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Original
A General Overview of Manufacturing Servitization in Italy / Mastrogiacomo, L., Barravecchia, F., Franceschini, F.. - 64:(2017), pp. 121-126. (The 9th CIRP IPSS Conference: Circular Perspectives on Product/Service-Systems Copenaghen 19-21 June) [10.1016/j.procir.2017.03.010].

Availability:
This version is available at: 11583/2674028 since: 2017-06-05T17:37:27Z

Publisher:
Elsevier B. V.

Published
DOI:10.1016/j.procir.2017.03.010

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19 November 2026

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Procedia CIRP 64 (2017) 121 – 126

www.elsevier.com/locate/procedia

The 9th CIRP IPSS Conference: Circular Perspectives on Product/Service-Systems

A general overview of manufacturing servitization in Italy

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Abstract

The process that involves companies developing the capabilities to provide services and solutions that supplement their traditional product offerings is commonly called servitization. With regards to manufacturing, the servitization process has been found to provide many advantages, such as: increasing the value of the offering, enhancing product customization, developing customers' loyalty, generating profits throughout the whole product life cycle, etc.

Despite the many studies related to this process, there is a major lack concerning its quantification. Through an in-depth analysis of medium-large size Italian companies in the manufacturing sector, this paper examines the process of servitization proposing (i) an assessment of its extent in terms of percentage of servitized companies (ii) a taxonomy of the services offered and (iii) an estimation of their relative diffusion. Also, the paper offers a perspective on the effects that this process may have on production technologies and systems.

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Peer-review under responsibility of the scientific committee of the 9th CIRP IPSS Conference: Circular Perspectives on Product/Service-Systems.

Keywords: Servitization; Servitization level; Product Service System; Manufacturing.

1. Introduction and literature review

In a recent study, advanced manufacturing has been defined as the process of creating "integrated solutions that require the production of physical artefacts coupled with valued-added services and software, while exploiting custom-designed and recycled materials and using ultra-efficient processes" [1]. This definition formalizes the service activities as a potential output of a production process.

Neely et al. [2] defined servitization as the innovation of organization's capabilities and processes to better create mutual value through a shift from selling product to selling Product-Service Systems (PSS), i.e. integrated offerings of products and services.

This process, particularly interesting in the manufacturing sector, has been described from different viewpoints: (i) Chase and Erikson [3], Voss [4] and Mathieu [5] propose classifications of services and corporate approaches to servitization; (ii) Wise and Baumgartner [6], Lewis et al. [7] and Malleret [8] discuss and analyses the main drivers of servitization; (iii) the guidelines and methods for the implementation of servitization strategies are discussed by a number of researchers[9, 10]; (iv) few authors directly address the definition of servitization [11, 12] or its evolution in manufacturing [13, 14]; (v) some studies are related to the challenges that manufacturers have to tackle when moving into services [15-17], the architecture of servitized organizations [10, 18] and the effect of its adoption as a competitive manufacturing strategy [6, 9, 17, 19-24].

Despite the many studies on the process of manufacturing servitization, few are the conclusions related to the extent of this process and its effects. To the best knowledge of the authors, the most important work in this regard is the one proposed by Neely [2]. Relying on the analysis of balance data of a sample of companies retrieved by the OSIRIS database, the authors produce a set of major findings: (i) depending on the analyzed country, the percentage of servitized companies ranges from about 1% (China) to 58% (USA); (ii) servitized manufacturing companies are larger than traditional manufacturing companies in terms of sales revenues; (iii) at the

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doi:10.1016/j.procir.2017.03.010

aggregate level they also generate lower profits as a percentage of sales; (iv) the company size (in terms of numbers of employees) is a factor of servitization: in smaller companies servitization appears to pay off while in larger companies it proves more problematic; and (v) servitized companies seem to be prone to a higher risk of bankruptcy. The same authors point out the main limitations of their study: the sample of analyzed companies is heterogeneous in terms of size, core business, geographical location, etc.; the comparison is done on the average of balance data and not following a statistically sound approach; the study is limited to a reduced number of nations.

Following the conceptual scheme suggested by Neely for the segmentation of servitized companies, this paper proposes an analysis of the impact of the process of servitization on medium-large size Italian companies in the manufacturing sector. In detail, this paper examines this process proposing a taxonomy of the services offered by manufacturing companies and an assessment of the extent of the phenomenon in terms of percentage of servitized companies and service types.

The remainder of the paper is structured as follows. Section 2 describes the method of analysis while the results are presented in Section 3. The concluding section summarizes the original contributions of the paper, focusing on the benefits, limitations and possible future developments.

