

Customer satisfaction of electric power services: a research agenda

Maria Eduarda Letti Souza

Pontifical Catholic University of Parana

me.lettisouza@gmail.com

Ana Glória Abrão Gomes dos Santos

Pontifical Catholic University of Parana

anagloriaabrao@hotmail.com

Edson Pinheiro de Lima

Pontifical Catholic University of Paraná / Technological Federal University of Paraná

e.pinheiro@pucpr.br

Sergio E. Gouvea da Costa

Pontifical Catholic University of Paraná / Technological Federal University of Paraná

s.gouvea@pucpr.br

Angela Catapan

Pontifical Catholic University of Parana

angela.catapan@copel.com

Abstract

The present work develops a research agenda based on a systematic literature review of customer satisfaction in household electrical power supply services, applying for this purpose the Cochrane method. Research trends could be identified through the lens of service operations, and they are presented mostly using a bibliometric analysis.

Keywords: Customer Satisfaction, Electrical Power Supply, Operation Strategy,

INTRODUCTION

One of the basic assumptions for an enterprise's success is the customer's expectations fulfillment regarding products/services offered. When it comes to the electrical power supply customer satisfaction, it is automatically inferred to a specific sector that is strongly regulated, and often approached as a monopoly. Since competition could be low or inexistent, there's loss in competitiveness and dynamicity, and the relevant factors to support the economic and business activities could be different that in traditional scenarios (Picolo, 2005).

Electrical power supply customer satisfaction is a multidisciplinary theme that could be approached through three knowledge areas: customer satisfaction in a marketing based perspective, service operations in operations management context, and energy supply service founded in the infrastructure of electric power systems.

Generally, consumer satisfaction can be defined as the consumer's response to the perceived discrepancy between prior expectations (or some other norm of performance) and the actual performance (Tse and Wilton, 1988). James (2007), relying on the expectations approach, proved that high satisfaction with the local government's services involves low expectations, rather than simply performing public services well, while low satisfaction ratings point both to poorly performing services as well as high expectations. Gronroos (1995) supports the idea that service quality must be, above all, "what the customers perceive". Slack et al. (1997) try to synthesize all the different approaches identified by Garvin (1984) by the following definition: "quality is the consistent conformity with customer's expectations".

Gaither and Frazier (2001) define service operations as a long term action plan for the production of products and service of a company and establish a map of what the production must execute if it wants to realize their business' strategies. In developing and managing a service operation one of the critical decision areas is how to structure operations, i.e., how to divide up the activities and assign them to people or machines. While there could be constraints of various types that restrict the set of available choices, there is usually considerable discretion. As compared to manufacturing operations, constraints which require a specific machine or type of machine to perform the activities are usually less prevalent, so the range of choice is usually larger. Furthermore, there may be fewer constraints on the sequence in which operations are performed. Another key difference to manufacturing is that service operations are very frequently in direct contact with the customer. Given these differences, the ideas developed to understand how to divide up the activities in manufacturing can rarely be applied to service operations without considerable adaptation (Buzacott, 2000).

Electrical energy is at the heart of modern society, as an essential component of lifestyle and a determining factor in the competitiveness of the economy (Gouveia et al, 2015). The electrical power supply system can be mistaken by the very topography of the cities, branched throughout their streets and avenues to physically connect the supply system, or even medium or large scale unities of power generation, to the electric power's final customers. The connection, the treatment (or service) and the effective electric power supply to the regulated environment customer occur by the Electrical energy distributors. The distributed energy, therefore, is the effective electric power supplied to the customers connected to an electrical network of a determined distribution company (ABRADE, 2015)

The term "energy system" in general sense, refers to a system containing energy producers (generators or suppliers), storages (energy traders), links (transporters, transmission lines, distributors), and customers (users). These entities are basic common elements in all energy systems (Sheikh, 2014).

