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Service dominant logic of marketing in smart grids

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ABSTRACT

This manuscript considers the smart grids through the lenses of service dominant (S-D) logic of marketing, which focuses on the service prevision rather than the traditional good dominant logic in the conventional power production. Different premises of the S-D logic have been presented and contrasted to the features of the smart grid. It has been studied that the attentions are being shifted from prioritizing cost reduction to innovation service provision methods to satisfy the demands.

1. Introduction

During the last decade, the broader industrial applications of Information Technology (IT) has caused revolution in the economy of service provision industries (Löbler and Lusch, 2014). Against this background, new paradigms in the marketing such as the Service-Dominant (S-D) logic has been developed (Vargo and Lusch, 2004; Lusch and Vargo, 2006, 2006b) to justify the phenomena that could hardly be explained by the traditional constructs and theories (McColl-Kennedy et al., 2012; Kowalkowski, 2010; Lavie, 2006).

The smart grid is one of the manifestation of the IT based revolution of businesses and has opened up a new line of service provision in the power systems (Huang et al., 2015; Geelen et al., 2013; Erlinghagen, and Markard, 2012). Therefore, definitely the smart power system is affected and even driven by the factors of cause and effects of the IT revolution and of service provision, which will ultimately lead to change and alteration in the power market model (Engelken et al., 2016; Valocchi et al., 2014; Starace, 2009; Schoettl and Lehmann-Ortega, 2011). Hence, this paper tries to leverage the S-D logic to present a complementary understanding and new paradigms of the marketing of smart power systems.

Since the original introduction of S-D logic (Vargo and Lusch, 2004), it has been considered as the foundation of the service system. It essentially says that the basis of exchange is to give service, defined as the application of competence for benefit of the others. Service Dominant logic has been proposed basically by Vargo and Lusch, and then extended (Vargo et al., 2010; Paul et al., 2009, Kowalowski 2010) as an alternative to Good-Dominant (G-D) logic paradigm. S-D logic concerns more on the concepts such as value co-creation, operant resources, and phenomenological values, while G-D logic focuses on the concepts such as value-added, profit maximization, and transaction. G-D logic, which sometimes is referred to as the industrial logic too, divides between producers and consumers, and focuses the unit of exchange on the unit of output, either tangible or intangible, while in contrast, S-D logic puts the focus on the system of exchange, when the value is created in a mutual and reciprocal manner.

The S-D logic can be considered as the most important debate in marketing during the last decade. The seminal work on S-D logic is the most cited article of Journal of Marketing over the same period, and several special issues and forums have been emerged on the topic (Kowalowski 2010). It is considered as a possible foundation for evolving the general theory of marketing (Vargo et al., 2006).

The S-D logic is constructed on ten premises and established a mindset to re-evaluate what is exchanged in the market, what is offered and how interactions between the stakeholders work efficient (Vargo and Lusch, 2004, 2008a; Vargo and Lusch, 2008b).

The ten premises by which the S-D logic has been differentiated from G-D, present remarkable similarities to the aspects that the derive smart power systems from the traditional power systems both in utilization and development. Hence, the S-D logic potentially can offer an interesting setting to be leveraged for the assessment of the smart power systems (Löbler and Lusch, 2014).

Analyzing smart grids through the lenses of the S-D logic's prospective can enrich its marketing paradigm both from the theoretical and practical contents. While most of the researches have been done for the technology development, very little efforts have been dedicated to technology exploitation, revenue generation and marketing stages (Richter, 2012, 2013; Sadjadi, 2020; Shomalia and Pinkse, 2015; Hannes and Matt, 2013). The S-D logic can provide useful perception and understanding in this sense, considering the emphasis the smart grid puts on the customer's satisfaction and the relationship between the actors, for co-creation of value.

The main advantage of adopting the S-D logic of marketing prospect to the smart power systems, in our view, is clarification of the influential role the technology users play in shaping the optimum strategy for technology utilization and market development. The emergence of new business models (Teece, 2010; Osterwalder, 2004; Osterwalder et al., 2005*)* for the new technology explicitly clarified the potentials,

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rewards and drawbacks of the technology commercialization (Baden-Fuller and Haefliger, 2013; Zott and Amit, 2008; Gordijn and Akkermans, 2001; Osterwalder and Pigneur, 2009). Several marketing strategies and business models have been elaborated for the smart power firms, however, they mainly focus on either internal drivers of the firms (Shomalia and Pinkse, 2015) or are related to the external factors of technology development and the competitiveness of the environment (Richter, 2012, 2013). The application of the new mindset of the managers and S-D logic of marketing to the electricity firms in smart grids can offer a contribution on this aspect with a wider and more comprehensive view and more practical implications to the decision makers and managers (O'Reilly and Tushman, 2004; Christensen et al., 2011; Graham et al., 2008; Valocchi et al., 2014).

