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Services Typology from the Perspective of the Labour Process, Including the User as a Production Component

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Abstract

The user (consumer/client) is increasingly involved in production and innovation processes. This phenomenon is changing the way we look at innovation. Therefore, two changes are at play: on the one hand, the joining of goods and services innovations in a common framework, and on the other, linking them with consumer participation. These approaches allow us to derive a service-goods-user typology according to the different kinds of production. So, another element must be added to the historical production organizations: artisanal, manufacturing, industrial, informatics, scientific, and customization. The method consists of the evolution of those productive organizations based on tools, machinery, energy, information and science, and customer participation. Even if they are present since the artisanal production, an unfold of productivity began with the industrial revolution, separating itself into machinery and energy. Then, there came the computer and scientific revolutions. Different services and goods are correlated with each stage of organizational production increasing, in this context, customization and user involvement.

Keywords

Service Innovation, Customization, Customer-Driven Manufacturing, User Involvement, Service Typology

1. Introduction

This paper proposes a typology of services, including client participation in the production and innovation of goods and services based upon the organizational labour production development.

The approach involves adding customer/client participation as part of the la-

bour process in different kinds of artisanal, manufacturing, industrial, informatics, and scientific organizations.

From this point of view, including those typologies cited in the literature on service innovation, the aim is to characterize the relationships between users (customer/client) within production, looking mainly at the economic dynamics of diminishing costs and transaction costs.

2. Literature Review

Early research on technology was based on evolutionary theory linked to product development, focusing on the manufacturing sector (Schumpeter, 1942). Until that stage, "the study of technical change in the service sector was largely neglected as services were viewed as low technology users" (Cainelli, Evangelista, & Savona, 2004). Services have some of the following general characteristics (Djellal & Gallouj, 2013):

Intangibility as "it does not have a 'tangible' form that can be accumulated and circulate economically independent of its support".

Interactivity by means of customer participation in the production of the service, as they specifically co-produce the service. Consumer of Information Technology, IT, and network services sometimes provide their labor, their technologies (computers, Internet), and eventually a certain amount of capital to co-produce the service (Djellal & Gallouj, 2013: p. 285).

Time factors, such as the need to distinguish the short-term service from its medium- and long-term effects, that is to say, the outcome.

More recent studies show that innovations require increasingly sectorial interrelationships between goods and services (Omachonu, 2010) and are presenting convergence tendencies of technologies and knowledge (**Table 1**).

1) The technological convergence is focused on manufacturing, reaching a certain level of "fusion", as is the case of mechatronics and optoelectronics (1975-1990) (Kodama, 1986). Modularization is facilitated by introducing Information and Communications Technologies, ICT, within the framework of achieving the integrity of the product.

2) Product Service System, PSS, deal with dynamic interdependencies of products and services in production (Meier, 2010), which are defined as a marketable set of products and services that are capable of jointly fulfilling customers'

Table 1. Convergence of technology and knowledge in goods and services.

	Technology	Service knowledge
Goods	1. Technological Convergence and Fusion	2. PSS, Product Service System (Baines et al., 2007), (Omachonu, 2010)
Services	3. Technology Enabled Services (TES)	4. Service Convergences: integrating services customization and user involvement

Source: Author's adaptation from (Chang, Miles, & Shih-Chang, 2014).

needs" (Omachonu, 2010). The term "service" has evolved to include many of today's offerings that are characterized by bundled solutions consisting of products and services (Nam & Lee, 2010).

3) Services enabled by technologies, TES, provided by a "business services company that uses proprietary technology to deliver something better, faster, and cheaper than if you do it yourself or hire a traditional firm" (Hurst, Lesko, & Byrnes, 2014).

4) Convergence involves removing boundaries between multiple services to offer a total solution through collaboration, coordination, constellation value in a single place of purchase, and integration of services. This involves creating networks of customers, partners, and employees to co-create and facilitate interaction with the client-producer (Fogliatto, da Silveira, & Borenstein, 2012).

The customer-driven services and manufacturing are marked by increased variety to tailor the product or services to the customer's needs (Desmarchelier, Djellal, & Gallouj, 2019). These trends result in manufacturing "in small batches, while at the same time showing steadily decreasing product life cycles driven by customer orders" (Wortmann, 1997). There is a broader variety of services, ranging from how the service is designed and developed to how it is delivered and managed (Miles, 2005). The innovation strategies are changing from "innovating for customers" to "innovating with customers" and involving those customers in the process of "knowledge co-creation" (Desouza et al., 2008). Services increase their heterogeneity depending on the extent of customer interaction (Randhawa & Scerri, 2014).