2. Method

The data used in the presented study were drawn from the AIDA database. The AIDA database contains personal, commercial and financial data of about 1,000,000 companies registered in Italy. Data were downloaded in November 2016. Only medium-large companies operating in the manufacturing sectors were considered, i.e. those with a number of employees greater than 50 and belonging to the NACE (Nomenclature statistique des Activités économiques dans la Communauté Européenne) sectors classified with codes 10 to 32 (see Table 1). These limitations resulted in a sample of 9615 companies.

To classify companies as servitized or not, we followed the guidelines proposed by Neely [2]. Since the AIDA database provides a textual overview of the core activities carried out by every indexed company, an automatic lexicographical search within the textual overview has been implemented in order to classify companies into three different categories: (i) pure manufacturing companies, i.e. those companies whose activities can be classified only as manufacturing activities; (ii) servitized manufacturing companies, i.e. those companies producing and delivering both services and products and (iii) pure service companies, i.e. those companies that only provide services. Companies included in the latter category may be seen as database allocation errors, typically being companies originally in the manufacturing sector and eventually operating in the service sector.

In order to operate this classification, two sets of keywords have been defined by the authors to describe (1) manufacturing and (2) service activities. To build the keyword list, the authors analyzed 200 overviews randomly drawn from the sample of analyzed companies, selecting those believed to be representative of manufacturing and service activities. After a preliminary selection, the keyword list was then extended with variants and synonyms to get the final set. See Appendix A for further details about the list of keyword used for this study.

Tab. 1 Detail of NACE rev. 2 sectors from 10 to 32 [25].

NACE rev. 2 Code	Description
10	Manufacture of food products
11	Manufacture of beverages
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing

3. Result Analysis

A total of 961 companies, out of the 9615 composing the sample, were not considered in the analysis since the database does not include a description of their activities. Table 2 shows a breakdown of the companies according to NACE sector and Table 3 according to (a) number of employees and (b) geographical location.

Tab. 2. Breakdown of the companies in the analyzed sample by NACE sector (8,654 Italian manufacturing companies).

Nace Rev. 2 Code		Nace Rev. 2 Code	
10	8,23%	22	6,91%
11	1,02%	23	4,11%
12	0,03%	24	4,47%
13	4,11%	25	14,99%
14	3,37%	26	3,33%
15	3,47%	27	5,30%
16	1,44%	28	17,31%
17	2,68%	29	3,07%
18	1,39%	30	1,46%
19	0,45%	31	3,34%
20	4,74%	32	2,49%
21	2,29%		

Tab. 3. Breakdown of the companies in the analyzed sample by (a) number of employee and (b) location (8,654 Italian manufacturing companies).

(a)		(b)	
Number of employee		Location	
>2500	0,42%	NORTHERN ITALY	77%
1500 – 2499	0,52%		
1000 – 1499	0,94%	CENTRAL ITALY	14%
750 – 999	1,08%		
500 – 749	2,40%	SOUTHERN ITALY	9%
250 – 499	8,72%		
150 – 249	14,49%		
75 – 149	36,04%		
50 -74	35,40%		

The characteristics of the Italian entrepreneurial system lead to a composition of the sample characterized by a majority of medium-sized companies, typically located in the north of Italy. The largest sectors in terms of number of companies are NACE 28, 25 and 10, respectively related to production of machinery, metal products and foods.

3.1. The overall extent of Servitization

The first finding of the present study is the share of Italian manufacturing companies that, besides their physical products, have also the skills and resources to provide relevant services.

The pie chart in Figure 1 shows the percentage of servitized (~37%), pure manufacturing (~62%) and pure service companies (~1%).

The proportion of servitized companies tend to increase as the dimension of the company increases in terms of number of employees. Figure 2 shows the distribution of servitized, pure manufacturing and pure service companies as a function of the company dimension.

Almost the 67% of small-medium companies are classified as pure manufacturing, while the 32% are servitized companies. These proportions are reversed for very large-size companies, namely with a number of employees greater than 2500: the 36% belongs to the pure manufacturing category while more than the 58% are servitized.

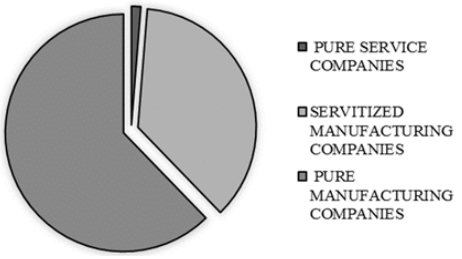


Fig. 1. Distribution of the analyzed manufacturing companies.