The paper is structured as follows. First, we introduce the smart power system paradigm in brief and compare it to the traditional power systems. Then we review the available literature of the business models for smart grid firms. Later on, we turn to the logics of marketing and focus on the ten premises of the S-D logic. We describe and interpret them for smart power system paradigm and analyze them employing the real world examples. The paper is concluded by outlining some achievements and challenges for marketing of smart power systems.

2. Definition of smart power systems

Smart grids are defined as "an electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end-users" (IEA, 2011).

In this regards, the smart grids can be considered to be a requisite for accommodation of the increasing amount of distributed and intermittent energy sources in the electricity networks, for reliably meeting the growing electricity demand of the consumers (IEA, 2011). Therefore, it is a socio-technical network where the customer management, IT Technology and smart metering infrastructures, all are of high importance (Geelen et al., 2013; Faruqui et al., 2010; He et al., 2013).

IT technology in smart grids plays an important role by facilitation of monitoring and control of the energy flows in the grid at every level of the system, from large scale generation and transmission to the low voltage distribution networks, where the residential end-users are located (Erlinghagen and Markard, 2012; Giordano and Fulli, 2012; Piccoli and Pigni, 2013). The management of information through the IT infrastructure enables the consumers participate in network optimization, known as "demand response" (Geelen et al., 2013).

Smart meters act as hubs for information flows and facilitation of monitoring of the load patterns for all the equipments and control of energy demands and supply from the various resources (Gans et al., 2013). This structure makes it possible to achieve the demand side management purposes of the smart gridsä providers through the two-way communication. In addition to that, it provides operational capacity and control, primarily to the energy users, who are also very likely producers as well (prosumer).

The idea of smart grids technology runs fully counter to the conventional power systems that only serves the information requirements and control capability to the energy suppliers. The advance of smart grids and smart meters create new opportunities of marketing and revenue generation along the acceleration towards the sustainable energy patterns (Engelken et al., 2016; Raisch et al., 2009).

3. Demand for adaptation of a new logic for marketing

While traditional good based power market model can be useful in the delivery of the electricity, we believe that a non-traditional, integrated good-service model of the market can provide more competitive pressure and new and innovative ways for economically improving the outcome of the smart power systems. Since the ultimate goal of the smart power system is to protect better the interest of the existing and the future consumers, hence, we need to know the benefits, costs and risks to make suitable regulations for achieving that important. Indeed, the business model of the firms in smart grids is argued to be different to those in the conventional power systems (Shomalia and Pinkse, 2015; Richter, 2012, 2013; Petrill, 2008). It is expected that over time, the nontraditional business models will gain the potential to transform the existing energy market (Starace, 2009; Schoettl and Lehmann-Ortega, 2011; Engelken et al., 2016).

Based on the definition, the business model is conceptualized upon two theories of management: resource based view and transaction cost economics (DaSilva and Trkman, 2013; Shomalia and Pinkse, 2015). Hence, the underlying logic and mindset for the managers would be first to find a unique combination of the firm's resources and capabilities for progress of the firm, and then to make an efficient practice and process for value generation to both the firm and the customers employing the firms' resources, capacities and capabilities.

After the emergence of a new technology, the capabilities, common practices and processes in the firm will be affected and the managers need to innovate a business model to make benefit from the implementation and exploitation of the new technology. Hence, it is believed that business models are the mediators between the technological innovation and economical value creation (Baden-Fuller and Haefliger, 2013; Klose et al., 2010a)

The business model normally has the same importance to the firms for new technology exploitation as the technology itself and the primary reason that firms may lose their position of industry is most often their weakness in revenue stream generation, yet the technology itself (Osterwalder, 2004; Teece, 2010). Therefore, for the sustainable and practical employment of the new technologies in the market, it is mandatory to create a viable business model upon an appropriate logic of marketing in the second step after the research and development stage.

Business mangers employ the business model concept as a device for classification of the ideas and expansion of their understanding of business process for revenue generation by building generic categories and renovation of marketing logic after emergence of the new technologies (Teece, 2010; Osterwalder and Pigneur, 2009). Hence, the managers of the firms in the same new technology share the same business mindset and logic that help to propose, create, visualize, and realize the business process (Osterwalder et al., 2005).

In the smart grid arena, the energy sector liberalization, the unbundling in the different functioning of energy systems (e.g., generation, transmission, distribution), and evolving the large state-owned utilities to the increasing involvement of the private actors have given the occasion for creation of the new business models to the managers to renew their mindset in order to keep up the revenue generation stream and customer satisfaction (Battaglini et al., 2009; Hannes and Matt, 2013), but there is a rare study to see whether the variation in the mindset and logic of marketing along the innovation in the technology is being happening in the smart grids market toward maximizing the value creation and capturing (Zio and Aven, 2011).

