Assessing the customer value generation in the electricity utility industry

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Abstract

The customer perception plays an important role in an electricity industry growth and customer value generation. Until the present time, the electricity industry has been widely studied in the field of industrial policy/planning, but not in-depth of creating value associated with the electricity utility industry. This paper shows that customer value generation has drivers, which could be different according to each stakeholder within electricity industry, affecting its growth. Each stakeholder has different interests that affect decision-making process and the customer value perception in long term, which impact on profitability. In order to illustrate how to identify and modeling key performance drivers to evaluate creating value in the electricity utility industry, this study used simulation with the system dynamics methodology. Through simulation scenarios, this study show that, the high customer value perception allow to align the electricity utilities industry to create more value. This is illustrated whit the case of some electricity utilities engaged in the generation and distribution in the Colombian electricity market of photovoltaic. The results show a new point of view that contributes to marketers and engineers in analysis of the relationship between the stakeholders and electricity firms.

Keywords
Customer value, electricity utilities, system dynamics, photovoltaic

1. Introduction

Recently, renewable energy market has shown significant growth that has contributed in competitiveness of the Latin American countries (Castaneda et al., 2017a; Gómez et al., 2017; Herrera et al., 2017a; Mastropietro et al., 2014). The rapid growth of the renewable energy market has provoked serious challenges because of: the significant financial resources that are required, highlighting the need for marketing of the utility industry in the electricity sector (Paladino and Pandit, 2012). Considering that now customers are best informed and more demanding, it is a priority to give more value and consider the stakeholders when determining which improvements are needed

(Kumar and Reinartz, 2016). The value that utility industry delivers to stakeholders is opportunity to build a different point of view of products offer for sale.

Given that the customer perception contributes to industry and commercial development (Kotler, 2017; Paladino and Pandit, 2012), the role of value perception influence on customers image, which affect demand changes and financial resources used by the electricity utility industry. Thus, the value generation of electricity utility industry influences on citizens' perception and allows appropriating technologies innovation related with non-conventional renewable energy (Herrera et al., 2017b), such as solar power.

One of the fastest growing products for the electricity industry is rooftop solar panel of greater use in the residential sector. In the case of Colombia, the potential of solar energy is very high, solar radiation to reach a daily average of 4.5 kWh/m^2, which exceed the world average daily of 3.9 kWh/m^2 (UPME and BID, 2015). Although solar power have great potential in the household sector as well as positive impacts on emission reduction (Cardenas et al., 2017, 2016), Colombia has not developed residential market sufficiently, which not allow rapid response to the challenges of household market. In response to this concern, there is interested in understanding the effects of value generation on customer image of utility industry.

The concept of value has been extensively studied in the marketing literature but few studies related to the value generation of electricity utility industry (Salem Khalifa, 2004). This paper attempts to present a framework about this topic, in order to understand the importance of customer value in the electricity utilities industry. The proposed simulation model is supported by system dynamics methodology. To understand the dynamic effects of customer value generation, the model represents citizen satisfaction and its effects on financial resources employed by utility industry in Colombia. In this case, the perception of customers is intangible resource that affect utility industry performance and competitiveness (Bianchi et al., 2015; Cosenz, 2017). Thus, this paper provides a model-based framework for analyzing intangible resources and offers guidance for designing alternative marketing policy formulations.

The research simulates the dynamic of value generation as from future scenarios generated by different marketing policies. This paper is organized into five sections including this introduction. An overview of the customer value in utility industry is discusses in section 2. Section 3 describes simulation model as from the system dynamics methodology. This section considers the validation model and assumptions data in the case of study for SMEs in photovoltaic industry of Colombia. Section 4 discusses the obtained results of simulation. Finally, the conclusions are presented.

2. Understanding the customer value in utility industry

Given the considerable disruption now happening in electricity market, utilities need to be transitioning their business modes (Tayal, 2017). The customer value is a fundamental component the businesses model, which comprises how firms create, communicate and deliver value to support customers collaboration (Ulaga, 2001; Wouters and Kirchberger, 2015). It is a key factor when seeking ways to differentiate from competitors and gain competitive advantage (Keränen and Jalkala, 2014; Woodruff, 1997). This involves a suitable relationship between customer and company through product and price.