In order to understand the development of these areas in the literature, this paper proposes a systematic review of the existing publications in customer satisfaction of electric power services. According to Fink (1998), "a systematic literature review is the explicit and reproducible design for identifying, evaluation and interpreting the existing body of recorded documents", thus this study aims to analyze the main academic settings forward customer satisfaction issues in electric power service, the development trend of the subject and its interaction with several research areas, thus contributing to identification key authors and journals associated. The structure of this paper covers a literature review about the topic, the methodology defining the basis for paper and methods for analysis, the results obtained from bibliometric analysis and respective considerations.

RESEARCH STRATEGY AND DATA COLLECTION

It is possible to observe the development of a specific study field by the scientific production attributed to it. In order to study the development of the customer satisfaction in the household electrical power supply services, a systematic literature review as applied based on the Cochrane method. One example of this is the SLR which originated in the medical field and is supported by the Cochrane Collaboration; an organization established in the 1970s that seeks to standardize this process in medical research (Cochrane, 2002). According to Tranfield et al. (2003), a systematic literature review is an important part of any research project. For Armitage and Allen (2008), the systematic literature review is a structured way of identifying all relevant researches of a problem or a specific research field, and has the objective of mapping the available literature on the subject, identifying literature gaps, find the paper's position and evaluate the research field. According to Cook et al. (1997), the systematic research review diverges from the traditional narrative review by adopting a scientific, transparent and replicable process that identifies the main scientific contributions of a research field and minimizes the bias of the researcher by an exhaustive research of published and unpublished papers. The Cochrane Collaboration (2001) by the Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0. provides a method for systematic literature review divided in 7 steps, where the first defines the systematic literature review, the second defines the database and keywords, the third selects the papers, the fourth collects data, the fifth analyses the data, the sixth creates a table of review of the conclusion and results presentation, and finally the seventh interprets the results and draw conclusions.

For a good conduction of the systematic literature review, it is extremely important to develop a systematic literature review protocol, since according to Tranfield et al. (2003), the protocol is a plan that helps protecting the objectivity providing explicit descriptions for the steps taken. On the Table 1, the systematic literature review protocol is presented

Table 1 Research Protocol

Search terms	Group 1. P1 ("customer* satisfaction*" OR "quality* service*" OR "consumer satisfaction" OR "customer orientation" OR "customer relationship management" OR "service* quality*") P2 (satisfaction OR "quality service")
	Group 2. P1 (electric* OR "public sector" OR "energy politic" OR "utility energy" OR "utility regulation" OR "public service") P2 (electric OR energy)
	Group 3. P1 ("operation* strategy*" OR "performance" OR "service operation*" OR "management* operation*" OR indicator*) P2 ("operation management" OR indicator OR performance)
Search strategy	AND between groups P1 or P2
Databases	Emerald, IEE, Proquest, Science Direct, Scopus, Springer, Taylor and Francis, Web of Science e Wiley.
Subareas Searched	Business, Management and Accounting; Decision Science; Economics, Econometrics and Finance; Energy; Engineering;
Exclusion criteria	Duplicate Article

	Meet at least two search groups
Languages	English and Portuguese
Publication's types	Articles of national and international journals with peer review
Search period	Not specified

After the appliance of the search strategy defined after a scoping study, 2118 papers were identified on 9 different databases. The titles and abstracts of all of them were read and separated according to the exclusion criteria determined: the publications should comply with at least 2 of the 3 “search term” groups and could not be doubled. After the separation, 397 publications complied with the groups’ criteria and were selected, being Proquest the database with the higher approval rate of 47% and Taylor and Francis the lowest one, with 7% of approval rate. The average approval rate was 18.75%. Among the 397 publications 100 were doubled, leading to 287 publications as the final portfolio for the bibliometric analysis. Figure 1 shows the final results for the papers portfolio.