Another approach involves considering which factor is undergoing the most change: physical (goods), information, Knowledge-based or people, or stressing intra-services differences regarding the patterns of technologies used, relevant market characteristics, and the technical skills required (Miles, 2008).

3. Methodology

The point of departure is to make a synthesis of the different kinds of typologies already developed for service innovation and for user participation in innovation which is increasing due to economic tendencies such as:

1) Competing costs, quality, and positioning in globalization and value chains (Skaalsvik & Johannessen, 2014).

2) Mass customization is related to the following steps a) building the product catalog, b) configuring customer orders, c) transferring orders to manufacturing, and d) manufacturing customized orders (Da Silveira, Denis, & Flavio, 2001).

3) Artisanal manufacturing, "offering broader access to a level of quality that traditional mass-scale businesses cannot achieve" (Upbin, 2013).

4) Open innovation as a means of reducing costs and grasping opportunities (Mina, Bascavusoglu-Moreau, & Hughes, 2014); it is much less a dichotomy (open versus closed) than a continuum with varying degrees of openness (Huizing, 2011), with an enormous scope of ways and instruments.

5) Collaboration for innovation, which is more frequent in the services firms (Chesbrough, 2011a, 2011b).

To classify service innovation, a four-dimensional model is based on a) service concept, b) client interface, c) service delivery, and d) technology, thus establishing different patterns in the relationship of the supplier, service firm, and client, which are related to personal, organizational, marketing and competing capabilities (den Hertog, 2000).

In the case of the client is a consumer, producer, or both, the following concepts have been applied: service co-terminality (Miles, 2008) and co-production (den Hertog, 2000) or client interaction (Kvålshaugen et al., 2008).

According to a service-dominant logic (S-D logic) perspective, four types of service innovation are presented based on two levels: high and low, of two dimensions: co-creation between firm and customer; and networked collaboration, therefore firm needs to enhance their capabilities for service innovation by applying the resources of all actors including suppliers and customers (Nam & Lee, 2010). Service-dominant (S-D) logic is tied to the value-in-use, then "roles of producers and consumers are not distinct, meaning that value is always co-created, jointly and reciprocally, in interactions among providers and beneficiaries through the integration of resources and application of competences". His logic primarily unifies the distinction between goods and services in terms of benefit provision. The traditional view is referred to as goods-dominant (G-D) logic and is based on the value-in-exchange (Vargo & Maglio, 2008).

The question is how innovation applies to services (Gibbert, Leibold, & Probst, 2002):

- Good innovation concepts apply readily to services.
- Working closely with customers to develop new solutions.

Thus, the relationship between user and producer in cooperation during the production and the innovation process could be classified considering: a) what kind of production process is involved, b) what kind of services and how they are related to goods, and whether or not they are part of marketing or financial activities.

Departing on these concepts, a method is proposed to generate a typology of production integrated with customers. The contemporary customization processes are added to the division of labor and the convergence of knowledge in goods and services (**Table 1**): artisanal, manufacturing, machinery system, automation, scientific, and customization (**Table 2**).

4. Results

The evolution of the labour process classified into services and goods is related to its corresponding components used in production (**Table 3**). Beginning with the artisan process, which needs hand instruments and knowledge related to specific skills.

Then follows the industrial revolution, which has two phases: one, manufac-

turing based on the division of labour between workers, and two, the introduction of machinery using steam energy. Therefore, machine-tool demand for different services, from maintenance to specialized skills, organizational services, and energy, require prospection and energy distribution services (Table 3).

The information technology revolution, based on Information and Communications Technology, ICT, impact first production through automation; with a demand for services such as supervision, control, information, and computing services, as well as software and design; and second, its application extends to all the labour processes including Science and Customer (Table 2 & Table 3).

The Scientific revolution, which is based on and producing knowledge services, incorporates intellectual and creative knowledge, Research and Development, R&D services, information systems, and creating a network of services and goods.

Besides labour, machinery, energy, information, and new materials, the consumer who also serves as a co-producer is added, generating a kind of co-producer and self-service, thus relating these processes and their main components to service technology convergence.

