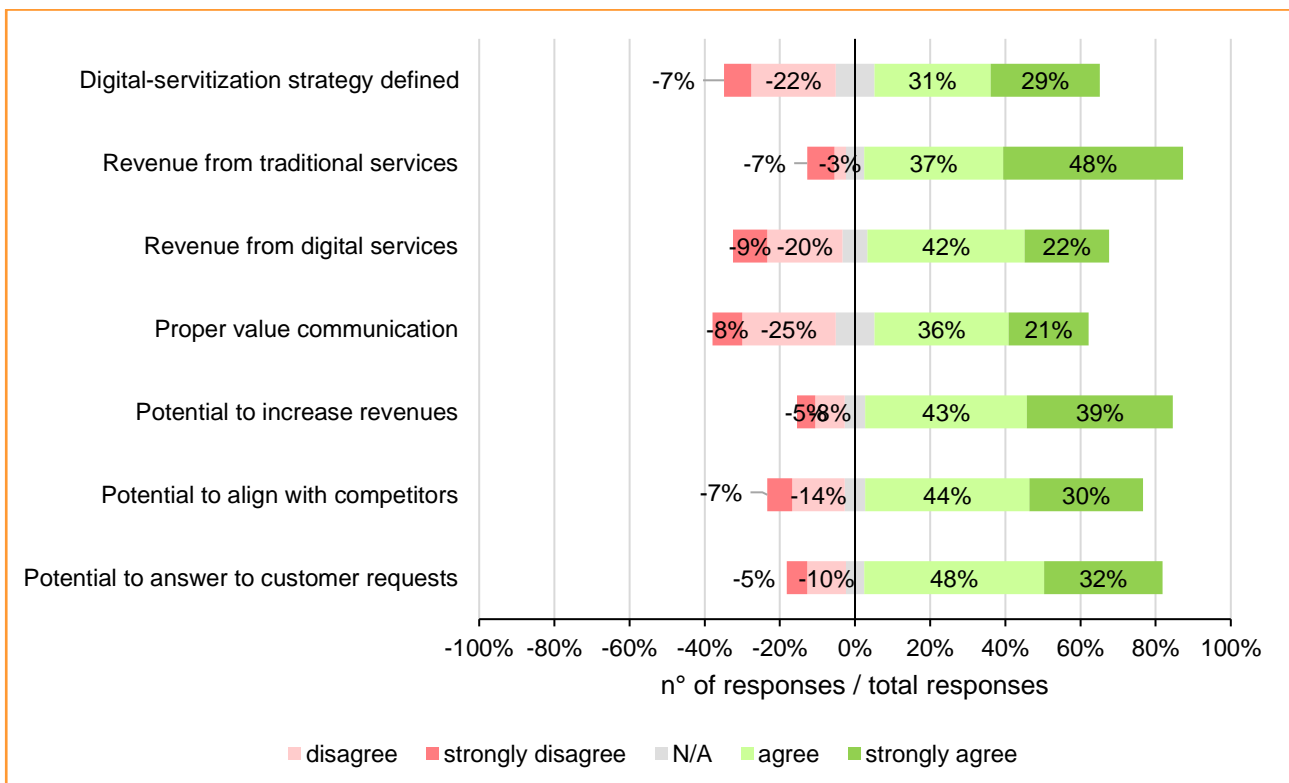
Figure 14 – Evaluation of adoption of the digital technologies in the service offering among the small, medium, and large enterprises of the sample

## Digital servitization journey

The second part of the questionnaire was also focused on investigating the process of digitization of services. Different actions and practices were investigated by asking the respondents to provide their perceptions on the basis of the Linkert scale (*strongly disagree*, *disagree*, *agree*, *strongly disagree*, and *N/A*). The main areas that were investigated are the following:

- Digital Servitization Strategy, which focuses on business value & revenue generation, capabilities, and cooperation;
- Design of digital services and knowledge management;
- Assessment tool for supporting decisions;
- Sustainability.

As previously stated, the results of this analysis are based on the sub-sample already in place digital services.