Understanding the customer value involves assessing the utility of service based on customer's perception, namely what is received and what is given (Leroi-Werelds et al., 2014; Oh and Kim, 2017). This comprises a decisive point to reach the goals of the utility industry. When the customer feels satisfied there are more possibilities to come back and buy again. The customer value also involves the emotional bond established between a customer and a producer after the customer has used a product or service, therefore, customer value propositions are created to reflect the customer value perceptions (Rintamäki and Kirves, 2017). Such a resulting emotional bond leads the customer to buy repeatedly or, better yet, exclusively from that supplier, to recommend that supplier to friends and family.

The creation of customer value comprises process where customers evaluate the benefits received and the sacrifices given form using a product/service. Early marketing studies focused on product quality as the primary "get" component and product as the main "give" component (Xu et al., 2015). When a consumer uses a product or service, it knows that has to pay something to receive what needs; in this point is when value becomes relevant in order to

satisfy a need causing a very good impression, because the customer evaluates the benefits according to his experiences.

In the B2B context, customer value is typically defined as a trade-off between benefits and costs involved in an exchange (Keränen and Jalkala, 2014; Ulaga, 2001). The companies also evaluate the benefits that receive when buy a product or service and the price to pay for satisfy their requirements. In that case, there is a strong relationship between price and value of the product according to the characteristics of utility industry. Thus, a low price is seen as the dominant factor permitting consumers from purchasing energy of clean technologies.

2.1 Customer value: a multidimensional structure

In order to comprise the customer value concept, it is essential to study it as a multidimensional concept, taking into account its complexity that has a relationship with different marketing concepts such as perception, image, satisfaction, customer service and quality (Oh and Kim, 2017). In this sense, the customer value analysis is equal to difference between market-perceived quality and market-perceived price (Leroi-Werelds et al., 2014).

In the marketing literature highlights two approaches to the creation of customer value (Leroi-Werelds et al., 2014). The first develops during the first years of research with a one-dimensional view, while the second is develops recently with a multidimensional view. According to the one-dimensional view, customer value is measured through a single overall concept that evaluates the consumer's perception of value. The second approach seeks to evaluate a trade-off between perceived quality and sacrifice. This last approach is highlight by capture the complexity of consumers' value perceptions, such as different perceptions, point of view and ways to evaluate products and services (Leroi-Werelds et al., 2014). The behavior of consumer is complex to study because of their feelings and thoughts; therefore, its perceptions have to be analyzed as from a multidimensional level.

The dynamic of customer value is related with four components: results, process quality, price, and customer access cost (McMurrian and Matulich, 2016). These components allow calculating the customer value in the utility industry. This proposal gives some elements in order to measure the customer value as follows:

$$CV = \frac{R + PQ}{Pr + C}$$

where,

CV: Customer value,
R: Results produced for the customer,
PQ: Process Quality,
Pr: Price to the customer,
C: Costs of acquiring the product.

Another important characteristic of customer value is that its benefit/sacrifice components vary with new consumption contexts (Ulaga, 2001; Xu et al., 2015). Thus, there are various benefits/sacrifices beyond product quality/price from using a product, which should be identified. In this sense, the paper addresses the concept of value as a multidimensional approach with two main components, benefits and sacrifice, taking into account that it is a complex construct related to other important concepts as image, customer service, identity and satisfaction.

All these concepts have a different relationship with each stakeholder and customer value is the responsible to improve their perception. Customer value takes the perspective of an organization's customers, considering what want and believe that they get form buying and using a seller's product. Others studies also consider that a company has social responsibilities that go beyond shareholder value creation to encompass other stakeholders such as employees, consumers, and society at large (Salem Khalifa, 2004). This situation is an opportunity for the electricity utility industry. In general, it is crucial for the companies to understand the importance of creating value their stakeholders. Clearly, the current businesses model is aimed creating value. The purpose of a sustainable business is,

first, to create value for customers and, second, to extract some of that customer value in the form of profit, thereby creating value for the firm (Kumar and Reinartz, 2016).