Recent works show that the conventional dominant logic of marketing is challenging for the electricity firms in the smart grids(Richter, 2012, 2013; Schoettl and Lehmann-Ortega, 2011). Upon a study, the ability of managers and senior staff to fully understand the need of variation of the current businesses has been the most crucial for companies rather than the technology development to be successful at two frontiers. For instance, the high production costs per kilowatt hour and insufficient project size clearly indicate that the executives and senior staffs are applying the traditional performance measures and logic of market to the disruptive technology (Richter, 2013). As a result, the renewable energy technology has not yet become cost competitive to the conventional fossil-fuel based power plants in the large scale production (Christensen et al., 2011; Graham et al., 2008).

In another study of the German electricity firms, it has been cleared that the firms could not vary their business models toward the outside of the current logic of market of the large scale fossil fuel power generation to commercially deal with the distributed generation (Richter, 2013), and have kept their stream of revenue generation and the value chain unchanged toward the innovative technologies in the renewables. Therefore, we have elaborated in this paper to see whether the same holds true for the smart grids or it is possible to make a portrait form lenses of a new logic to the market.

We distinguish several motives for the transition to the nontraditional S-D logic in the smart power marketing as the followings,

3.1. Transition to the more energy efficient production systems

By the 2030s, it is aimed to substantially lower level of carbon in energy power systems. This goal needs employing different power sources, such as nuclear, on- and offshore wind power together with biomass and other renewable resources together in the grid. It will bring about more variations in the electricity supply each day. Besides, there will be more electricity demands, as a result of having more patterns of consumption. Hence, it would be greatly required to improve the grid capacities and employ more efficient and flexible technologies, practices and policies for demand response management to deliver the expected energy. Such targets and policies need creation of new market models in the national, local and household levels. As the scope of the transition to modern and smart power systems expands, so too will the scale of opportunities for the new and innovative models in the smart power market.

3.2. Innovative technologies embedded in the smart grids

Smart grid technology includes different innovative solutions to open up consumer's engagement and better network operation. The smart meter through introduction of application of innovative demand side management has opened new flexibilities to the power market. Besides, there are other technological developments, such as PV, storage devices, electric cars or applications of information and communication technology, that have enabled new products, services and market models for their offering. Introduction of such service offering schemes along presenting the tangible products can change the market structure and open up new lines of business. It is expected that application of IT to energy sector will have the same impact of market expansion as it has had on other business sectors such as hospitality and e-health (McColl-Kennedym et al., 2012; Sabatier et al., 2012).

3.3. Lack of engagement of consumers in the traditional market model

In the traditional market framework, the consumers always lack the ability to access and act on the instantaneous information of the energy offerings to make their suitable choice in the market. The consumers´ trust and satisfaction also could not be measured well for their better engagement. In smart power systems, it is possible to take feedback of consumer´s experience through the communication channels or to act on the consumers' behalf and along their needs, hence, it potentially can alter business models of the power market (Faruqui et al., 2010).

3.4. Increasing affordability and supply to the vulnerable consumers

Development of the distributed generation schemes and the renewables would potentially make the energy more affordable, especially to those in more vulnerable situations (Fox-Penner, 2010). Using the new model in making up different packages for the demand management, prepayment service or offering green and "eco"-energy services to the consumers, there would be large opportunities for the public authorities to expand the coverage of the affordable access to energy for everyone (Starace, 2009).

Therefore, we believe that there are important drivers in the shift toward the new model of power market. Indeed, the electricity firms using the new model of market can put more pressure on the power market to take their advantage and also obtain the potential to provide consumers with new and innovative products/ services. In fact, the lines of their advancement can be on,

- Helping in the move to the green energy by increasing energy efficiency and greater demand-side flexibility.
- Setting up policies to help the consumers gain better engagement into the market with providing more transparent information, by which they can provide the consumer oriented products/services and demand management.
- Performing better market-making functioning to help in creation of innovative service-oriented programs and organizations in the smart power system domain, such as big data marketing, big data storage services, home controlling devices and services, etc.
- Contribution in making access to the more symmetric information in the market, through, for instance, better price signaling, better real-time feedback accessories, etc.
- Help in making the consumers as the energy producers on their side and thereby, expanding the market platform to be available to both producers and prosumers, through energy efficiency devices or micro-generators which will result in boosting the competition level in the market.