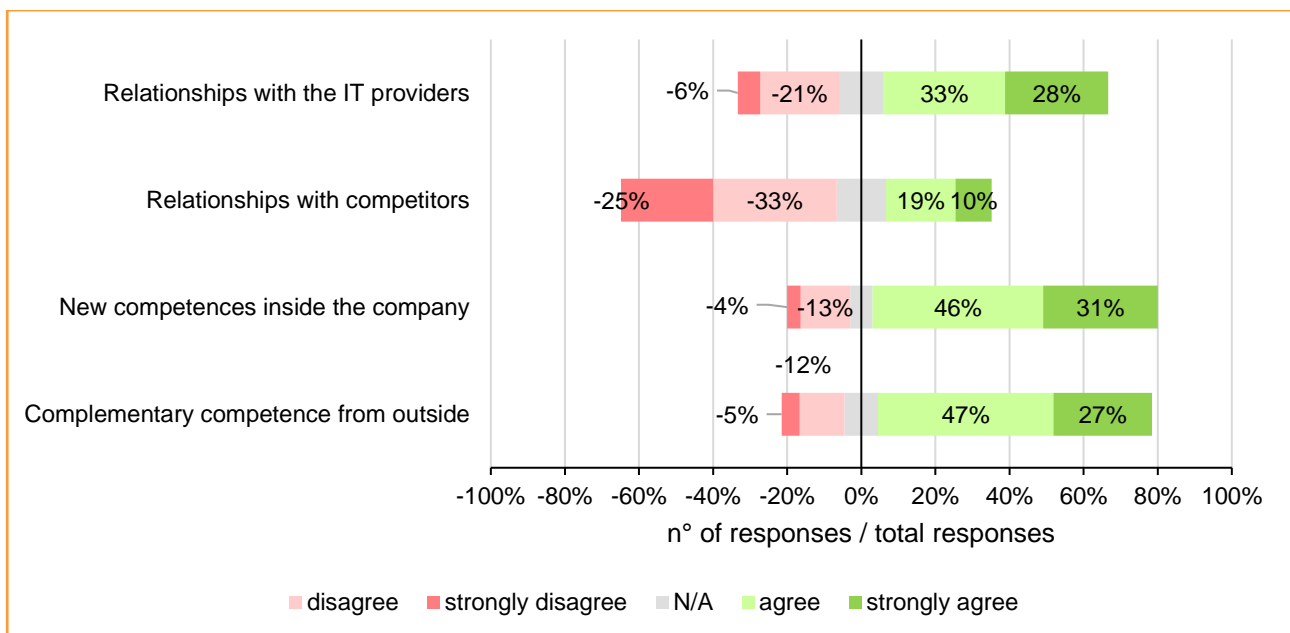


**Figure 15 – Respondent perceptions on the actions related to the Digital Servitization strategy (value and motivation)**



Companies are investing in and developing digital services because they perceive their added value, especially the potential to increase revenues, face competition, and respond to customer requests, as it is possible to observe in Figure 15. However, the revenues originated by digital services do not exceed the ones generated by traditional services sales. Indeed, the revenues still come from traditional services.