1.2 Measuring Customer Value

This process of creating value involves some drivers that determine the nature of the relationship between the firm and the customer, which help to estimate the level of profitability and the lifetime of each customer value (Kumar and Reinartz, 2016). As a result, the firm has to determine the drivers; these drivers impact the overall perceptions of the stakeholders. The value drivers could classify into two types: exchange characteristics and customer heterogeneity (Kumar and Reinartz, 2016). Exchange characteristics encompass the set of variables that define and describe relationship activities in the broadest sense. Customer heterogeneity refers to the demographic and psychographic indicators that help a firm in segmenting customers and managing customer–firm relationships. This point of view analyze the customer as an individual who has a specific personality, likes, interests and belongs to a specific segment. Additionally, it is useful to differentiate three levels of customer value: (1) the expected level; (2) the desired level; and (3) the unanticipated level (Butz et al., 2001). These levels allow studying the customer perception from several scenarios depending on the state of the purchase.

Customer value is an element that should be more studied in the marketing literature and applied to different areas, in order to improve the relationships among the stakeholders in the firms. The marketing return on investment should be measured in terms of an expected change in the value of the customer that occurs as from marketing strategies intervention (Braun et al., 2015).

Customer value measures not just a customers' satisfaction with every aspect of a product or service, i.e. the measure of "quality", but measures this satisfaction relative to the price paid (Daniels, 2000). This is a measure of perceived value related with creating value of the utility industry. To measure customer value is priority to identify the needs of customer, what is the most important form them when use a product/service and in this way the organization can improve their process. Figure 1 presents the process to determine the customer value that could be used in the utility industry (Keränen and Jalkala, 2014). The three strategies emphasize different ways of coordinating and managing organizational units that are responsible for customer value assessment at different phases of the process: emergent value sales; life-cycle value management; and dedicated value specialist strategies. This process provides tools to identify strategies that could help to continue with the evaluation process of customer value.

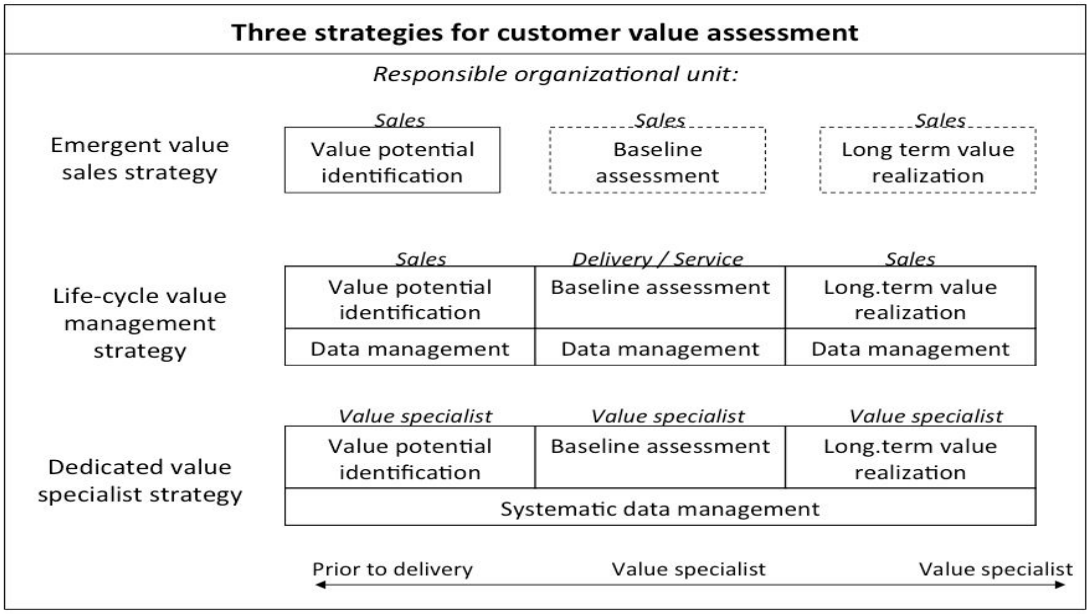

Figure 1. Customer value determination process
Sources: Own elaboration based on (Keränen and Jalkala, 2014)

The management literature on value is clustered generally around three categories of value: financial economists advocate shareholder value, marketers advance customer value, and stakeholder theorists promote stakeholder value (Salem Khalifa, 2004). If companies apply these categories to implement new tactics is possible to have a better understanding of the consumer needs.

Consequently, a simulation process may guide the new product development and service offerings to facilitate customer value creation (Herrera-Ramírez et al., 2017; Zhang et al., 2016). The simulation could help in the process of prediction and prospective becoming a tool to improve the perceptions and probably other aspects related to customer satisfaction.