We believe S-D business model fits to the market of smart power systems, since,

- S-D model can cover almost all the market segments for smart power systems, including smart appliance, smart meters, micro-generators, storage systems, ancillary services market.
- S-D model can address a wide range of the efforts done, and also cross the barriers in the development of smart power systems, including time variable pricing, different contract schemes.
- S-D model can cover both very new and innovative organizational structures in the smart power systems, for which only a few experiences exists as well as structures that have been presented and studied for long time in the traditional power system scheme. It allows a comprehensive and correct evaluation of the strengths and weaknesses of the marketing logic in the smart grids.

4. Smart power systems from the S-D logic lenses

The traditional power system market model focuses more on presenting the electricity as an operand for the units of exchange in the market, and tries to exchange the things that can be sold. Hence, what does mostly matter is production,) which is change in the form of resources), transmission and distribution, (which are the application of motion to the matter for make change in the place), and lastly, marketing, (for the purpose of transfer of ownership of the good). The organization negotiates to maximize the benefits in return of the value giving to the consumer (O'Reilly and Tushman, 2004; Tushman and O'Reilly, 1996), and the delivery should be such that the consumer sees value in exchange in the competitive environment (if there exists different providers).

On the other side, the smart power system emphasizes on employment of the operand resources plus operant resources by which the firms and organizations would try to advance the competition through the constant relations, and socio-economical interactions (Geelen et al., 2013). These interactions, dynamic updates and relations include the feedback, information, schedules, predictions, knowledge and learnings that the firm or organization can use to improve their operant resources for bettering the services to the customers. These operant resources also can give the organization the opportunity to discover latent needs of the customers, open up new services, reach new customer groups or to improve the overall performance (Akaka and Vargo, 2013).

The seminal work for treating the electricity in the market was by

Scheweppe et el. (Schweppe et al., 1988), where they have considered the electricity as a commodity, in MWhs. Hence, the price in the market has been spot price - based on the delivered power- and the several other market structures such as derivatives and forward contracts have been started to be used in the market.

The initiatives in the smart grid framework for the conciliation of the physical system and the market system by consideration of the provided service plus the plain energy delivered has been done by (Negrete-Pincetic, 2012) in the thesis.

They have considered the energy as a multi-attribute product, in which the energy is just one of its dimensions. In fact, the smart grid can provide more through the technological IT-based services than the plain electricity it delivers. It is widely accepted that the value of this product comes from the value that the involved technologies can offer plus how's of implementation of the contractual agreements (Graham et al., 2008; Giordano et al., 2013). Therefore, the success of the scenario depends greatly on design of a market structure based on an appropriate market model of the smart grid to take into consideration this multi-attribute nature of the delivered service- product (Marino et al., 2011; Poudineh and Jamasb, 2013).

To elaborate on design of such market structure, in the followings, we contribute to present an interpretation from the application of ten foundational premises (FP) of the S-D logic to the smart power system paradigm, through emphasizing the existing similarities.

5. FP1: The application of specialized skills and knowledge in service is fundamental unit of exchange

The first premise proposes that "service" is the main element of value creation and the resources involved in the production process (either operant or operand resources) apply their specialized competences for service creation, which is at the heart of the exchange process. The combination of knowledge and competence of the actors enhance the ability to meet needs of the customer and make them satisfied. Based on the S-D logic, the performance of the specialized activities (i.e. services) does matter more in the market place -rather than the output of some specialized activities (i.e. goods).

This premise fits well to the smart power systems as the unit of exchange is service provision employing the energy resources plus the specialized skills and knowledge gathered and accumulated from the information channels.

The performance of firms active in the smart power system domain and their functioning in making up relation to the customer, from one hand can give the possibility of knowing the latent needs and from the other hand, enhance the competitiveness to provide better services for satisfaction of the actual needs of the customers. Indeed, what they transmit in their efforts, came from the application of their knowledge and skills in satisfaction of the customer's needs and what they exchange in the market place are the intangible products (i.e. services) to the customer plus the tangible products (in Kwh) which are dynamically improved by the customer feedback (Geelen et al., 2013; Marino et al., 2011). Therefore, the value in smart grid market is value in use yet value in exchange. The potential value of the service to originate from the use is unpredictable.

The S-D logic of marketing fits better to the smart power market rather than the traditional power market, since, the traditional power market focuses mostly on the value of what is sold, whose possession is exchanged in the market, rather than the service it provides. However, in reality, people pay price for something that can bring about pleasure and satisfaction of a need (i.e. service) and value in the market belongs to something that can be used for a need, hence the real value in exchange comes from the use and application of what is obtained by the individual, not for what is obtained by making the payment (Gangale et al., 2013).

6. FP2: Indirect exchange masks the fundamental unit of exchange

This premise poses that there are many products, players, processes, specialists, institutions and vertical marketing systems around the direct exchange in the market which act as the vehicles of exchange and obscure the service-to-service nature of the exchange.

