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Submitted 10.27.2016. Approved 10.26.2017
Evaluated by the double-blind review system. Scientific Editor: Maria Alexandra Cunha
Translated version
DOI: http://dx.doi.org/10.1590/S0034-759020190103

THE SOCIAL REPRESENTATION OF CLOUD COMPUTING ACCORDING TO BRAZILIAN INFORMATION TECHNOLOGY PROFESSIONALS

A representação social de cloud computing pela percepção dos profissionais brasileiros de Tecnologia da Informação

La representación social del cloud computing desde la percepción de los profesionales brasileños de tecnología de la información

ABSTRACT

This study seeks to identify the social representation of Cloud Computing as perceived by Brazilian Information Technology (IT) professionals. Using accessibility criteria, 221 IT professionals were chosen as respondents to an online questionnaire. Using Social Representation Theory (SRT), the techniques of free evocation of words, the Vergès' framework, and implicative, lexical, and content analysis were performed. Analyzing the social representation of cloud computing yielded associated words such as cloud, storage, availability, Internet, virtualization, and security, implying that Brazilian IT professionals have a primarily operational, rather than strategic, approach to cloud computing. This paradigm is based on issues related to the safety and availability of cloud data, and the results match other scientific literature on this subject. The theoretical contribution of this research lies in the use of SRT. The integrated use of implicative, lexical, and content analyses may be used for a better examination of constructs in the future.

KEYWORDS | Cloud computing, social representation theory, word evocation technique, Information Technology infrastructure management, information security.

RESUMO

Este estudo busca identificar a representação social sobre Cloud Computing, pela percepção dos profissionais brasileiros de Tecnologia da Informação (TI). Os dados empíricos foram coletados por meio de questionários on-line respondidos por uma amostra por acessibilidade de 221 profissionais de TI e analisados por meio da Teoria da Representação Social (SRT), operacionalizada pelas técnicas de evocação livres de palavras e do quadro de quatro casas de Vergès, bem como pelas análises implicativa, léxica e de conteúdo. Como resultado, identificou-se que o núcleo central da representação social associada ao Cloud Computing é composto pelas palavras: nuvem, armazenamento, disponibilidade, internet, virtualização e segurança. Assim, conclui-se que os profissionais de TI no Brasil têm uma visão mais operacional do que estratégica do Cloud Computing. Essa visão funcional, congruente com parte da literatura científica sobre o tema, fundamenta-se basicamente em aspectos relacionados à segurança, armazenamento e disponibilidade dos dados armazenados no Cloud Computing, faltando uma percepção do valor estratégico do cloud computing, baseada na viabilização de novos modelos de negócio. Finalmente, este artigo traz uma contribuição metodológica original ao usar a SRT – por meio da aplicação conjunta das análises implicativa, léxica e de conteúdo – na definição de um constructo específico.

PALAVRAS-CHAVE | *Cloud Computing, Teoria da Representação Social, evocação de palavras, gestão da infraestrutura de Tecnologia da Informação, segurança da informação.*

RESUMEN

Este estudio busca identificar la representación social sobre Cloud Computing, por la percepción de los profesionales brasileños de Tecnología de la Información (TI). Se recolectaron datos mediante cuestionarios online con una muestra por accesibilidad de 221 profesionales de TI y se analizaron usando la Teoría de las Representaciones Sociales (SRT), con la técnica de recuperación libres de palabras y análisis implicados, léxicos y de contenido. Se identificó que el núcleo de la representación social asociada al Cloud Computing está compuesto por las expresiones: Nube de almacenamiento, Disponibilidad, Internet, Virtualización y Seguridad. Se concluyó que la percepción sobre Cloud Computing es más operacional que estratégica, y se alinea con parte da la literatura científica, basándose en la seguridad y la disponibilidad de los datos almacenados en el Cloud Computing. La contribución teórica original del estudio está asociada con el uso de la SRT mediante la aplicación conjunta de los análisis implicados, léxicos y de contenido para definición de constructos.

PALABRAS CLAVE | *Computación en nube, Teoría de la Representación Social, evocación de palabras, gestión de la infraestructura de Tecnología de la Información, seguridad de la información.*

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ISSN 0034-7590

INTRODUCTION

Information Technology (IT) is considered a basic utility service like any other such as water, electricity, gas, and telephone (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009). One of the computational paradigms that meets this vision, Cloud Computing, transforms IT into a basic utility service with an adequate infrastructure for users to access applications and data from anywhere (Buyya et al., 2009). Cloud computing spending is expected to reach $500 billion by 2020, which indicates the relevance of cloud computing to the IT industry in the coming years (International Data Corporation - IDC, 2016).

