SERVICE-ORIENTED ARCHITECTURES:

ENERGETIC SETTINGS AS SERVICE SYSTEMS

<Service-Dominant Logic>

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Abstract

Purpose – The development and the subsequent dissemination of renewable energy sources have led to the emergence of the need for a deep revision of electricity market (Zhang et al., 2016; Perrey and Lycett, 2003). In this regard, the work explores the latest issues concerning the several ways to use electric energy, rereading the new energetic systems in the light of the logic underlying the concept of "service system" (Spohrer et al., 2017, Maglio et al., 2015; Russo Spena et al. 2013; Barile and Polese, 2010; Lusch et al, 2008). In particular, the focus is placed on the role played by the so-called "aggregators", understood as key actors in promoting an economic (both effective and efficient) development of the entire service-oriented architecture (Moreno et al., 2013).

Design/Methodology/approach – The work is based on a theoretical approach to the study of electric energy distribution systems, aimed at verifying the presence of the characteristics needed to define them as service systems (Polese et al., 2016; Golinelli et al., 2015; Gummesson et al., 2011; Maglio et al., 2009). All the features identified in electricity sector are analyzed with the lens of studies dedicated to management of service-oriented architectures and, more particularly, of service systems (Spohrer et al., 2017, Maglio and Breidbach, 2014; Barile and Saviano, 2010).

Findings – Starting from the study of a broad theoretical background, the work highlights the possibility of framing the most modern energetic environments as service systems, characterized

by: a) the active participation of all actors involved in the management and consumption of electric energy; b) the supply of tangible and intangible resources for the construction of a robust service-oriented architecture; c) the cyclical nature of feedbacks; d) and the co-creation of a unique, global and mutual value.

Research limitations – The article presents a main weakness, linked to the authors' choice to confine the work to an only theoretical analysis of service electric systems. However, this limit provides the opportunity, in future researches, to practically test what emerges from a purely theoretical point of view, for example by administrating interviews to an high number of leading actors belonging to the electric energy market.

Practical implications – The work offers interesting insights for professionals operating in different energetic contexts, suggesting to direct their interests towards the changing dynamics characterizing the development of new service-oriented architectures and innovative ways of dissemination and use of electricity. In fact, the study shows that, only by paying adequate attention, especially in terms of resources investment, it is possible to foster a co-creation of value able to satisfy all stakeholders' interests.

Originality/value – The innovative nature of the work arises from the authors' choice to synergistically combine the theoretical background typical of researches on electricity markets with that one characterizing the studies dedicated to the service architecture and systems, enabling arriving at a conceptual result steeped in value for scholars and practitioners interested in both business management and energy engineering.

Key words – Service-oriented Architecture, Service System, Service management, Service aggregator, Electric energy aggregator

Paper type – Conceptual paper

1. Introduction

The development and the subsequent dissemination of renewable energy sources have led to the emergence of the need for a deep revision of electricity market (Zhang et al., 2016; Perrey and Lycett, 2003). The development of renewable energy, in fact, allows potentially every home, building, park, firm, etc. to act as a semi-autonomous energy production center, at more and more affordable costs (Mwasilu et al., 2014; Esen and Yuksel, 2013; Demirbas, 2005). In addition, the diffusion of new technologically advanced instruments is helping to boost the intensity and frequency of relationships established between energy operators and end-users, which, in this perspective, no longer play a role as mere recipients of inert But actively participate in each phase of the energy distribution process (Coroama and Hilty, 2009; Fettweis and Zimmermann, 2008; Pickavet et al., 2008). Not surprisingly, in the most recent literature dedicated to the energy sector (Yang et al., 2016; Nazari et al., 2014; Shandurkova et al., 2012; Karnouskos, 2011; Rathnayaka et al., 2011, Bremdal, 2011) But not only (Chandler and Chen, 2015; Karnouskos, 2011; Ritzer and Jurgenson, 2010), many authors identify in the prosumer an important figure representing the new frontier of collaboration between producer and consumer of energy.