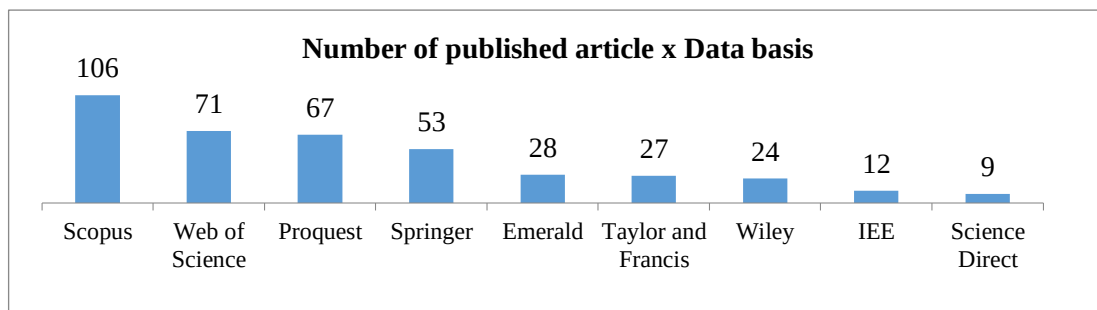


Figure 1 Graph number of published article x data basis

According to Tsay (2008), bibliometric analysis is a statistical method of bibliographic counting to evaluate and quantify the literature growth for a particular subject. Eom (2004) complementing, stating that a bibliometric may be defined as the identification of patterns and tendencies in scientific communication environments analyzing quantitatively and qualitatively, an aggregated of data about authors and documents, such as magazines’ articles and books.

BIBLIOMETRIC ANALYSIS

Based on the categorization and organization of information extracted from 287 papers, this study presented a general study on the customer satisfaction of electric power service, in order to examine opportunities for further research and trends among researchers.

Though publication year accounting, the first information that could be generated is the distribution of the number of published articles over time. It is possible to observe a continuous growth of publications in the studied theme, where the last 7 years represents 40% of the total number of published papers.

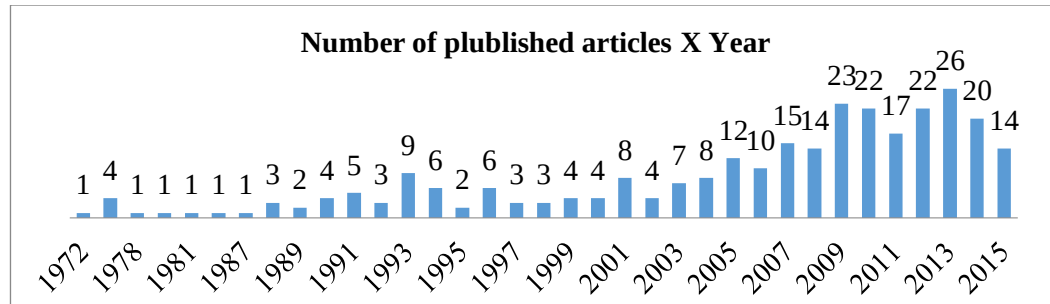


Figure 2 Graph number of published articles x year

The selected papers are spread into 179 journals. The multidisciplinary of the listed journals shows the interface of this topic with management, marketing and energy journals. Table 2 orders the top 11 journals (by number of paper relating the topic).

Table 2 The top 11 Journals

Journal	Papers	%	The year of publication (number per year)
International Journal of Public Sector Management	12	7%	1988(2), 1989(1), 1990(3), 1991(2), 1993(3), 1994(1)
Journal of the Academy of Marketing Science	11	6%	1977(1), 1978(1), 1994(1), 2001(2), 2007(1), 2009(1), 2011(1), 2013(1), 2014(2)
IEEE Transactions On Power Systems	9	5%	1996(1), 2003(1), 2004(2), 2005(1), 2006(1), 2008(1), 2011(1), 2014(1)
Total Quality Management and Business Excellence	7	4%	2004(1), 2005(3), 2006(1), 2008(1), 2013(1)
International Review on Public and Nonprofit Marketing	6	3%	2008(1), 2009(1), 2010(4)
Journal of Consumer Policy	6	3%	1977(3), 2007(1), 2009(1), 2010(1)
Managing Service Quality: An International Journal	5	3%	1992(1), 1993(4)
Energy Economics	4	2%	2011(1), 2013(1), 2014(2)
Energy Policy	4	2%	2007(1), 2009(1), 2010(1), 2012(1)
European Journal of Marketing	4	2%	1979(1), 1983(1), 1983(1), 1987(1)
IEEE Transactions on Power Delivery	4	2%	1998(1), 1999(1), 2004(2)

The list details all the journals that have at least 4 publications. After that, the study show 11 more different journals with 3 published articles each, then 44 different journals with 2 articles each and 135 different journals with 1 published article each.