The technical issues associated with the use of Cloud Computing have been widely addressed in the literature, mostly in the studies of Armbrust et al. (2010), Brian et al. (2012), Buyya et al. (2009), Mell and Grance (2011), Marston, Li, Bandyopadhyay, Zhang, and Ghalsasi (2011) and Verdi, Rothenberg, Pasquini, and Magalhães (2010). Some studies have also revealed how Cloud Computing has been strategically adopted by companies to build business models (Wirtz, Mory & Piehler, 2014). However, no studies were found to investigate, through the Social Representation Theory (SRT) (Bayramusta & Nasir, 2016; Wang, Liang, Jia, Ge, Xue, & Wang, 2016), the perception of IT professionals toward the concept of Cloud Computing.

Thus, in line with Joia (2017), who considered SRT an efficient approach for understanding constructs in the area of Information Management, this article seeks to identify the perception of Brazilian IT professionals toward the concept of Cloud Computing and compare the results with those found in the current literature.

With this introduction, the rest of the article is structured as follows. In the next section, the theoretical framework addressing the concepts of SRT and Cloud Computing are presented. Subsequently, the methodological procedures used are described, followed by the results, which are discussed based on the theoretical framework used. Finally, the conclusions are presented, covering the academic and management contributions, followed by the limitations of the study.

THEORETICAL FRAMEWORK

Cloud computing

One of the most wide-ranging studies on Cloud Computing has been conducted by the National Institute for Standards in Technology (NIST) in the United States, which addresses the subject in a highly technical manner. They state that this computational paradigm is composed of (a) five essential characteristics: self-service on demand, broad network access, resource pool, rapid elasticity, and measurable services; (b) three service models: software as a service, platform as a service, and infrastructure as a service; and (c) four implementation models: private cloud, community cloud, public cloud, and hybrid cloud (Mell & Grance, 2011).

According to Brian et al. (2012), one of the essential characteristics of the Cloud Computing model, or the "resource pool," as coined by Mell and Grance (2011), is that it can be obtained only through technologies such as virtualization and multitenancy. These technologies allow providers to deliver computing resources, simultaneously or otherwise, based on the demand and needs of multiple consumers.

Since Cloud Computing makes data available remotely, and thus is out of the owner's control, it is inevitable that it causes issues related to information security. According to Dikaiakos, Katsaros, Mehra, Pallis, & Vakali (2009), all responsibility for the protection of the user, his privacy, and the integrity of the information stored by him on the cloud belongs to the contracted service provider. Wei et al. (2014) agree with this statement and believe that security and privacy management are the main challenges associated with the implementation of Cloud Computing in organizations. Younis and Kifayat (2013), in turn, identify data integrity, availability and confidentiality, security threats, and attacks as the most important factors considered by IT users when it comes to Cloud Computing.

Although most concepts regarding Cloud Computing are focused on its technological aspects (Armbrust et al., 2010; Mell & Grance, 2011), there are other concepts such as Marston et al. (2011), considered by Madhavaiah and Bashir (2012) offer the most comprehensive explanation of Cloud Computing:

Cloud Computing is an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location. The resources required to provide the requisite quality-of-service levels are shared, dynamically scalable, rapidly provisioned, virtualized and released with minimal service provider interaction. Users pay for the service as an operating expense without incurring any significant initial capital expenditure, with the cloud services employing a metering system that divides the computing resource in appropriate blocks (Marston et al., 2011, p. 2).

Thus, for Marston et al. (2011), by using Cloud Computing, IT expenses in organizations would get converted from a capital expense (Capex) to an operating expense (OPEX). Armbrust et al. (2010) and Brian et al. (2012) believe that it would be more

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appropriate to consider Cloud Computing within the pay as you go (PAYG) or pay-per-use models.

Social representation theory (SRT)

The SRT was developed in the 1960s in France by Serge Moscovici to explain how common sense is formed, organized, grounded, and propagated in different human groups. According to Moscovici (1979, 1988), social representations are constructed with the aim of understanding, locating, and adjusting in the world. Jodelet (2001) corroborates this understanding, believing that social representations are important in everyday life, because there is always a need to know how a person or object is related to the world around them. Thus, "social representations are a form of knowledge socially constructed and shared with a practical objective, and that contributes to the construction of a common reality to a social set" (Jodelet, 2001, p. 22).

It should be noted that the literature on social representations is focused on the human being and his or her relations with society. It cannot be otherwise since SRT comes from psychoanalysis. However, in the context of this study, social representation is applied to a service model, a computational paradigm called Cloud Computing, and not to an individual. Jodelet (1993) confirms the possibility of applying the concept of social representation to this paradigm, since social representation corresponds to an act of thinking by which a subject relates to an object. This can be a person, a thing, a material, a psychic or social event, a natural phenomenon, an idea, or a theory.