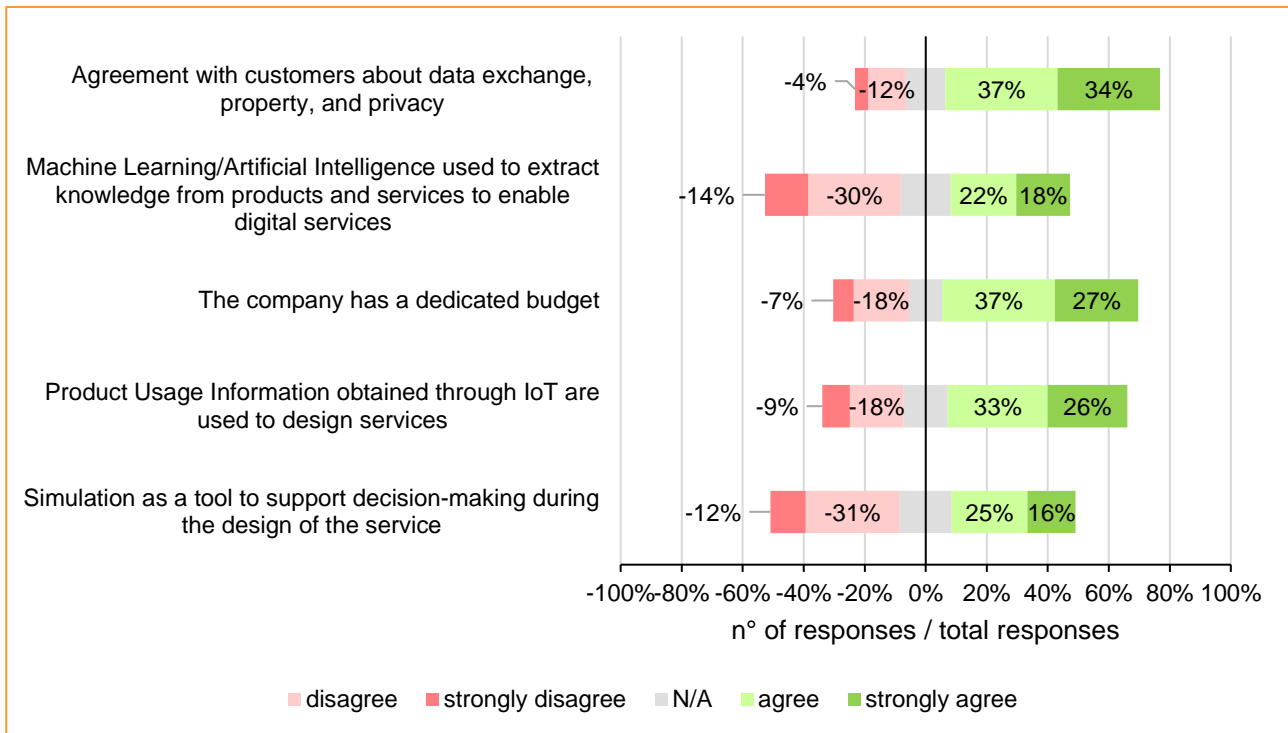
The companies which have defined a Digital Servitization strategy are 60% of the sample. It follows that almost half of the sample, even when offering a digital service solution, does so without a strategy in place. The ones succeeding in communicating the value of digital services are still 57% of the sample, suggesting that communication issues are still present and should be addressed to increase customer acceptance.



**Figure 16 – Respondent perceptions on the actions related to the Digital Servitization strategy (collaboration and competences)**

Companies are internally developing competences to implement a Digital Servitization strategy, however, as the necessary skills are often difficult to find internally, they also attempt to acquire them externally, mainly through collaboration with IT providers (Figure 16).