The total shows 179 different journals, with 287 articles and 643 different authors. Among all the authors, 6 of them have 3 publications, 29 authors have 2 publications and the other 608 authors have just one publication. In the table 3, in the left side are the 6 authors with higher number of publication and in the right side the authors with the higher H-index in Scopus bases. According to Schreiber (2008) H-index is defined as the highest number of publications of a scientist that received 'h' or more citations each while the other publications have not more than 'h' citations each.

Table 3 Lead authors

Authors order by number of publications	Authors order by H-index
---	--------------------------

Author	Publications	H-index	Author	Publications	H-index
Mishra, Pravudatta D.	3	2	Liu, Lei	1	64
Mugion, Roberta G.	3	3	Xu, Bin	1	51
Patel, Saroj K.	3	4	Louviere, Jordan J	1	47
Satapathy, Suchismita	3	2	Zhang, Jing	1	42
Sikorski, Douglas	3	4	Huang, Guohe	1	39
Van Ryzin, Gregg G.	3	11	Watson, Layne T.	1	37

Taking into account Table 3 information, their analysis show that the authors with more publications do not have a high H-index. On the other hand, this topic appears also on the agenda of experienced researchers and with high impact research. That suggests that a new topic is being study, probably identified as an opportunity for specialization, to become a specific topic, on their research agendas. This assumption also supports the lack of a big concentration of authors on this topic.

Another analysis usually done in a bibliometric study is related to 'keywords'. In all the 287 articles, 752 different keywords have been identified. That means that there is not a big concentration in keywords, instead there is a big dispersion. As well as the author's analysis, the keywords analysis also shows a lack of maturity in this field. In Figure 3, the top 18 keywords are shown in order of frequency (absolute number).

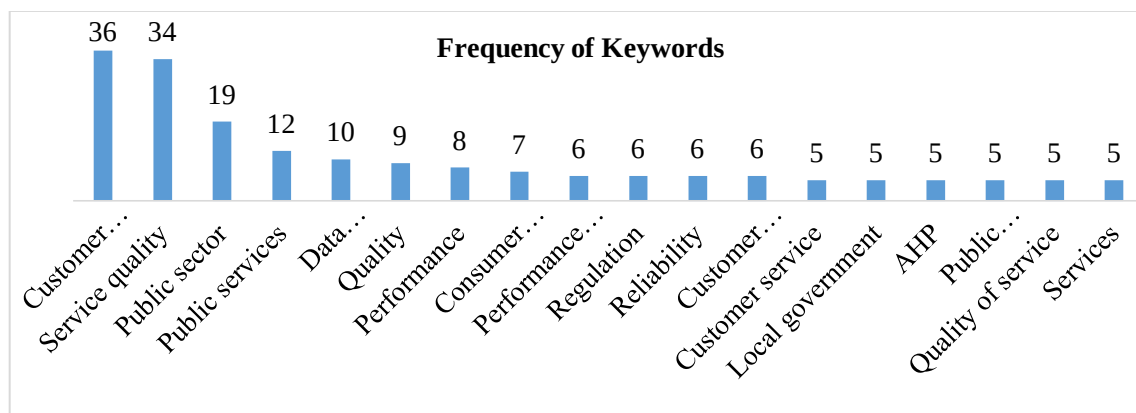


Figure 3 Graph Frequency of keywords

With the big dispersion and the lack of affinity of the top frequency keywords represent in the graph, it's possible to see a need and possibility of grouping the keywords in affinity groups. With this, five groups were defined: Management, Customer Satisfaction, Energy/Electricity, Country and Research's techniques. For the tree first groups, the criteria for the grouping were based on the definition of the research protocol. Then, two last groups were created after the authors identify the necessity of separate the keywords by country and research techniques.