It is interesting to note that the use of the concept of social representation in the field of Information Systems (IS) is not something new (Gal & Berente, 2008; Jung, Pawlowski & Wiley-Patton, 2009; Kaganer & Vaast, 2010; Vaast & Walsham, 2005), especially for understanding certain attitudes of users as well as for defining constructs in IS (Joia, 2017). On these lines, the studies of Cunha, Coelho, and Pozzebon (2014) are noteworthy in that investigate the reason for the change in users' behavior over the years in relation to digital public participation in the definition of the budget of Belo Horizonte (Minas Gerais) and that of Teodoro, Przeybilovicz, and Cunha (2014), which investigate how IT governance was perceived by the technicians involved in its implementation. Vaast (2007) goes further by investigating, using SRT, how professionals of a hospital recognize and represent the aspects associated with IS safety.

According to Vergara and Ferreira (2005), in SRT, it is necessary to identify the most important part of the social representation, the core. The core defines specific consensual aspects within a group regarding the social representation of an object (Menin, 2007). Thus, the core of a social representation is formed by values about which, in general, the subject is not aware, or by values that are not made explicit, but that guide the subject's action and behavior. It represents the immutable essence of social representation, is stable and resistant to change, and thereby ensures the maintenance of social representation. Therefore, in a specific historical and cultural context, the core is decisive in defining the sense that a given object assumes for a group (Vergara & Ferreira, 2005).

According to Abric (1998, 2003), there is a more flexible peripheral system around the core. This system accommodates the direct contextual contradictions, supports the heterogeneity of the group, and gets the different perceptions of its members to allow for the adaptation of social representation to the immediate, without affecting the core (Mazzotti, 2001; Vergara & Ferreira, 2005). Thus, the peripheral system is less stable than the core, playing the role of individual modulation, without putting at risk the role of the core (Menin, 2007).

According to Mazzotti (2001), a transformation in the core generates a new social representation. Correia and Joia (2014), in turn, state that, as the core is composed of highly important elements for social representation, its change or absence would disrupt this representation or give it a new meaning.

METHODOLOGICAL PROCEDURES

The methodology proposed in this study is based on the principles of qualitative and quantitative research. Thus, data were collected using the word evocation technique, treated using the four quadrants technique proposed by Jean-Claude Abric, and analyzed using implicit and content analysis (Abric, 1998; Vergara & Ferreira, 2005; Vergès, 2003).

The field research used a non-probability sample, that is, it was based on accessibility (Vergara, 2005). An online questionnaire was sent by email during April 2014 to professionals who were effectively working, or had previously worked, in the IT field. This was done to reduce the possibility of an erroneous representation of Cloud Computing.

Different techniques were used to identify social representation, such as the word association technique. Free word association, used in this article, refers to respondents evoking and expressing words when a given word or an inductive expression is presented to them, either verbally or in writing (Vergara, 2005). Thus, in this study, the participants were asked

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to express five words or expressions that they evoked instantly when they came heard or saw the term "Cloud Computing."

Following word association, complementary closed and open questions were presented in a complementary questionnaire. This questionnaire was used for content analysis, which in turn, served to support the understanding of the core and the statistical data of the sample.

To analyze the evoked words, the data treatment model of Pierre Vergès and the four quadrants technique were used. This technique consists of four quadrants that carry essential information for the analysis of social representation, through which the evoked words are separated (Abric, 1998; Vergès, 2003). To this end, the EVOC 2005 software was used. According to Abric (2003) and Pereira (2006), as summarized in Exhibit 1, using the four quadrants technique of Vergès shows that the recall frequency or quantitative information surpasses that of recall order or qualitative information.

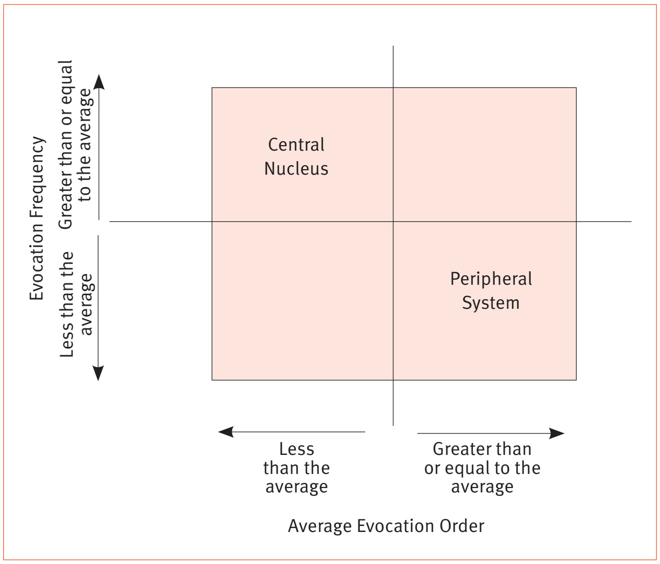
Exhibit 1. **Descriptive summary of the four Vergès quadrants**