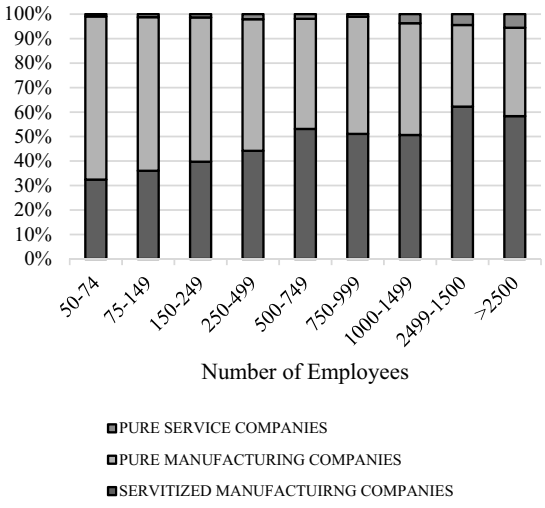


Fig. 2. Distribution of Italian manufacturing companies vs. dimensions of the company.

3.2. Servitization by type of service

The identification of servitized companies is performed according to a selection of keywords which, if present in the general overview of the company, describe the provided services. By grouping the keywords, it was possible to construct a taxonomy of services offered by analyzed companies. For details about the keyword used please refer to Appendix A. Ten different categories of services were identified:

- *Consultancy services*: the manufacturing company shares his practical experience in the field to advise and assist his client.
- *Design and development services*: the company customizes the design and development of the product for third parties so as to meet the specific needs of their customers.
- *Financial services*: the company directly manages long-term credits related to their products, deferring their payment or proposing rental or leasing contracts.
- *Logistic services*: the company provides delivery, transport and/or storage services for its or customer's products, components or raw materials.
- *Installation and setup services*: the company installs and tests its products, also training the personnel in charge of their use.
- *Management and operating services*: the company operates its products throughout their life cycle, the customer receives only the benefits of the use of the product without having to run it.
- *Maintenance and support services*: the company offers the necessary support services to solve potential operational problems during the life cycle of the product, offering spare parts and skilled labour capable of repairing or updating the product features.
- *Disposal and conversion services*: at the end of the life cycle of the product, the manufacturing company deals

with the demolition, conversion or recycling of the product materials.

- *Retail and distribution services*: the manufacturing company directly promotes and distributes its products to the end customers, exports it to foreign countries and sells it. These services do not include those of the simple sale of goods produced without an articulated organization to support the customer service.
- *Other services*: this category include all the other services not classified in the previous categories, mostly not related with the product, such as the organization of events, the import of raw materials and components, real-estate activities, etc.

Figure 3 describes the spread of the aforementioned types of services in servitized manufacturing companies in Italy, also providing an insight about their distribution in medium and large enterprises. Retail and distribution, design and development, and maintenance and support are the most common services.

Some services, such as management and operating or financial services, are offered to a greater extent by large-size companies. Other services, such as logistics services, do not seem to be influenced by the size of the servitized company.

3.3. Servitization level

To better quantify the process of manufacturing servitization, we define the number of different service categories – as defined in Section 3.2 and independently of the type – concurrently offered by a company as *servitization level*. As an example, a company that is only providing design and consultancy services has a servitization level equal to 2. Although questionable and improvable, we believe this level to be a useful proxy for quantifying how much a company has servitized.

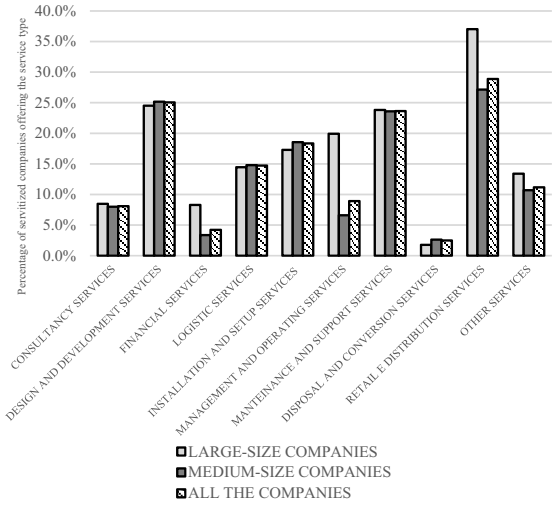


Fig. 3. Spread of service types per dimensions of the company.