In this perspective, the work explores the latest issues concerning the opportunity to foster a full and pervasive participation of all actors joining any electricity system, in order to highlight the several benefits arising from value co-creation. Specifically, the contribution follows a theoretical approach to the study of electric electricity distribution systems, aimed at verifying the presence of the characteristics needed to define them as service systems (Polese et al., 2016; Golinelli et al., 2015; Gummesson et al., 2011; Maglio et al., 2009). All the features identified in electricity sector are analyzed with the lens of studies dedicated to value co-creation, management of service-oriented architectures and, more particularly, service systems (Spohrer et al., 2017, Maglio and Breidbach, 2014; Barile and Saviano, 2010). As concerns its structure, the paper at first begins with a deep analysis of the main contributions about value co-creation in service systems. Subsequently, it presents the features of electricity market that allow properly considering it as a service system. Later, the focus of the research is placed on the role played by all users involved in any electricity market, each one understood as key actor in promoting an economic (both effective and efficient) development of the entire service-oriented architecture (Moreno et al., 2013). Finally, the conclusion is debated, the theoretical and practical implications are described, the insights for future researches are highlighted and the limits of the work are underlined.

1. Value co-creation in service systems

The turbulence and dynamism that characterizes the surrounding environment has attracted the attention of scholars (Ballantyne et al., 2006; Grönroos & Voima, 2013) towards a review of traditional corporate and organizational logic. In other words, there has emerged the tendency to adopt government models more geared towards participation and collaboration among the various social actors involved in value-generation processes (Loia et al., 2016). In line with these considerations, the notion of creating value as an underlying logic of service systems is increasingly emphasized. Value creation suggests, in fact, a different way of producing and making products and

services whose value is no longer only developed by the producer, but co-created with the final consumer (Prahalad & Ramaswamy, 2013).
In the marketing literature (Maglio & Spohrer, 2008; Vargo et al., 2008), several models have tried to describe the ways in which value can be generated by suppliers and customers in a joint manner. Vargo et al. (2008) emphasize that the key aspect of value co-creation is to apply skills and knowledge in order to gain ideas about products and services to be marketed. This possibility allows organizations, based on a more accurate knowledge of potential customers, to offer them personalized experiences (Mikalef & Pateli, 2017). Thus, in the light of the considerations previously expressed, it is essential to involve consumers in the process of creating value, by leveraging them capable of acting on their motives (Brodie et al., 2011). Therefore, the mechanism for participating in winning co-creation is based on internal and external connections of actors and their interactions (Storbacka et al., 2016). Mutual interaction between providers and users therefore leads to a real turnaround, even in the way of understanding the service. In fact, it is considered as a set of activities in which suppliers and consumers exchange resources, integrating them into each other, in order to provide solutions that can respond effectively and promptly to a range of needs (Gronroos 2003, Alter 2008). The discriminating element thus becomes the collaboration in sharing and integrating resources. In fact, the various actors (customers, suppliers, partners) involved in value-generation processes are considered as resource integrators (Vargo and Lusch, 2008). In this way, a real network is created in which, through a multi-to-many interaction, there is a value to be distributed to all those who have, in various ways, participated in its determination (Cova and Salle, 2008, pp. 272). The relationship between suppliers and customers can be considered, in line with the arguments of Mele and Polese (2011), as true service systems, understood as systematic interactions of interacting and working parties, aimed at providing a service. Single people represents the smallest service system, while the largest service system is represented by the global economy. In this regard, Maglio and Spohrer (2008, p. 18) define a service system as a configuration of dynamic value co-creation, consisting of people, technologies, shared information (language, value, measurements) and other related resources through value propositions. Collaborative relationships that are triggered in value creation processes, therefore, go beyond traditional government models, turning to adopting more interpretive patterns of involvement of the various stakeholders.

2. Electricity market as a service system (Roles description and table of advantages)

The Electricity Market (EM) establishment in its current form has two main objectives including supplying a secure power in an economic way. In a liberalized EM, security can be achieved using distinctly different services available to the market. Moreover, the economical operation of the EM can be realized through generation cost reduction or change in load pattern consumption. In order to achieve a secure and economic EM operation, appropriate strategies should be designed to promote the EM efficiency while fulfilling the power system's needs.

