

User as a new component of production: Typology of Services from the perspective of the Labour process.

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Abstract

Nowadays there is an increasing involvement of the user (consumer/client) 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. These organizations are based on tools, machinery, energy, information and science, and customer participation, respectively. In this context, there are different kinds of services and goods correlated with each organizational production stage.

Key words: Service innovation, Customization, Customer-driven manufacturing, User involvement, Service Typology.

1. Introduction

The objective of this paper is to propose 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 a customer/client participation as part of the labour process in different kind of organizations - artisanal, manufacturing, industrial, informatics, and scientific.

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 focussing 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, et al., 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 service¹;

Time factor, such as the need to distinguish the output, that is, 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):

Table 1: Convergence of technology and knowledge in services		
	Technology	Service knowledge
Goods	1. Technological Convergence, and Fusion	2. PSS, Product Service System (Baines, et al., October 1, 2007), (Omachonu, 2010)
Services	3. Technology Enabled Services (TES)	4. Service Convergences

Source: Author's adaptation from (Chang, et al., 2014)

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 the introduction of 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

¹ Consumers of IT and network services sometimes provide their own labor, their own technologies (computers, Internet), and eventually a certain amount of capital to co-produce the service (Djellal & Gallouj, 2013) p285.

customers' 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, which are provided by "business services company that uses proprietary technology to deliver something that is better, faster, and cheaper than if you do it yourself or hire a traditional firm."(Hurst, et al., 2014).
4. The convergence of services 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.

The customer-driven services and manufacturing is marked by an increase in variety in order to tailor the product or services to the customer's needs. These trends are resulting in manufacturing "in small batches, while at the same time showing steadily decreasing product life-cycles driven by customer orders"(Wortmann, 1997). In services there is a wider variety 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 a process of "knowledge co-creation" (Desouza Kevin C., 2008). Services increase their heterogeneity depending on the extent of customer interaction (Randhawa & Scerri, 2014).

. Another approach involves considering which factor is undergoing most change: physical (goods), information, Knowledge-based or people, or stressing intra-services differences in terms of 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 kind of typologies already developed for service innovation and for user participation in innovation.

User participation is increasing due to economic tendencies such as:

- 1) Competing costs, quality and positioning in globalization and value chains;
- 2) Mass customization tendencies (Da Silveira , et al., 2001);
- 3) Artisanal manufacturing, "offering broader access to a level of quality that can't be achieved by traditional mass-scale businesses" (Upbin , Dec 11, 2013);

4) Open innovation as a means of reducing costs and grasping opportunities (Mina, et al., 2014); it is much less a dichotomy (open versus closed) than a continuum with varying degrees of openness (Huizing, 2011), with a large scope of ways and instruments.

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

In order to classify service innovation a four-dimensional model is based on: 1) service concept, 2) client interface, 3) service delivery, and 4) 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 being 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) perspective², 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 own capabilities for service innovation by applying the resources of all actors including suppliers and customers (Nam & Lee, 2010).

The question is how innovation applies to services:

- Many 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: 1) what kind of production process is involved; and 2) what kind of services and how are related with goods, and whether or not they are part of marketing or financial activities.

4. Results

A method to generate an integrated typology of production with customer is proposed, first, based on technology change in the division of labour which is expressed through historical production organization's development: artisanal,

² 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).

manufacturing, machinery system, automation and scientific processes to which it is added a customization process.

The evolution of the labour process is classified into both services and goods used in production. The point of departure is the artisan process which needs hand instruments and knowledge related to specific skills.

Then follows the industrial revolution that has two phases: one, manufacturing 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 on up to specialized skills, organizational services and energy require prospection and energy distribution services (Table 2).

The information technology revolution, based on Information and Communications Technology, TIC, impact first production through automation; with a demand of services 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).

The Scientific revolution which is based and produces knowledge services incorporates intellectual and creative knowledge, R&D services, information systems, and networks services into production of good and services.

Besides labour, machinery, energy, information and commodities, the consumer who also serves as 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 3).

Table 3. Production processes and its components.

Production PROCESS->	Services			
	Technology	PSS	TES	Service
ARTISAN				
MANUFACTURING				
MACHINERY SYSTEM				
AUTOMATION				
SCIENTIFIC				
CUSTOMIZATION				
	COMPONENTS			
LABOUR				
MACHINERY	C			
ENERGY	C→D	C/D	D	D
INFORMATION			X	C/D
RAW MATERIAL- Science	X	X	X	X
CLIENT, CONSUMER- (as)PRODUCER	D	X	X	D

	PSS, Product Service System	TES, Technology Enabled Services	C, convergence D, distributed
Source: Author's elaboration			

Then the questions are how costs are diminishing on the whole production process as the customer is participating in certain activities. And then, how much is increasing productivity and quality are increasing with regard to working hours versus those not paid by the customers?