The keywords from the Management group are related to the whole area of management and operations strategy, then items related to performance indicators are in that group. The words most frequently in this group are related to the service sector and the indicator that appears most is quality. This group was chosen because of the importance of management in all the fields. Especially for the theme of this study, which is multidisciplinary, all that is related to performance indicators and processes, and management systems integration are extremely relevant.

The keywords from Customer Satisfaction group are related to the content or research focus, which is a study that belongs to consumer behavior models that are explain by marketing theories. The keywords that appear most are related to customer satisfaction and combined in different ways, and customer satisfaction is one of the main topics is what most appears in this group.

The sector chosen for the study is Electrical Energy Industry, so one group with keywords related to energy, energy management and also everywhere and distribution of electricity. In this group there is a keyword with great emphasis as in the other, we see a linearity and mostly with keywords related to electricity.

The group of "Countries" was created to see if there were any prominent country in the study area, but what we saw was linearity between five countries that appeared on these keywords in three separate articles each.

The latter group is the research techniques. In this group it may be find the main techniques that were used in the portfolio of defined items. What can be seen is that quantitative research techniques excel and multi-criteria techniques are widely used for the study area, reveling once again that the topic of this study it is in the beginning of the search stage.

Table 4 Main keywords for groups

Management		Energy/Electricity		Countries	
Service quality	34	Electricity distribution	4	Canada	3
Public sector	19	Electricity industry	4	India	3
Public services	12	Energy efficiency	4	Malaysia	3
Quality	9	Power quality	4	United Kingdom	3
Performance	8	Smart grid	4	United States	3
Performance management	6	Electric power distribution	3		
Regulation	6	Electric utilities	3		
Reliability	6	Electricity	3		
		Energy management	3		

Customer Satisfaction		Research Techniques	
Customer satisfaction	36	Data envelopment analysis (DEA)	10
Consumer satisfaction	7	AHP	5
Customer services quality	6	Multi-criteria analysis	4
Customer relationship management	4	Service Quality Measure (SERVQUAL)	3
Satisfaction	4		
Customer	3		
Dissatisfaction	3		

The data show that this field of research has not yet mature. To deepen this analysis the authors made an analysis of groups of keywords x journal published x years of publication. The results are in the table below, and the conclusion about it is the same: there is a lack of maturity in all the groups. On the other hand, with those tables it is possible to interpreting an increase of publications after year 2000.

Table 5 Main journals by group by decades

MANAGEMENT	Year
European Journal of Marketing	1980 - 1989
International Journal of Public Sector Management	1980 - 1989

Managing Service Quality: An International Journal	1990 - 1999
Public Administration and Development	1990 - 1999
International Journal of Public Sector Management	1990 - 1999
IEEE Industry Applications Magazine	1990 - 1999
Total Quality Management and Business Excellence	2000 - 2009
IEEE Transactions on Power Delivery	2000 - 2009
International Journal of Quality & Reliability Management	2000 - 2009
Housing Studies	2000 - 2009
Journal of the Academy of Marketing Science	2000 - 2009
Journal of Operations Management	2000 - 2009
Journal of Purchasing and Supply Management	2000 - 2009
International Journal of Management Science and Engineering Management	2000 - 2009
Electric Power Components and Systems	2010 - 2015
Quality - Access to Success	2010 - 2015
Energy	2010 - 2015
American Review of Public Administration	2010 - 2015
Total Quality Management and Business Excellence	2010 - 2015
ENERGY/ELECTRICITY	Year
Information and Management	1990 - 1999
National Productivity Review	1990 - 1999
Managing Service Quality: An International Journal	1990 - 1999
IEEE Transactions on Power Delivery	1990 - 1999
IEEE Transactions on Power Systems	2000 - 2009
Internet Research	2000 - 2009
Service Industries Journal	2000 - 2009
Cogeneration and Competitive Power Journal	2000 - 2009
European Journal of Operational Research	2000 - 2009
IEEE Transactions on Power Delivery	2000 - 2009
Engineering Optimization	2000 - 2009
Journal of Energy Engineering	2000 - 2009
Total Quality Management and Business Excellence	2000 - 2009
Journal of Business Ethics	2000 - 2009
Service Oriented Computing and Applications	2010 - 2015
Energy Economics	2010 - 2015
International Journal of Business and Systems Research (IBSR)	2010 - 2015
IET Generation, Transmission and Distribution	2010 - 2015
Local Environment	2010 - 2015
International Journal of Communication Systems	2010 - 2015
Energy Sources, Part B: Economics, Planning, and Policy	2010 - 2015
Energy	2010 - 2015
Management and Marketing	2010 - 2015
Service Business	2010 - 2015
Public Performance & Management Review	2010 - 2015
Acta Technica Corviniensis - Bulletin of Engineering	2010 - 2015
Journal of Consumer Policy	2010 - 2015
Enterprise Information Systems	2010 - 2015
Transylvanian Review of Administrative Sciences	2010 - 2015
American Review of Public Administration	2010 - 2015
CUSTOMER SATISFACTION	Year