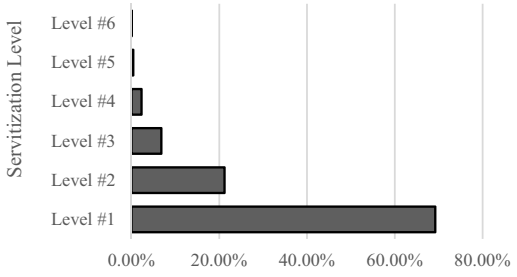


Fig. 4. Distribution of servitization level.

The analysis of the sample shows that about the 70% of the servitized companies offers a single service typology. Figure 4 shows the distribution of servitization level.

The analysis of the servitization levels shows an effect of the company size. The trend of the servitization level is to grow with the company size. Figure 5 shows that while the 71% of medium-size servitized companies offers a single type of services, this percentage drops to 52% for large-size companies (number of employees greater than 1000) which conversely means that the 48% has a service portfolio that covers multiple service types.

3.4. Servitization by manufacturing sector

Manufacturing activities are classified in 23 different sectors by NACE, i.e. NACE 10 to 32 (see Table 1 for the correspondence between NACE codes and manufacturing sectors).

Figure 6 shows an analysis of servitization distribution by manufacturing sector. Differences among sectors are significant and may depend on the characteristics of the companies and the realized product. NACE 13 (Manufacture of textiles), 26 (Manufacture of computer, electronic and optical products) and 30 (Manufacture of other transport equipment) are the commodity sectors with a greater percentage of servitized companies.

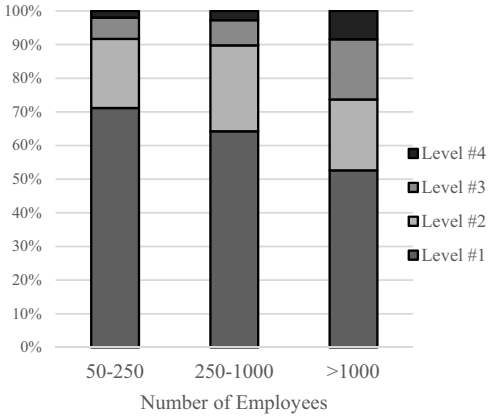


Fig. 5. Servitization level per company size.

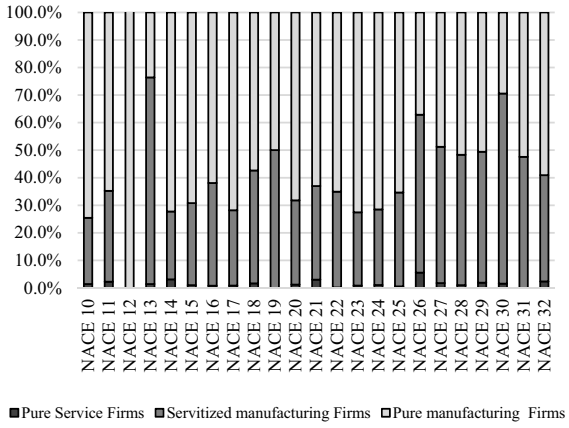


Fig. 6. Servitization level per NACE sector.

Also, the distribution of service types within each NACE sector can be significantly diverse. As an example, Figure 7 provides the distribution of service types in NACE 28 (Manufacture of machinery and equipment) and 31 (Manufacture of furniture). It is noteworthy how companies in NACE 31 often offer design, logistic and retail services and virtually no management and operating services. On the other hand, the 20% of companies in NACE 28 offers maintenance and support services and only 11% retail and distribution or logistic and distribution services.

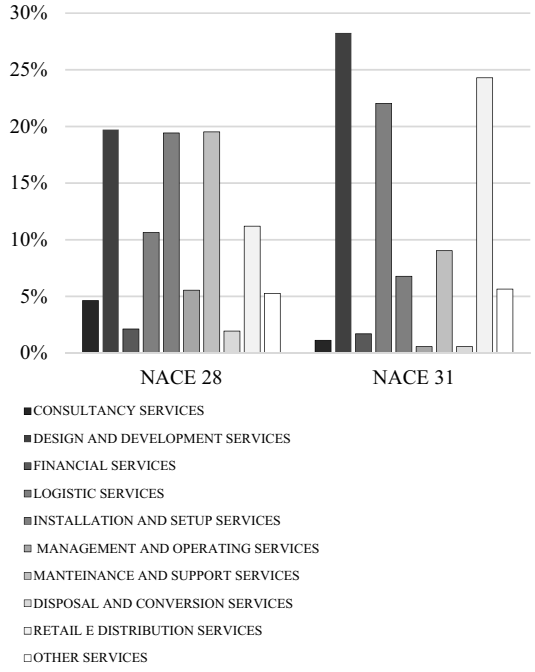


Fig. 7. Distribution of service type in NACE 28 and 31.