For interpretation of this premise for the smart power systems we would consider that in the traditional power production and the power transmission organization, because of the bureaucratic, hierarchical structure of companies and vertically marketing systems, specialists have seldom contact to the customers and the view on the customers as the direct business partners has largely disappeared. The organizations take the feedback from the people and forward it to the specialists in improving the design and performance of the systems, however, the feedback is not direct and the specialist is more compensated with the payment for the skills he has and puts into practice, yet for the reciprocal skill based learning and knowledge he gains from the customers. Hence, the main element of exchange can sometimes be forgotten, which would result in micro specialization as an illness in the firms (Clastres, 2011; DaSilva and Trkman, 2013).

This lack of direct contact and skills-for-skills (service to service) relation have come over in the smart power systems using the functioning of the agents (or intermediaries) to facilitate the relations or through the smart meter feedback systems. Moreover, it could facilitate better direct relations of the specialists inside the production, transmission, and other parts of the organization by the Holonic architecture (Negeri et al., 2013), whose relation together can be regarded as the internal customer of the organizationor firm.

This situation comes over the traditional limitation of micro specialization in the firm and converts the smart power system to a more complex organization, with the unite mission of service-to-service exchange.

The European Commission Joint Research Centre's (JRC) annual report of smart grid projects (Giordano et al., 2013; Erlinghagen and Markard, 2012) has stipulated the potential of new players in the value chain and the skill-to-skill relations of the actors and analyzes their position vis-à-vis in electricity firms, expressing the emergence of strong collaborations of the electricity firms with the universities and research centers, manufacturers of new technologies and ICT firms. The collaboration of different universities, institutes and firms in the projects demonstrates the importance of relations and mutual sharing in the knowledge and technology around the exchange process in the smart grid projects.

7. FP3: Tangible goods distributed on the power system are for service provision

This premise focuses on the essence of service and establishes value in service. In other language, this premise separates the value "in service" of what is being done by the electricity firms, from the value "in exchange" of the product being delivered. Hence, the different functions in the power systems (i.e. energy production, transmission, distribution and retailing) are just the mechanisms to render the service.

Actually, the smart power systems could move beyond distributing pure tangible products and the market is beyond plain exchange of the goods. This is because of sharing knowledge and bringing about skills to the specialists through the relation between the consumers, intermediaries, producers and other actors in the value chain, embedded in the structure of smart grids. These extra values, embedded in the product give benefit to both sides of the merchant with the service it renders. The customer sees smart grid services as a platform to meet his high order needs such as more security, happiness, readiness and accomplishment. As an instance, security in the case of terrorist attack and lowering greenhouse emission have been two great expected services and actually incentives in the development of the smart power systems. The expected services such as fulfillment, satisfaction and security that the consumers would gain based on the functioning of the smart power systems have been leaded them to accept the smart power systems and participate in the demand side management programs (Sierzchula et al., 2014; Baron et al., 2006).

Therefore, we see that indeed the exchanged energy (i.e. tangible good), the smart meter and other appliances in which the knowledge is embedded or distributed are all mainly the mechanisms of providing services.

8. FP4: Knowledge is the fundamental source of competitive advantage

The source of advantage in the context of the present technological complexity and the increasing network's dynamics, is the combination of the innovative technologies with the human skills and knowledge provided for the integration of the capabilities of all the actors to make use of their own competencies (Eisenhardt and Martin, 2000; Tushman and O'Reilly, 1996).

The movement toward the smart power systems is grounded in the increased use of operant resources and has special attention to the flow of information between the consumers, intermediaries and the service providers. This flow of information from the consumers, links, co-creates and co-produces knowledge by which, the electricity firms could track patterns of the consumers' electricity utilization to make accurate model of customer behavior and prediction of their needs and preferences, upon which, they also could customize their service offerings (Engelken et al., 2016; Baron et al., 2006; Fox-Penner, 2010). The firms also could sell the data to other actors, manufacturers or service providers to improve their offerings and consumer relationships.

If the data received from the customers brings the details of their type of usage, for instance at the household level, cooling, or heating portion of the electricity consumption, then the electricity firms could renovate their offering for better demand side management services by different tariffs and pricing schemes based on the consumption patterns not just the amount of consumption (Huang et al., 2015; Giordano and Fulli, 2012). It helps much in the improvement of the firm´s competence capability and knowledge. Considering this potential of expansion of value network and entry of new patterns of consumer relationship management, the electricity firms face the challenge of balancing the cooperations and competitions.

The access to more accurate information in the smart grids also would make electricity firms able to detect possible problems and outrages in the grid in the earlier stages and hence achieve more safe and reliable transmission and distribution network functioning.

To summarize, the creation and dissemination of knowledge, skills and techniques in the value chain and the use of mental competence of the service providers, intermediaries and consumers are the main motor of the movement towards the fast economic growth and competitive advantage for better performance of the smart grids.