3. Simulation model

The behavioral patterns of customers generated by the dynamic of the Latin-American electricity market required a systematic analysis. Particularly, system dynamics is a methodology of simulation based on feedback structures analysis and time-delays, which define the behavior of a complex social system (Ford, 1997; Qudrat-Ullah, 2016; Sterman, 2000). Scenarios based on simulated results can provide guidelines for policy planning and management of complex and dynamic system (Bala et al., 2017). In essence the system dynamics methodology model and simulate the market structure to design management strategies. The simulation model structure is based on the relationships among the variables and represented by stock-and-flow diagram, as shown in Figure 2. The stock and flow diagram is composed by a system of differential equations, which is solved through a simulation structure.

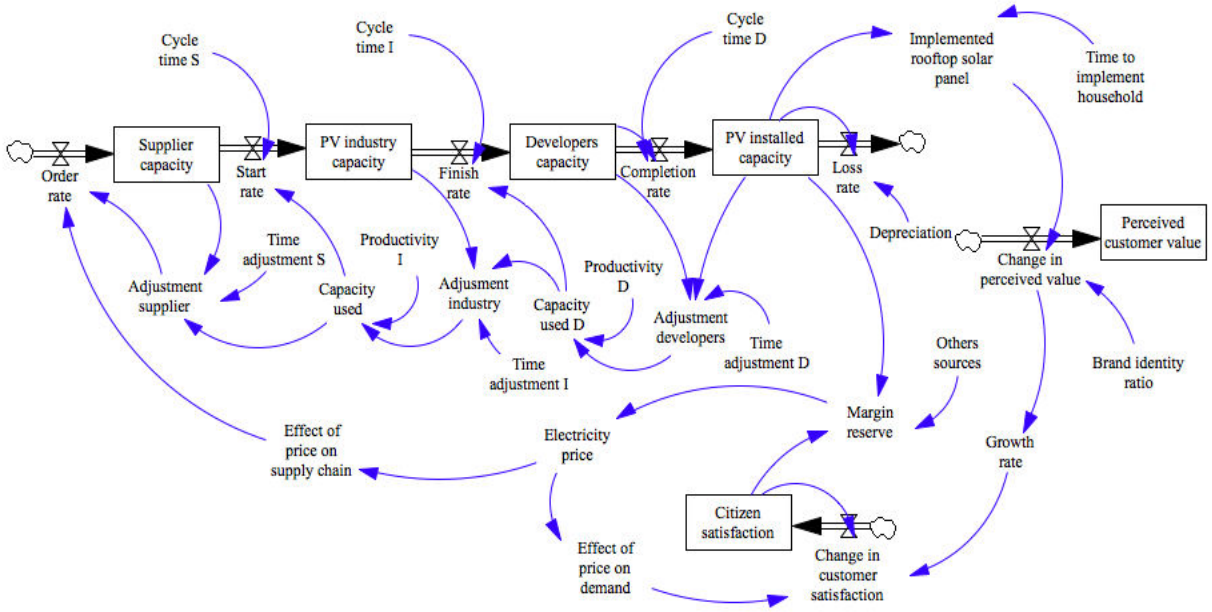

Figure 2. Stock-and-flow diagram to assess the perceived customer value in the electricity industry

The main equations that oriented the decision-making along the supply chain are given by synchronization and coordination of response time of supply chain capacity. The response capacity of each actor is determined by the adjustment between current capacities and desired (Becerra et al., 2016). The stock and flow diagram shows how the installed capacity of solar industry is related with implementation of rooftop solar panel in household. Regarding, the behavior over time of perceived customer value, which allows understand effects on citizen satisfaction is calculated as follows.

$$\text{Implemented rooftop solar panel} = \frac{\text{PV Installed Capacity}}{\text{Time to implement household}}$$

To simulate the mid- to long- term effects of response time a simulation time horizon of 20 years was considered. Also, the proposed supply chain structure as well as behavior was validated with traditional statistics methods used by community of system dynamics (Qudrat-Ullah and Seong, 2010; Sterman, 1984). Others assumptions in the simulation was considered below:

- An average PV system lifetime of 25 years is assumed in the model (Radomes and Arango, 2015).
- It is determined the growth rate of demand in a value of 3% per year (Morcillo et al., 2017).
- This paper assumed the forecast of peak demand in Colombia (UPME, 2016).