3.5. Servitization by geographical location

The geographical location of a company is also a factor of servitization. The results herein presented are in line with those discussed by other studies [26, 27], and in particular by Neely (2008): the percentage of servitized companies in Italy (~ 37%) is comparable to that of other European countries. Table 4 shows a benchmark between the obtained results and those by Neely. Notice that there are several major differences between the data compared: (i) the analysis of Neely refers to 2008, (ii) for each nation Neely considers only a limited sample of companies in the manufacturing sector, and (iii) the set of keyword used to classify companies are potentially different.

Tab. 4. Benchmark between results obtained by Neely (2008) and this study (*).

Country	% of pure manufacturing companies	% of servitized manufacturing companies
USA	41	59
Netherlands	60	40
Belgium	62	38
Italy	**62***	**37***
Norway	69	31
Germany	71	29
Spain	74	26
UK	75	25
France	81	19
China	99	1

To further stratify the analysis, companies in the sample were clustered according to the location of their headquarters in Italy. The spread of the servitization process was assessed with regards to the three specific clusters identified: northern, central and southern Italy (including the islands). The analysis shows a percentage of servitized companies that is relatively lower in the south of Italy (31%) than in the north (37.5%) and center (37.6%).

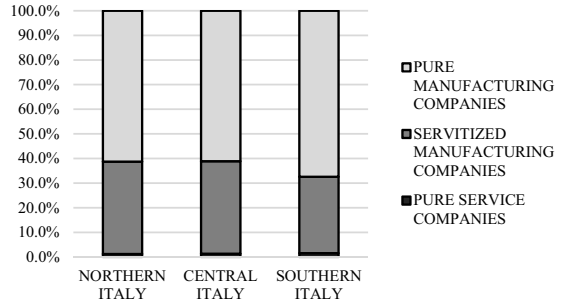


Fig. 8. Servitization vs. geographical location.

4. Conclusions

This paper is aimed at presenting a picture of the servitization process of manufacturing companies in Italy. The presented analysis shows that the servitization process is a

widespread reality: the 37% of the analyzed companies provides evidence of a portfolio of offerings that includes different service components. The manufacturing sectors that present the highest percentages of servitized companies are production of (1) machinery and (2) metal products. To better detail the analysis, the paper also proposes a taxonomy of the main services offered by the considered sample of companies, analyzing how servitized companies are distributed per each product sector. The study offers several elements of novelty: (i) it is the first attempt to quantify the process of manufacturing servitization in Italy, (ii) it analyses the process according to several factors, including geographic location, commodity sector, type of services offered, etc. and (iii) for each company, it analyses the servitization level – i.e. the variety of services offered. The main limitations of the study are related to the use of the AIDA database in which data concerning the description of a company's activities are updated from time to time and do not allow to follow the evolution of servitization over time.

Future developments of this study will (i) further investigate the concept of servitization level and (ii) address the possible impact this process may have on technologies and production systems and vice versa.

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Appendix A.

Table A.1 Keyword list. Service keywords are divided by service type. Symbol "*" indicates any possible character(s).

MANUFACTURING	SERVICE		
Transformation	**Consultancy services**		
Blending			
*Construct**	*Consult**	*Planning*	
*Manufact**	**Design and development services**		
*Assembl**	*Design*	*Development*	*Conception*
*Refin**	**Financial services**		
Production	*Financial*	*Leasing*	*Hir**
Process	**Logistic services**		
Build	*Transportation*	*Trucking*	*Consignment*
Work	*Logistic*	*Storage*	
Treat	**Installation and setup services**		
Print			
Produce	*Installation*	*Implementation*	*Procurement*
Industrial firm	*Testing*	*Training*	
Producing	**Management and operating services**		
Treatment	*Operating*	*Conduction*	*Management*
Coating	**Maintenance and support services**		
Casting	*Repair*	*Maintenance*	*Support*
Weaving	*Servicing*		
Tanning	**Disposal and conversion services**		
Dressing	*Demolition*	*Conversion*	
Finishing	**Retail e distribution services**		
	Retail	*Marketing*	*Promotion*
	Export		
	Other services		
	Real estate	*Event*	*Import*
	Agency	*Outsourcing*	