Journal of the Academy of Marketing Science	1990 - 1999
International Journal of Public Sector Management	1990 - 1999
Cogeneration and Competitive Power Journal	2000 - 2009
Electronis and Electrical Engineering	2010 - 2015
International Review on Public and Nonprofit Marketing	2010 - 2015
RESEARCH TECHNIQUES	Year
International Journal of Public Sector Management	1980 - 1989
Public Administration Quarterly	1990 - 1999
Review of Industrial Organization	2000 - 2009
IEEE Transactions on Power Systems	2000 - 2009
International Journal of Public Sector Performance Management	2000 - 2009
International Journal of Solar Energy	2000 - 2009
Measuring Business Excellence	2000 - 2009
Production Planning and Control	2000 - 2009
Energy Engineering: Journal of the Association of Energy Engineering	2000 - 2009
Operational Research	2000 - 2009
International Review of Administrative Sciences	2000 - 2009
Journal of International Council on Electrical Engineering	2010 - 2015
Utilities Policy	2010 - 2015
Journal of the Academy of Marketing Science	2010 - 2015
International Journal of Business and Systems Research (IBSR)	2010 - 2015
Energy Systems	2010 - 2015
Information Systems Frontiers	2010 - 2015
International Journal of Production Research	2010 - 2015

Aiming to contribute for future research, authors proposed themes and research questions to guide future research according to Customer Satisfaction of Electric power Services agenda. Suggestions are categorized in the table below.

Table 6 Future research

Proposed Themes	Research Questions
Study of intervening factors in overall performance and customer satisfaction for EE service operations. The research strategy could apply multi-criteria for decision-making techniques, and can be related to the construction of a AHP for defining the relative weights of the intervening factors.	What factors influence the performance and customer satisfaction in the provision of energy services customer?
Study of metrics to evaluate the performance of EE service operations, with emphasis on aspects related to customer satisfaction. The metrics can be studied as a metadata information and the quality (accuracy / availability etc ...) can be elements to be incorporated.	How to evaluate the performance in terms of customer satisfaction of electric power service?
Proposed method for estimating the satisfaction of the consumer through technical data mining, pattern analysis and intelligent systems in an electric power utility.	How to estimate consumer satisfaction of energy services?

CONCLUSION

This paper presents some initial results obtained from a literature review and intends to contribute with the electric power services study. Since 9 databases were used for the collection

of data, it is possible to say that was an exhaustive analysis that brings significant results. Through all the presents analysis and results, it is possible to conclude that the field of customer satisfaction of electric power service has no maturity, but it tends to grow. An research agenda is proposed for future research on this topic.

ACKNOWLEDGMENTS

Authors wish to thank COPEL and LACTEC for providing financial support for this research project through grant ANEEL R&D - PD 2866-0370/2013.