9. FP5. All economies are service economies

Smart power production, transmission and distribution can be considered as the functioning of the organizations in the service-based economy with the goal of creation and utilization of the technologies for the benefits and satisfaction of the consumers. From the other hand, through monitoring of the utility patterns and demand control, it would increase the efficiency and productivity of the whole system. Therefore, irrespective of the means and process of the exchange, the basis of any exchange in the smart power system will be the facilitation and provision of the services the advanced technology would render (Geelen et al., 2013).

Moreover, in the smart power system context, the wide diversity of technology exploitation possibilities and their vast applications could make it clear that, any activity indeed contributes to the development, distribution, adoption, use and employment of the technology, with the aim of better service provision.

10. FP6. The customer is always a co-creator of value

This premise indicates the importance of the interaction of operant resources and operand resources in the value chain, which finally would co-create value. Hence, it emphases on the role of user participation in the service provision process as part of the value chain.

Although, since long ago, the importance of customer involvement in the value creation process of power systems has been recognized, but, in the case of the smart power systems, using the devices and measures for management of relations, consumers can integrate better into the production process through self-service energy production activities and selling the electricity back to the grid. As an instance, the capability of the end users to provide some combination of demand response and/or energy storage to the system, is a manifestation of their active roles in the smart grid for integration of the new value chain.

This re-characterization of the value chain will reshape the value creation and value proposition between energy, service and product providers, distributers, as well as customers and the value model of the industry as a whole. The participation of the consumer in the value chain reconstructs the market model and the pricing system where the market can respond to the proactive needs of the consumer and the consumer involves in the value creation process more quick. It also provides stronger competition for the existing revenue streams through the involvement of the consumer in the demand side response and load profile management.

In this way, consumer has transformed as an operand resource (i.e. target) to the operant resource (co-producer) to play a stronger role in the value chain. Involvement of the consumer in the planning and decision making process of the market and real time marketing also can make the market more effective and efficient. (Efficiency of the market increases by reducing the time between the moments an effective event in the system happens to the moments that the price balances to an equilibrium point after the transition due to the event).

11. FP7. The enterprise cannot deliver value, but only offer value propositions

The premise poses that companies just offer value propositions that render the services, however, value creation and delivery is just upon the acceptance of the end users.

This premise immediately applies to the smart grid firms, as the smart grids could allow the electricity firms to use consumer empowerment and capabilities to their benefit by the possibility of the consumers' participation in the network optimization and demand response.

The actual price of the power delivery depends on how the available technology permits the users to participate in the demand management programs and the distributed generation will be a transparent dialog where the prosumers have the opportunity to demand for the power they want and/or offer the power they have generated.

Considering the amount of the investments in the smart grids, and the incentives of the contributions to meet the consumers' needs only when the consumer participates in the demand response programs, the value will be created from the smart grid deployment. Hence, the value creation will be upon the quality of mutual communication of the involved actors in the smart grids.

Due to the importance of consumer participation, over the past years, several pilot projects have been conducted in Europe to study the level in participation of the households in the demand management programs of the smart grids. Examples of such projects include PowerMatching City (Bliek et al., 2010; Geelen et al., 2013), Energy@Home, Linear and Jouw Energiemoment. Often, such field tests have been initiated to study the consumer behavior and acceptance to the products and services of the smart grids.

On the other hand, from the firms' prospective, whether the grid balancing scenarios will be successful or not, greatly depends on a good understanding of the consumer preferences and their needs, that ultimately determines the likelihood the consumers actively get involved in the demand management.

12. FP8. A service-centered view is inherently customer oriented and relational

In the smart power systems, the value is created in an interactive process between the producer (aggregator) and the end user. Hence, it can be considered in a relational context where the exchange is essentially customer oriented, and the end user determines the value, upon FP7.

An agreement between the production and consumption is often required to adapt to the unexpected changes in the production and the uncertain factors in the network, that makes up a relation.

Moreover, the consumers play a dominant role in the smart grid development, adoption, and power generation (as prosumers) and their participation is fundamental in the entire process of smart grid implementation.

Importance of consumer engagement in the smart grid becomes clear when we consider that in the smart grids, in principle, due to the intermittency of power output of the renewable energy resources, along the large load of the electrical vehicles and machins, combined with the autonomy of the prosumers, it is very much expected to have volatile load profile. Hence, it order to adapt to the intermittency of the energy resources, it is required to employ appropriate incentives to motivate the selfish prosumers to manage their load profiles or to schedule their own energy resources in accordance to the desired grid aggregation profile. Therefore, the load management strategy very much depends on how motivate the consumer/ prosumers to match their loads or resources to act in line with the profile of the energy community. The common practice is to offer energy pricing incentives; however, S-D logic based view to the market can give us more options through focusing on the offered services along the delivered electricity for convincing the self-interested prosumers to maximize their mutual energy-service benefits with acting in accordance to the energy community requirements (Huang et al., 2015).