Convergence is more important in manufacturing, machinery system, and automation. Distributed energy is a clear tendency. Science and the client as co-producer are applied to all convergences (Table 2).

Because productivity in the service sector has increased more slowly than in the manufacturing sector (Ganz, Moerschel, & Schlet, 2013). Therefore, a typology of services is generated by ordering their importance to develop a new wave of productivity, considering its value creation and its value realization (Table 4):

1) The main service impacts on value creation are through Information, which

Table 2. Production processes and their components.

Production PROCESSES	COMPONENTS	Service Convergence (Table 1)			
		Technology	PSS, Product Service System	TES, Technology Enabled Services	Service
ARTISAN	LABOUR				
MANUFACTURING	MACHINERY	C			
MACHINERY SYSTEM	ENERGY	C/D	C&D	D	D
AUTOMATION	HARDWARE/SOFTWARE			X	C/D
SCIENTIFIC	**NEW MATERIALS-Science**	**X**	**X**	**X**	**X**
CUSTOMIZATION	**CLIENT, CONSUMER-(as)PRODUCER**	**D**	**X**	**X**	**D**
			C, convergence. D, distributed. X, applied.		

Source: Author's elaboration.

Table 3. Role of services and goods in labor process & its Components.

LABOUR PROCESS-->	ARTISAN PROCESS		MANUFACTURING		MACHINERY SYSTEM		AUTOMATION		SCIENTIFIC PROCESS	
COMPONENTS (Table 1)	Goods	Services	Goods		Goods	Services	Goods	Services	Goods	Services
LABOR	Hand Tools	Skills, Capabilities, Knowledge, Physical work		Division of Labour		Labor: Routine tasks. subordination to the machine. Work specialization		Supervising & Maintenance	Training equipment	Researcher. Intellectual collective work. Development of creative abilities
MACHINERY			Machine Tools powered by human muscle	Maintenance	Machine Tools powered electrically, hydraulically or via line shaft, Electric Motor	Maintenance	Computer Numerical Control (CNC) Robotics. Automation	Specialized software	Laboratories: Phisycs, chemical, biology, nanotechnology	R&D
ENERGY					.Coal Oil Gas Electricity.	Prospecting Electricity distribution	New energy sources: nuclear, solar, biological Power generation, transmission systems, and distribution systems	Prospecting control system	Technologies for renewable resources, TER Distributed Energy Resources (DER)	Design. Prototypes PPP electricity services
INFORMATION							ICT Information and Communications Technology	Computer systems and information processing	Cloud Data Storage	Integration of information: Images, data & sounds
NEW MATERIALS-Science (knowledge)									Science instruments: telescope, microscope, particles acceleration	Scientific networks
CONSUMER-(as)PRODUCER		Do it yourself (DIY)	Self service machines	Co-terminality or not (Miles, 2008)	Mass Industrial Production	Standardized Service	Flexible automation	Automated Teller Machine	Customer involvement in service development. Use of new methods/Customers as resources/Utilization of user innovations	

Source: Author's elaboration.

Table 4. Service's Value Creation in the Labour Process.

ORGANIZATION	LABOUR PROCESS	SERVICES	Services' Value creation: value in use			Services for Value Realization: value in exchange	
			Production cost	Transaction cost	Quality	Marketing	Financing
ARTISANAL	ARTISAN PROCESS	Skills, Capabilities, Knowledge, Intellectual and Physical work	commerce and bargaining	Low or null	Handcraft	retail market	Banking
INDUSTRIAL	MANUFACTURING	Maintenance	TES, Technology Enabled Services	outsourcing services	Standard	Retail and Wholesale market.	Consumption and investment financing
	MACHINERYSYSTEM	Prospecting	PSS, Product Service System	outsourcing services	Control Laboratory		
		Electricity distribution	ESS, Energy Service System	Regulations for exchange	Commodity		
INFORMATIONAL	AUTOMATION/ INFORMATION	Computer systems and information processing	non-rivalrous	Big Data generates tradable value	ACCURATE*	KIBS, Knowledge Intensive Business Services' Markets	Banking System
SCIENTIFIC & TECHNOLOGICAL	SCIENTIFIC PROCESS/Knowledge	Scientific networks	non-rivalrous	Regulations via patenting or confidentiality rules	Peer Review; Commercialization of knowledge	New service markets	Risk Capital
CUSTOMIZATION	SOCIETAL PROCESS/ Client-Customer	Customer involvement in service development. Use of new methods Customers as resources Utilization of user innovations	diminishing costs via transferring costs to the customer	outsourcing services	customer participating in Quality	Customer requirements and consumption	Credit

*ACCURATE, Complete, Cost-beneficial, User-targeted, Relevant, Authoritative, Timely, Easy to Use (Murtala, 2012). Source: Author's elaboration.

is naturally non-rival, as sharing or selling information does not reduce the information available to others. However, as the information accumulates, it becomes Big Data generating tradable value.