In view of the fact that productivity in the service sector has increased more slowly than in the manufacturing sector (Ganz, et al., 2013), a typology of services is generating by ordering their importance to develop a new wave of productivity (Table 4):

- 1) The main service impacts on value creation are through *Information* based on the wide range of TIC's applications. An important economic aspect is the natural non-rival information. However, as the information accumulates as Big Data it generates tradable value.
- 2) *Scientific & Technological* labour process and output is expected to potentially produce larger productivity gains.
- 3) *Technology Enabled Services (TES)*, *Product Service System (PSS)* and *Energy Service System (ESS)* are outsourcing services or new service development originated from industry. ESS considered complex energy service systems with multiple energy carriers including environmental impacts and consequences of different regulating regimes (Baken, et al., 2004). If technology is employed as a new and innovative source that can form the basis of the development of entirely new services, it could be labelled as "New technology-originated service" (TOS). (Kuusisto, et al., 2013).
- 4) *Customer* involvement in outsourcing services, or developing new methods as well as participating in innovations and quality services. However, this is a result of the use of customers as resources and sometimes using their resources. Then productivity comes from diminishing costs via transferring production costs to the customer.
- 5) *Marketing and financing* services are necessary to ensure production and sales. With regards to marketing, this could be the retail or wholesale market depending on the economic sector. KIBS' markets' varies accordingly with the type of knowledge. New service markets are related with innovation products (goods and services). The customer is participating as 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).

Table 4 Service’s Value Creation of Labour process

LABOUR PROCESS		SERVICES	Services’ Value creation			Services for Value Realization	
			Production cost	Transaction cost	Quality	Marketing	Financing
	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 customer	outsourcing services	customer participating in Quality	Customer requirement and consumption	Credit

*ACCURATE, Complete, Cost-beneficial, User-targeted,Relevant, Authoritative, Timely, Easy to Use.(Murtala, 2012).

Source: Author’s elaboration

4.1 Discussion

The changes in production processes, as part of the division of labour, imply a set of innovations which increase productivity achieved by:

- 1) Diminishing production costs;
- 2) Whenever the transaction costs of a productive activity are lower in the market, they tend to be moved outside the firm (Williamson, 2007-3); and
- 3) Regarding services, a way to diminish costs is through time and activities provided by the customer, as is the case of Self-service³.

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

Conclusions

1. "The transition toward a service-based economy, however, calls for a revised understanding of value creation within organizations" (Pitelis, 2009). It is necessary to consider not only the "value-in-use" of services to the customer, but also the "value-in-exchange", in order to return to services as a productive activity for value creation
2. Technological changes are defined on the basis of goods. Therefore, services are production inputs. From this point of view, services are directly affecting the way of producing with the Information and the Scientific and Technological revolutions and the development of Customization (Table 3).
3. The typology proposed as a function of increasing productivity is the following:

1° *Information services* that are grouped with the Informational labour process based on the wide range of TIC's applications.

2° *Scientific & Technological services*.

³ Literature on Self-services mainly focus on the quality of the service and the customer acceptance. (Curran & Meuter, 2005).

3° *Product-Energy-Technology Enabled Services (PETS)*, which are associated with product, technology and energy changes and development.

4° *Customer* involvement in outsourcing services and developing new methods as well as participating in innovations and quality services.

5° *Marketing and financing services.*

6° *Public services.* Characterized in most cases by the circumstance of having no price, collective consumption and direct/indirect consumers.

4. There remains the question about how services, particularly KIBS (which might be of any of the above categories), could become agents to increased social productivity and give an impulse to a new “customization revolution”.
5. New changes in services –innovations and customer participation- must be evaluated in function of their economic impacts and dynamics, depending on which sector and which technology is used as well as their relations with goods⁴.

⁴ The debate is about whether innovations will remain bottled up in a few tech-intensive sectors that employ the highest-skilled professionals and 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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Table 3. Role of services in labor process & consumption

LABOUR PROCESS-->	ARTISAN PROCESS		MANUFACTURING		MACHINERY SYSTEM		AUTOMATION		SCIENTIFIC PROCESS			
COMPONENTS	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 Toolpowered electrically, hydraulically or ,vialine shaft	Maintenance	Computer Numerical Control (CNC)	Specialized software	Laboratories: Phisycs, chemical, biology, nanotechnology	R&D	INDUSTRIAL	
ENERGY					Electric Motor			Robotics. Automation				
					Coal OilGas.	Prospecting	New energy sources: nuclear, solar, biological	Prospecting	Technologies for renewable resources, TER	Design. Prototypes		
					.Electricity	Electricity distribution	Power generation, transmission systems, and distribution systems	control system	Distributed Energy Resources (DER)	PPP electricity services		
INFORMATION							ICT Information and Communications Technology	Computer systems and information processing	Cloud Data Storage	Integration of information: Images, data & sounds	INFORMATI ON	
RAW MATERIAL- Science (knowledge)									Science instruments:telescope, microscope, particlesacceleration	Scientific networks	SCIENTIFIC & TECHNOLOGI CAL	
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		customiza tion	

Source: Author elaboration based on (Corona-Treviño, 2015).