Bibliography

- Armitage, A., Allen, D. K. 2008. Undertaking a Structured Literature Review or Structuring a Literature Review : Tales from the Field. *The Electronic Journal of Business Research Methods*. **6**(2): 103–114
- Buzacott, J.A. 2000. Service system structure. *International Journal of Production Economics*. **68**(1): 15-27.
- Cochrane Collaboration 2001. The Cochrane Brochure. <http://www.cochrane.org/cochrane/cc-broch.htm#BDL> (accessed date Jan 05, 2016).
- Cochrane, 2002, "The Cochrane Collaboration Open Learning Material." The Cochrane Collaboration Open Learning Material. The Cochrane Collaboration.
- Cook, D. J., N. L. Greengold, A. G. Ellrodt, Weingarten, S. R. 1997. The Relation Between Systematic Reviews and Practice Guidelines. *Annals of Internal Medicine*. **127**(3):210–216.
- Cook, D. J., C. D. Mulrow, Haynes, R. B. 1997. Systematic Reviews: Synthesis of Best Evidence for Clinical Decisions. *Annals of Internal Medicine*. **126** (5): 376–380.
- Fink, A. 2013. Conducting research literature reviews: from the Internet to paper. Sage Publications.
- Gaither, N., Frazier, G. 2001. *Administração da produção e operações*. Thomson Learning, São Paulo.
- Garvin, D. A. 1984. What does “product quality” really mean? *Sloan Management Review*. **26**(1): 25-43.
- Gouveia, M. C. D., Antunes, L.C., Boucinha, C. H., Inácio, J. M., Catarina, F. 2015. Benchmarking of maintenance and outage repair in an electricity distribution company using the value-based DEA method. *Journal Omega*. **53**: 104.
- Gronroos, C. 1995. *Marketing: gerenciamento e serviços: a competição por serviços na hora da verdade*. Campus. Rio de Janeiro, 377.
- Guedes V.L.S., Borschiver, S. Bibliometria: uma ferramenta estatística para a gestão da informação e do conhecimento, em sistemas de informação, de comunicação e de avaliação científica e tecnológica. http://www.cinform.ufba.br/vi_anais/docs/VaniaLSGuedes.pdf (accessed date Jan 05, 2010).
- Howard, M.B. and Caldwell, N.D. 2011. “Introduction”, Caldwell, N.D., Howard, M.B., ed(s). *Procuring Complex Performance: Studies of Innovation in Product Service Management*, Routledge, New York, NY. <http://www.epri.com/Pages/Default.aspx> (accessed date Jan 05, 2016).
- <http://www.abradee.com.br/setor-de-distribuicao/a-distribuicao-de-energia> (accessed date Jan 05, 2016).
- Mcintire, J.S. 2006. The clothing and textile research base: an author co-citation study, Master Degree dissertation, Faculty of the Graduate School, University of Missouri.
- Mulrow, C. D. 1994. Systematic Reviews-Rationale for Systematic Reviews. *British Medical Journal*. **309** (6954): 597-599.
- Oliver, J. 2007. Evaluating the expectations disconfirmation and expectations anchoring approaches to citizen satisfaction with local public services. *Journal of Public Administration Research and Theory*, **19**: 107-123.
- Picolo, J. D. 2005. Influência do desempenho de atributos de produtos ou serviços na satisfação dos clientes: uma análise comparativa entre diferentes técnicas de pesquisa. Dissertação (Mestrado em Administração) — Programa de Pós-Graduação em Administração. Santa Catarina: Universidade Regional de Blumenau.
- Schreiber, M. 2008. An empirical investigation of the g-index for 26 physicists in comparison with the h-index, the A-index, and the R-index. *Journal of the American Society for Information Science and Technology*, **59**(9): 1513.
- Sheikh, S., Komaki, M. Malakooti, B. 2014. Multiple objective energy operation problem using Z utility theory. *The International Journal of Advanced Manufacturing Technology*, **74** (9-12): 1303 – 1321.
- Slack, N. 1997. *Administração da produção*. Atlas. São Paulo.

- Tranfield, D. R., Denyer, D., Smart, P. 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, **14**:207-222.
- Tsay, M.Y. 2008. A bibliometric analysis of hydrogen energy literature, 1965–2005. *Scientometrics*. 75(3): 421–438.
- Tse, G.K., Wilton, P.C. 1988. Models of consumer satisfaction formation: an extention. *Journal of Marketing Research*. **25**(2): 204-212.