For instance, in an initiative, Texan utility Austin Energy planned to go beyond providing the common services like financing or consulting and started to offer a fee-based energy service as partnership to incentivize the consumer for participation in the demand side management program (Frantzis et al., 2008; Graham et al., 2008; Nimmons and Taylor, 2008).

In this initiative the customer signs a service contract for a fixed cost per month to receive all power he needs, within a predetermined range for a fixed price. In return, the consumer agrees to make his roof available for solar devices owned by the utility firm and will be obliged to participate in the demand-response program. Based on this contract, Austin Energy owns the solar systems facilities and, is able to earn from the assets and facilities (Richter, 2012).

13. FP9. All social and economic actors are resource integrators

Basically all the players that participate in the service production process can be considered as the social or economic actors in the value chain. Through their functioning, they integrate resources and develop solutions for the consumers' problems and their satisfaction by service provision and improvement to the well-being.

As stated above the smart grids are defined as the socio-technical network to meet the varying electricity demands of the end-users. In the smart grid context, several actors participate in the energy deployment, exploitation and technology development (such as producers, prosumers, service providers, aggregators, competitors, and customers) and it can hardly be justified that the producer on its own may possess all the required resources, skills, knowledge and capabilities to handle the entire value chain of the smart grid. Each actor contributes to the value chain through its specialized technological capabilities, organizational structures, relations or resources (Sierzchula et al., 2014; Richter, 2012). Hence, the composition of various marginal contributions creates the value (Klose et al., 2010a, 2010b).

Contrary to the traditional power system with its "one-directional value creation" approach, which identifies the utilities dedicated to production, transmission, distribution, retailing and consumer as the actor of the value chain, the smart grid deployment enhances integration capability of the electricity firms to employ the distributed renewable energy sources, electric vehicles and storage devices, etc., all in the grid (Fox-Penner, 2010).Besides, smart grids allow the firms to integrate vertically to use their other resources e.g. the transmission and distribution networks more efficient. The bi-directional value chain in the smart grids has encouraged the smart grid firms to start partnership with the IT companies and start-ups to manage the follow of information on the grid. As a result, many smart grid firms have been conceptualized as the multi-layered firms, composing both the hardware layer - including transmission and distribution equipments - and software layer – including IT companies and start-ups (Erlinghagen and Markard, 2012; Giordano and Fulli, 2012; Piccoli and Pigni, 2013). Such integrations of different layers and different concepts in the smart grid firms often occurs in the IT based businesses. (Sabatier et al., 2012; Akaka et al., 2013; Kowalkowski and Kindström, 2012).

When the actors in the value chain integrate resources, they often arrive to the innovative patterns of making business in the market place, which change the common logic of marketing.

14. FP10. Value is always uniquely and phenomenologically determined by the beneficiary

This premise poses the end-user depending on the specific context (time, place and network relationships) judges the value which has been created by the actors in the value chain. On the other hand, technological value, in its turn, can be classified to value-in-use and value-in-context according to the needs and goals of each beneficiary under the circumstances. Value also can change as a function of time.

This premise fits perfectly to the smart grids context; since the smart grids technology is regarded as a potential solution to consumer´s problems, and the user evaluates the actual value and usefulness according to the context and practice, where the technology will be applied.

The value proposition in the conventional power production systems comprises production and delivery of electricity for a fixed price per kilowatt hour. However, in the smart grids, the value proposition bundles the products to services for value creation to the consumers. As a result, all the components in the smart grids from the distributed energy resources, to the measures and policies of energy efficiency, and the smart energy applications will have different shares in the value proposition. Hence, the context would be of high importance and the value will be determined uniquely by the beneficiary (Valocchi et al., 2014).

The value model in the smart power system is a combination of the value delivered to customers and the reciprocal value captured from customers, in return. Some of these new elements of the reciprocal value are essentially operational; peak consumption time, demand response, load profile flexibility, storage capacity and power production capacity, etc. which can assist in optimization of system performance and asset utilization (Frantzis et al., 2008; Graham et al., 2008; Nimmons and Taylor, 2008).

Others, such as information on consumer demographic, and access to personal connections/networks for social content delivery are the foundation for new revenue sources for companies to effectively leverage the information and capture value.