There are several emerging entities in the liberalized EM which have their own responsibilities. The essential EM entities are Independent System Operator (ISO), GENCOs, DISCOs, RETAILCOs,

aggregators, end-use customers and a governmental body assures the fairness and efficiency of electricity sector so-called regulator.

ISO is an independent and none-profit entity which has accessibility to all transmission system users and is responsible mainly for monitoring the wholesale market transactions with the aim of assure the system security. The ISO not only has the authority of supply-side and demand-side resource dispatch but also ensures that correct price signals are sent to all market players. The GENCOs are profit-based market players that produce power and sell different services such as electricity, reserve, regulation and so on to ISO. The GENCOs encompass various generation technologies and their main objective is maximization of their profits (revenue of selling minus cost of generation) through participation in EM. DISCOs distribute electricity to end-use customers. DISCOs also are responsible for providing reliable and high quality power for customers in their own geographical area.

In new market structures, the role of DISCOs has been changed slightly due to advent of new market player so-called RETAILCO. In fact, DISCOs mainly have the authority of construction and maintenance of distribution network equipment including wires, transformers and etc. However, RETAILCOs are dealing with selling the electricity to the end-use customers. It is noteworthy that, RETAILCOs are considered as profit-based intermediary entities that attempt to maximize their profits as a result of buying power from wholesale market and selling it to small customers through retail market. In other word, the technical aspect of the distribution network is associated with DISCOs while the economic related issues has been assigned to RETAILCOs.

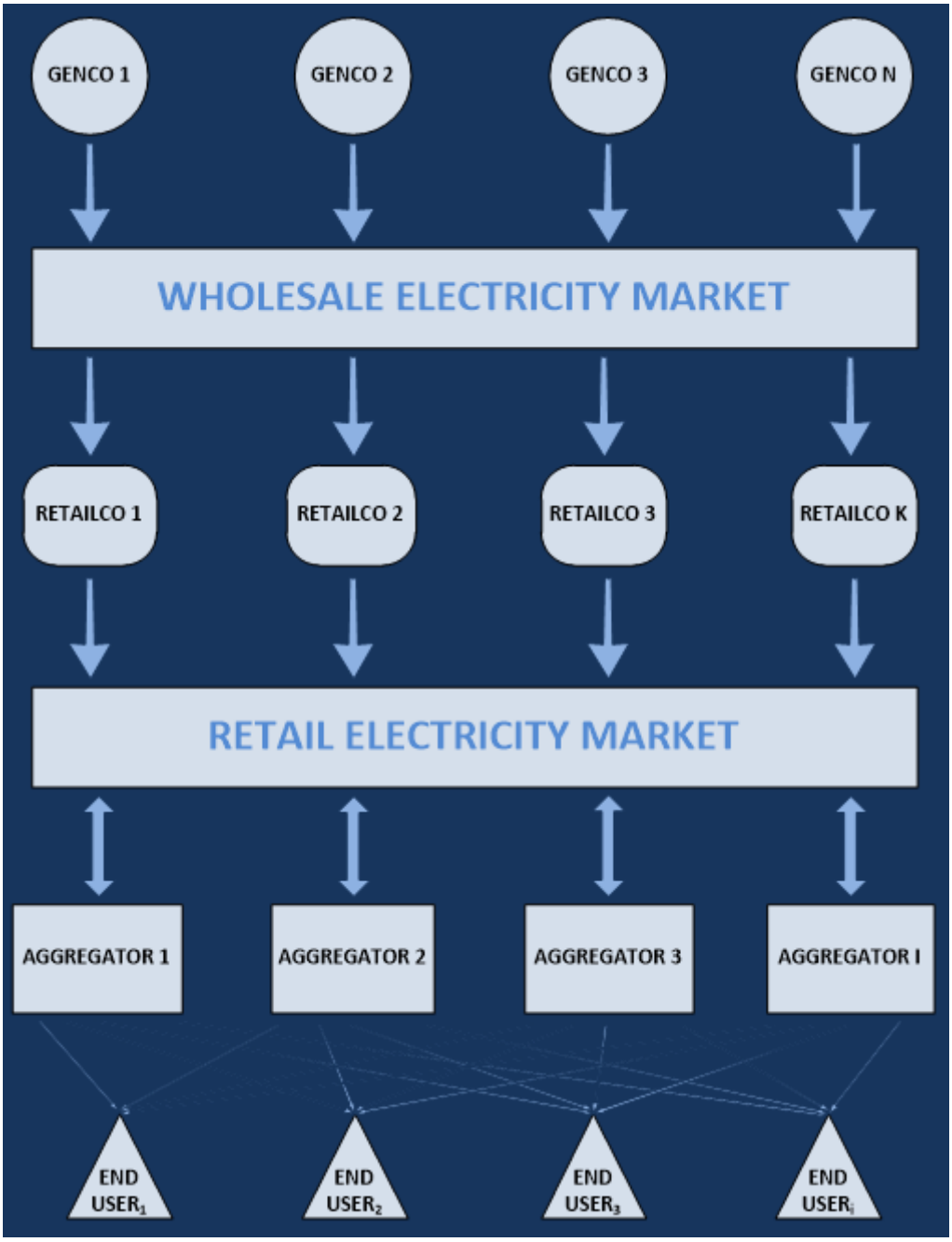
The aggregators are third party profit-based entities that have the responsibility of participation in EM for either buying or selling power on behalf of a group of end-use customers. Under this perspective, the small customers also can participate in EM.