2) Scientific & Technological labour processes and output are expected to potentially produce more considerable productivity gains.

3) Technology Enabled Services (TES), Product Service System (PSS) and Energy Service System (ESS) are outsourcing services or new service development originating from the industry. ESS is a complex energy service systems with multiple energy carriers, including environmental impacts and consequences of different regulating regimes (Bakken & Holen, 2004). If technology is employed as a new and innovative source that can form the basis for developing entirely new services, it could be labelled as a "New technology-originated service" (TOS) (Kuusisto, Kuusisto, & Yli-Viitala, 2013).

4) Customer involvement in outsourcing services, developing new methods, and participating in innovations and quality services. However, this is a result of the use of customers as resources and sometimes using their resources. Then, a source of productivity comes from lowering costs by transferring some production costs to the customer and intertwining them (Hofmeister, Kanbach, & Hogreve, 2023).

5) Marketing and financing services are necessary to ensure production and sales. Regarding marketing, this could be the retail or wholesale market, depending on the economic sector. KIBS' markets vary according to the type of knowledge. New service markets are related to innovative products (goods and services). The customer participates as a co-producer but sometimes also in marketing and financing. Firms are implementing Customer Relationship Management (CRM) integrated and balanced approach to technology, process, and people (Chen & Popovich, 2003).

5. Discussion

Services are present with goods in the evolution of the production organization, which is oriented by productivity. As productivity in services is more diffuse than in goods, however, both are involved and have aggregation economic problems. The co-creation and co-production of the customer added additional difficulty, as their time does not express in costs.

These research problems appeared relative to the stage of evolutionary production processes, as part of the division of labour, which implies a set of innovations that increase productivity achieved by:

1) Diminishing production costs;

2) Whenever the transaction costs of productive activity are lower in the market, they tend to be moved outside the firm (Williamson, 2007); and

3) Regarding services, a way to diminish costs is through time and activities provided by the customer, as is the case of Self-service, which mainly focus on the quality of the service and the customer acceptance (Curran & Meuter, 2005).

The typology based on goods and labour processes applied to services and adding the recent participation of customers in production provides us with a framework to propose a typology of services. This typology emphasizes the need to ponder the value of use and exchange.

6. Conclusion

"The transition toward a service-based economy, however, calls for a revised understanding of value creation within organizations" (Pitelis, 2009, cited by Randhawa & Scerri, 2014). It is necessary to consider not only the "value-in-use" of services to the customer but also the "value-in-exchange", to return to services as a productive activity for value creation.

Technological changes are defined based on goods. Therefore, services are production inputs. From this point of view, services directly affect the way of production with the Information and the Scientific and Technological revolutions and the development of Customization (**Table 2**).

The typology proposed as a function of the evolution of the labour production processes, which are based on the productivity organization stage, is the following (**Table 4**):

1) Information services grouped with the Informational labour process based on the wide range of TIC's applications.

2) Scientific & Technological services.

3) Product Energy-Technology Enabled Services (PE-TES) are associated with product, technology, and energy changes and development.

4) Customer involvement in outsourcing services, developing new methods, and participating in innovations and quality services.

5) Marketing and financing services.

Public services could be added, and classified by those 5 types, but with an additional public value, which influences the use and exchange values, in most cases by the circumstance of having no price, collective consumption, and direct/indirect consumers.

KIBS, Knowledge Intensive Business Services, which might be of any of the above types, could increase productivity as part of the "customization revolution".

New service changes, innovations and customer participation, must be evaluated in function of their economic impacts and dynamics, depending on which Sector, where technology is used, and their relations with goods (**Table 3**).

The debate is whether innovations will remain bottled up in a few tech-intensive sectors that employ the highest-skilled professionals, account for a relatively small share of GDP, or spread to the bulk of the economy. The consequences of any innovation for productivity, employment, and equity ultimately depend on how quickly it diffuses through labor and product markets (Rodrik, 2016).

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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