15. Discussion

In the market place the key point is to have a clear definition of what is offered to the market, either the product or the service. In the conventional power market, there is no need to elaborate on the definition of the product of the power system to the market, since it is very clear. However, in the smart grids, we need to have a clear definition for the product and contrast it to the service being offered to the consumer. Hence, in the manuscript, we have looked at the operating system of the smart grids and its associated market through the lenses of S-D logic of marketing. Such scaffolding of the operating system and its components will be the vehicle in transition from the traditional market model to a new model of the market proper to the smart grid paradigm. Without a proper view to the market of smart power systems, the interference between the physical system and the market could be magnified.

We believe that with consideration of S-D logic mindset in the smart power systems, the firms would focus better on the value creation, value delivery, value capture and revenue creation for progress and the development of smart grids. In particular, the firm managers need to extend their experiments to include the S-D logic in their prospect to the market and business model innovation. This will require the managers to create the processes by which the firms unlearn part of the G-D based practices and mindset which can be difficult and then replace them with more open ways of conducting, exchanging and creating more values for both the customers and the firm from the smart grid commercialization, upon the S-D logic.

We believe that using such carefully constructed framework will lower both the short term costs (e.g. the costs of ramping), along the long-term costs (e.g. those associated with the pollution), and also, reduces the market volatility. In this way, the S-D model, we proposed in this manuscript for the smart power systems, will result in more operational flexibility and thereby, helps in the fulfillment of the socio-economic objectives of the smart grids scenario.

The importance of addressing smart grid market based on the service logic of marketing, especially at the distribution level, is that many smart grid initiatives are expected to be deployed and employed at that level. Hence, as one of its direct impacts, it can be expected to be able to make the better incentives for the consumers' co-creation of value through good self-scheduling or other activities for selling back the energy to the grid or for their own utilization, which both result in more efficient employment of the renewable resources, thereby, reduces the costs in smart grid development and increases the firms´ revenue streams.

16. Conclusion and policy implications

We have explored how the smart grids structure fits to the S-D logic of marketing. The smart grid technology and S-D logic of marketing both turn attention to the value-in-use and value-in-context as the center of exchange in comparison to the G-D logic and the conventional mindset of centralized power system and also assert that value is gained better from collaboration of actors instead of one-way relation of production, transmission, and distribution to the end user and consumer. These perspectives show the way forward for doing businesses by collaboration of different actors in the value chain and co-creation of value, leaving behind the orientation to value-in-exchange, that now are seen in the energy market. The contribution of this study then allows us to think again in the essential terms of the electricity market.

An other contribution of this work is that it encourages the electricity firms in the smart grids to consider improving practices of the various premises towards the adaptation of innovative business models. It has been demonstrated that the business models in accordance to the S-D logic of marketing in the ICT based industries, at the firm level, would result in more competitive advantage of the involved actors and at the higher level, would facilitate the achievement of basic goals and premises of the technology development.

Many challenges for further progress in marketing upon the S-D logic are now open for the electricity firms.

First, the firms should investigate the difference of the performance based on the G-D and S-D logic oriented looks to the modern power systems in their activities and make up the associated value proposition, value capture, offering and relationship to the customers. It is also required to discover new and more efficient ways for the involvement of other actors in the process of value co-creation and value capture.

The other challenge is that since the resources involved in the smart grids can provide different services to the consumers, then, do we have a proper contract scheme for them? If yes, how the prices of the services can be determined as a function of the environmental impacts, controllability and the social objectives such as efficiency, reliability and sustainability?

In parallel to the notion of active customers and prosumers, which kind of business models, regulatory systems and conditions can be considered to incentivize the financial systems have a centric role in the demand side management or energy financing? This would help much in the mainstream energy market to create the ancillary service market as an extra big segment of its structure.

It is highly required to make further study on the performance of the prosumers in response to the different services received from the smart power providers and to analysis the relation between the services provided and the performance indicators of the prosumers. Using such analysis, it will be better possible to simplify the decision making by the electricity firms on the resource allocation and on the on-going unit commitment problems. The outcomes of such studies can be useful for the central authorities to draw better signals for the adjustment of the regulations and policies to govern the interactions between the different actors in the market or enhance investment in the innovative services and technologies.

Since one of the main motivations in the transition toward the modern power systems is to save natural resources through the ownership and control of the unilaterally controlled resources for making electrical energy and services out of them, hence, the try to find out the most beneficial ways of taking output from the utilization of resources will help largely in the preservation of natural resources and reduction in the resource depletion. Also, as the wealth and well-being of nations are driven largely by the development and exchange of operant resources and services, cultivating the service-good logic for marketing of the modern power systems and taking benefit of their applications can give better trajectories toward the development of well-beings for all.

Emphasizing on the service sector side of the smart power systems by the authorities, can ultimately help the nations in their process of development and growth in economy, as the service sector is highly reflective and effective in gross domestic product (GDP) of the nations (Paul et al., 2009; Vargo et al., 2010).

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