According to competitive EM structure, it is interesting to claim that the foundation of EM is based on the value which is created collaboratively considering distinct interactions and mutual exchanges among different EM players. Under such perspective, different EM players interact together to create a value so that each participant attains to his/her own specific goal.

In the EM context, the GENCOs generate electricity through different initial fuels such as coal, oil, gas or other form of primer energies such as wind, photovoltaic and etc. So, the GENCOs produce a value (i.e., electricity) that should be delivered in a secure way to the customers through different exchanges between the market players. The ISO monitors the possibility of various power exchanges due to the fact that the power grid must be operated in a secure manner in all instances. The bulk volumes of value (i.e., electricity) is traded in wholesale market between the sellers who produce the value (i.e., GENCOs) and the buyers who need it for their industry (i.e., RETAILCOs, large consumers or aggregators). Afterward, the RETAILCOs distribute the value among their contracted customers in competitive retail market. It is noticed that, the aggregator may combine customers into a buying group because of buying large volumes of electric power in a cheaper price. The aggregators frequently are considered as intermediary agents between customers and RETAILCOs.

The co-created value has particular advantages for each of the EM players as described in follow. In the context of co-creation, the end-use customers experience more comfort, less expenses, more reliable and high quality electric power and services and also have more choices to contract with various aggregators who present better services. Aggregators may experience more profit with less market risk and furthermore attract more end-use customers by suggesting interesting services. The same advantages also can be imagined for the RETAILCOs as well. The co-creation also brings several benefits for the ISO including more social welfare, more secure and reliable electric power and more competiveness as well as less market power. GENCOs gain more revenues and are faced with less risk for selling their produced power to the EM. From regulator point of view, long-term efficiency and fairness can be achieved toward a sustainable electricity sector.

Figure 1: *Electricity market as a service system*



3. Co-creating value in electricity system (Figure and features: users' involvement; resource sharing; feedbacks; etc.)

The analysis of the electricity market suggests how the various social actors involved in it can gain many benefits. In fact, as indicated in the table below, end use customers benefit from greater comfort, greater cost savings, and more reliable service potential. The Gencos, on the other hand, get substantial sales margins, more revenue and lower costs, and lower risk associated with market share. Even for aggregators, there are the same benefits as lower costs, higher earnings, and a lower degree of risk. Finally, it is easier for system operators and regulators to pursue a greater level of social welfare, stronger service delivery and, moreover, a higher level of quality, efficiency and efficiency.