4. Results

In this section, the results of simulation model for different scenarios are presented. The scenarios are design to analyze the changes in value of brand identity and its effects on perceived customer value. Also, the results present the amount of customer satisfied for each scenario proposed. Table 1 exhibits the scenarios that were simulated with model previously mentioned. The scenarios are the combination of two behaviors analyze about the perception of customers on brand identity. Note that the value of 4 and 5 % are arbitrary and they only indicate balances or imbalances in the perceived customer value.

Table 1. Proposed simulation scenarios

	Value of brand identity (%)	Description
Scenario 1	4	This scenario assume an increase of 4% for each period due to investment in marketing strategies
Scenario 2	2	This scenario assume an decrease of 2% because of the lack of development in solar industry

Due to the favorable conditions that have Colombia, the photovoltaic power is an alternative for the expansion of energy matrix. Figure 3 shows the behavior of the perceived customer value for the two scenarios. These results show how an increase in the brand identity through investment has a positive impact on the perceived customer value, while that the lack development and financial resources affect the customer value.

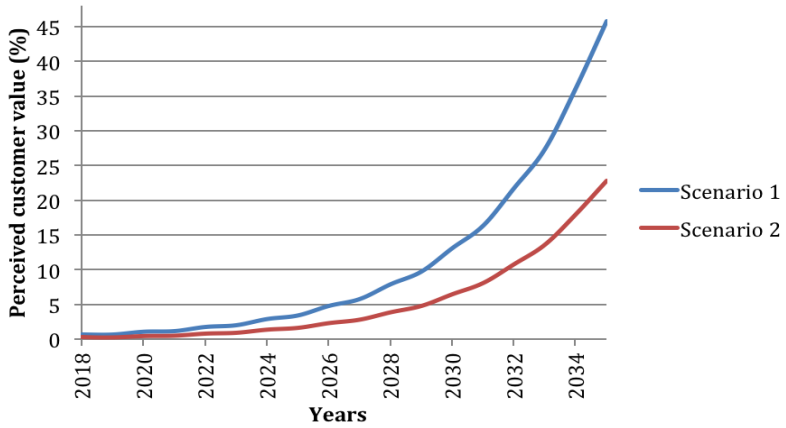

Figure 3. Simulation results of the perceived customer value

Considering the proposed scenarios, Figure 4 presented the amount of customer satisfied. As it is mentioned in the analysis of the results of the perceived customer value, the scenario 1 exhibits an increase due to the causes prviously mentioned.

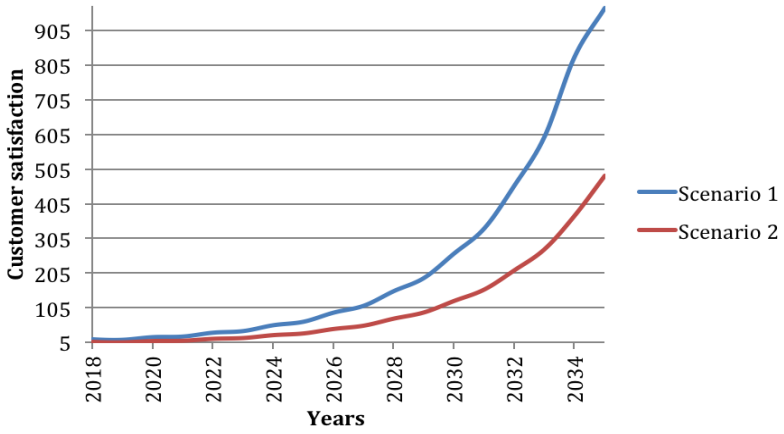

Figure 4. Dynamic of behavior of the customer satisfaction

5. Conclusions

This paper developed a simulation model that establishes the dynamic impact of the structure related with the perceived customer value for the utility industry. It is presented a framework for analysis of the solar industry that incorporates the effects of the perceived customer value on the customer.

Although this paper not presents the effects of customer value on solar supply chain, the simulation model could be supported this analysis. Also, a similar strategy could be used to analyse others marketing policies, using the simulation approach proposed here.

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