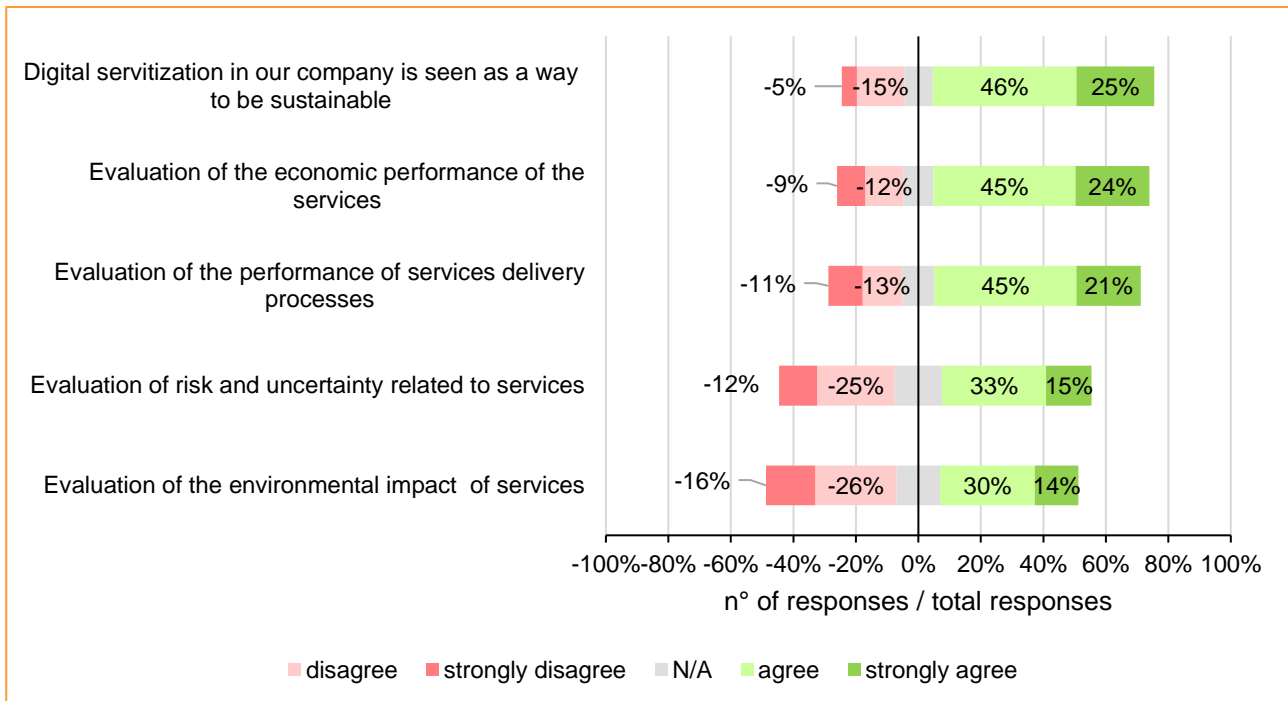
When viewed from the ecosystem perspective, most respondent companies do not include developing relationships with competitors; instead, they focus primarily on developing partnerships with IT providers.



**Figure 17 – Respondent perceptions on actions related to the service design and knowledge management**

Companies have agreements with their customers about data exchange, property, and privacy (Figure 17) – important issues to which practitioners pay special attention. They highlight the need for a dedicated budget for the service design that may impact the technical advancement during this phase.

Machine Learning and Artificial Intelligence are not widely used to extract information from products and services, enhance their design, or support digital services. Moreover, simulation is not actually utilized to support the design of new services, which is not surprising considering that its adoption rate is not as significant as obtained in the previous analysis. Although IoT systems are one of the most adopted digital technologies of Industry 4.0, only half of the sample (58% of the responding companies on average) exploits this data to design services (e.g., threshold for maintenance).



**Figure 18 – Respondent perceptions on the assessment for decisions and sustainability**

By examining the responses (Figure 18), it appears that Digital servitization is perceived as a mean to achieve sustainability, and companies, up to now, have metrics evaluating the service delivery and economic performances of their services. At the same time, the assessment of the environmental impacts and risks of services are still limited. Therefore, companies cannot measure the sustainability impacts of their services in the Triple Bottom Line – economic, environmental, and social sustainability. Nevertheless, from a risk and environmental standpoint, businesses do not have the necessary resources to assess risks and their effects on the environment.

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## Conclusions

The Digital Servitization Observatory research has been conducted to provide a state-of-the-art Digital Servitization transformation process among industrial sectors. The exploratory survey shed light on the actual service offerings of businesses and the adoption of digital technologies for enabling the services.

Specifically, although **the survey reveals companies to be still product-centric** (i.e., the main source of revenue is product sales), they have diversified service offerings in their portfolio. Among the service offering portfolio, **transactional services are the most adopted in the service portfolio, followed by multi-year services**. The dimension of the company appears to affect the diversification of the service offering portfolio since small enterprises have limited services in their portfolios with respect to medium and large ones. However, small companies manage to obtain higher revenues from the sale of services, although they have a more limited service offering. Therefore, **having a more diversified service portfolio does not influence revenue generation**. This also resulted in comparing the service offering portfolios of the three main industrial sectors of the sample, for instance, Industrials, Consumers, and IT&Communication services, and their revenue streams from service sales. Although industrial enterprises have a wide range of service offerings, their contribution to the total revenue production is less than that of the other two sectors. Particularly in the sales of transactional services, which is unexpected given how well industrials enterprises do in the provision of such services. The only exception is the IT&Communication service sector, where companies are able to provide multi-year services to a significant extent and also generate revenues from their sales.