Table 1: *Benefits from participation in the electricity market*

ACTORS	BENEFITS
END USER CUSTOMER	Comfort, money saving, more reliable power, more choices for the customers to contract with various
GENCOS	More selling, more revenue and less costs, less risk for participation in the market
AGGREGATORS	More revenue and less costs, attract more end-use customers, less risk
SYSTEM OPERATOR	Maximum social welfare, high reliable power, security and quality, more efficient market and more competiveness and less market power
REGULATORY	Sustainable power grid and long – term efficiency

Source: elaborations of authors

The advantages described in Table 1, therefore, stimulate the participation of the various social actors involved, leading them to an active and proactive collaboration. Indeed, in light of the considerations so far carried out, the advantages outlined above may have been even increased through greater interaction between social partners (Vargo and Lusch, 2008, Grönroos, 2011). In this regard, scholars of the SD logic (Edvardsson et al., 2011; Vargo and Lusch, 2008; 2006; Plé et al.,

2010) have in fact suggested how the different social actors involved in value creation processes, They can undoubtedly obtain a total value derived from the activation of a mutual and mutual comparison, greater than the sum of the benefits they would get by operating individually (Grönroos, 2011; Payne et al., 2008). On that trail also Johnson et al. (2005) highlighted how exchanging and sharing resources among the actors involved in value-generation processes leads to the pursuit of a durable and sustainable competitive advantage. According to this observation perspective, value is co-created, therefore, through the combined efforts of firms, organizations, users and other social actors (Vargo and Lusch, 2008), among which, service beneficiaries continue to play a role always more important. Consistent with such arguments, work seems to lead to the conviction that even the energy sector, as well as many others, can be reread in the light of the suggestions provided by scholars of the SD logic (Vargo and Lusch, 2014; Vargo and Akaka, 2009, Ng et al., 2012), focusing on greater involvement of the various social actors involved, in order to increase the potential of developing the electrical sector and generate a total value greater than the sum of the individual components.

4. Conclusion and implications

The purpose of the job was, therefore, to increase the understanding of the most important concepts of the dominant logic of the service (service exchange and value co-creation). Value co-creation goes through the application of key concepts also proposed by other social theories (Barile et al., 2013): social structures and systems, roles, positions, interaction. Although the study does not present any kind of empirical implications, it has been able to highlight how the energy market can be a service eco-system in which the actions of different social actors converge towards the pursuit of one Common purpose. In fact, the work emphasizes how electricity users are contributing to value creation, interaction and sharing of resources and useful information to improve the delivery of electricity, together with other social partners involved. Figure 1 shows the role played by the various actors involved in the process of supplying electrical services, highlighting, above all, the dynamic role played by consumers in these services. Indeed, they are able to act in processes of value co-creation, both from suppliers and beneficiaries, thus creating value for themselves, for the communities in which they live and for the organizations that are in charge of supply and organization Of the electrical service. In addition, the study shows that the benefits that individual social actors derive from the electricity market, as described in Table 1, are included in a comprehensive framework of collaboration and resource sharing among all those who, Participate in the delivery of services, lead to the pursuit of a total value, undoubtedly greater than what would be achieved if one continued to operate individually. The participation of different social actors is also capable of contributing to the activation of mutual learning processes that can strengthen the community as a whole, creating conditions, streamlining information flow and greater interlocution (sharing of Knowledge, comparison, dialogue) between suppliers and recipients of services to ensure the provision of a higher quality service. Providing a quality service naturally translates into a service that can respond promptly to the ever-changing needs of the users. In the light of these considerations, the work, while based on an exploratory approach that is not capable of providing adequate empirical evidence, is a useful tool for managers and researchers

in the electricity sector in order to enhance understanding of the potential of an approach more collaborative and transparent to the provision of electrical service. The exploratory analysis of the electrical sector has, in fact, led to useful indications for those who are engaged in the provision of electrical service, in order to better respond to user requests, showing factors capable of acting as useful levers to increase efficacy and the efficiency of the energy market.

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