**(Industrial) Internet of Things, Cyber Security, and Cloud Computing** are the most adopted Industry 4.0 technologies in the service offering. Therefore, the adoption of **Industry 4.0 technologies to enable services is still in the preliminary phase** since companies have yet to adopt the more complex digital technologies up to now. Only large are moving to more complex technologies, such as **Big Data Analytics, Artificial Intelligence/Machine Learning, Simulation, and Mixed Reality**. Contrarily, small businesses are now considering adopting the three most in-demand technologies, which their limited financial resources may explain, lack of digital resources and skills, and the

difficulties they have networking with other businesses compared to medium and large businesses.

The transition from a Servitization approach to a Digital Servitization approach is an articulated, complex, non-linear one that necessitates strategical, tactical, and operational knowledge and support for impacting business performances. The sources of weaknesses and strengths of the Digital Servitization journey were identified and summarized as follows.

### Weaknesses:



Difficulty in communicating the value of digital services.



Difficulty in developing an ecosystem network.



Difficulty in designing services from the collected data.

Difficulty in extracting and using the knowledge from products and services to take the right decisions.

Lack of supporting tools for service design and decisions.



Lack of metrics for risk assessment of the services.

Lack of metrics for environmental assessment of the services.

### Strengths:



Multiple benefits generated by the Digital Servitization: revenues increase, differentiation from competitors and customer loyalty.



Data property and privacy issues seem to be resolved by companies allowing for data sharing, which is an important opportunity for resolving data management issues and ecosystem communication.



Capabilities for evaluating of the economic and service delivery process performance to measure service impacts.



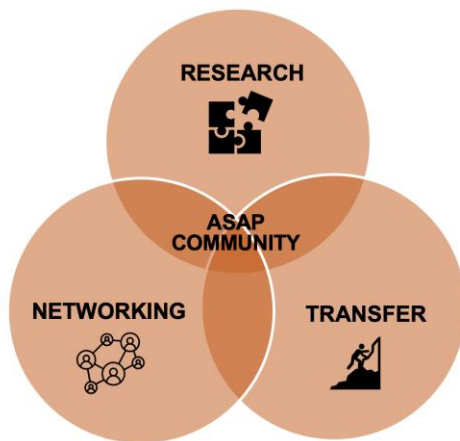
An important opportunity of Digital Servitization is the possibility of complying with sustainable goals.

## Who are we?

ASAP is the "Inter-University Research Centre on Innovation and Service Management in Industrial Enterprises" and is the point of reference in the national panorama, and one of the main ones at the European level, on the subject of service management. It conducts research, training, workshops, and conferences, and promotes networking and dissemination.

In the ASAP Community, **universities, research groups and companies collaborate** for innovation in service design and management, for the strategic development of the "service business" and change management.

Since 2003, we promote culture and excellence in service management and servitization through research, networking and transfer of solutions.



## Partners

For the development, validation, and consequent dissemination of the survey different Universities and Research centers were involved:

 <p>UNIVERSITÀ DEGLI STUDI DI BERGAMO</p>	 <p>UNIVERSITÀ DEGLI STUDI DI BRESCIA</p>	 <p>UNIVERSITÀ DEGLI STUDI FIRENZE</p>
<p><b>HSLU</b> Lucerne University of Applied Sciences and Arts</p>	 <p>University of Novi Sad, Faculty of Technical Sciences Department of Industrial Engineering and Management</p>	
<p><b>BIBA</b> Bremer Institut für Produktion und Logistik</p>	 <p>Tecnológico de Monterrey</p>	 <p>MONDRAGON UNIBERTSITATEA</p> <p>GOI ESKOLA POLITEKNIKOIA ESKUELA POLITECNICA SUPERIOR</p>



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