Core Has a evoke frequency higher than the AEF and a evokes order lower than AEO	**First periphery** Has a evoke frequency higher than the AEF and a evokes order higher than the AEO Close connection to the core
Contrast zone Has a evoke frequency lower than the AEF and evokes order lower than the AEO Close connection to the core	**Second periphery** Has a evoke frequency lower than the AEF and evokes order higher than the AEO Distant connection to the central core

According to Joia (2017), the average evokes frequency (AEF) measures the average evokes frequency of a given word and is calculated by the total evokes of a given word over the total number of distinct words. The average evokes order (AEO) is obtained by the mean evokes of words, considering the order in which they were evoked – first, second, third, fourth, and fifth places. The AEO mean is obtained by dividing the sum of all AEOs by the total number of distinct words. Figure 1 summarizes the distribution of the AEF and AEO values in the framework of the four quadrants of Vergès

Thus, to find the core of social representation, according to the framework of the four houses of Vergès, these steps must be followed i) organization of the evoked words; ii) calculation of word frequency through EVOC; iii) calculation of the mean order of evocation of words through EVOC; iv) creation of reference points (average), so that evoked words are properly disposed within the frame of four quadrants of Vergès, that is, calculate AEF and AEO using EVOC, and v) make an individual comparison between the values associated with the words and the values of AEO and AEF, using EVOC, thereby creating the Vergès framework for Cloud Computing (Abric, 2003; Correia & Joia, 2014).

Figure 1. **The Vergès quadrants**



Source: Joia (2017).

In this study, we sought words that would enable the completion of Exhibit 1, with special attention to the words in the upper left quadrant, known as the core, and to those in the lower right quadrant or second periphery (Abric, 2003; Pereira, 2006), also known as the peripheral system (Vergara, 2005). In Tura (1997), the lower left quadrant (contrast zone) and the upper right quadrant (first periphery) allow a less direct interpretation of social representation, since they represent cognitions that are distant from that of the core (Abric, 2003; Pereira, 2006), and, therefore, they were not used in the study.

An implicative analysis was then performed to identify the relationship among words that are part of the social representation of Cloud Computing (Gras & Almouloud, 2002). According to Pereira (1997) and Gras and Almouloud (2002), the implicative analysis enables the confirmatory analysis of the core and the peripheral systems of social representation under study, defining the structural model of the components of social representation that were found. Thus, we obtained the groups formed by the evoked words with the highest implication indices

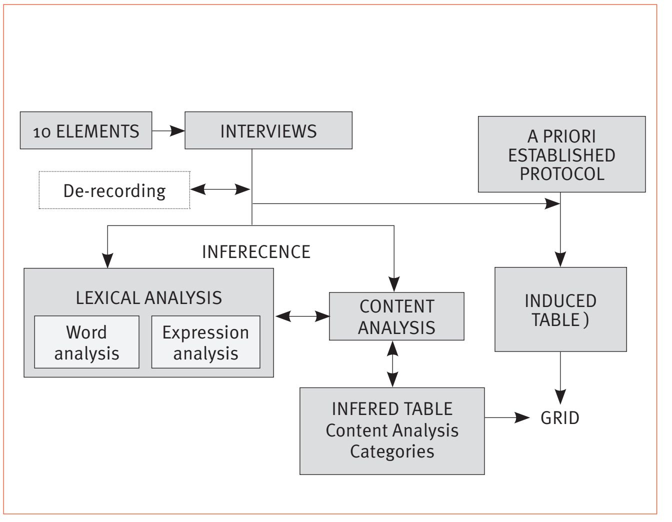
ISSN 0034-7590

with other evoked words to understand how these groupings and the words, individually, are formed and related to each other (Pereira, 1997).

To perform the implicative analysis, we used the CHIC software, which, according to Sarubbi et al. (2013), aims to provide a quality index of the associations among the elements of the core, representing them graphically.

Finally, the data were analyzed using the lexical and content analysis techniques, as proposed by Freitas and Janissek (2000). Lexicon analysis enabled content analysis, which sought to identify what was written about Cloud Computing based on the responses to complementary questionnaires, seeking indicators that would allow inferring knowledge on the conditions of production/reception of these messages (Vergara, 2005). Thus, the elements of the Vergès quadrant, obtained via lexical analysis, will serve as the basis for the categorization of the content analyzed in the open questions to generate a list with the final categories, as proposed by Freitas and Janissek (2000) and summarized in Figure 2.

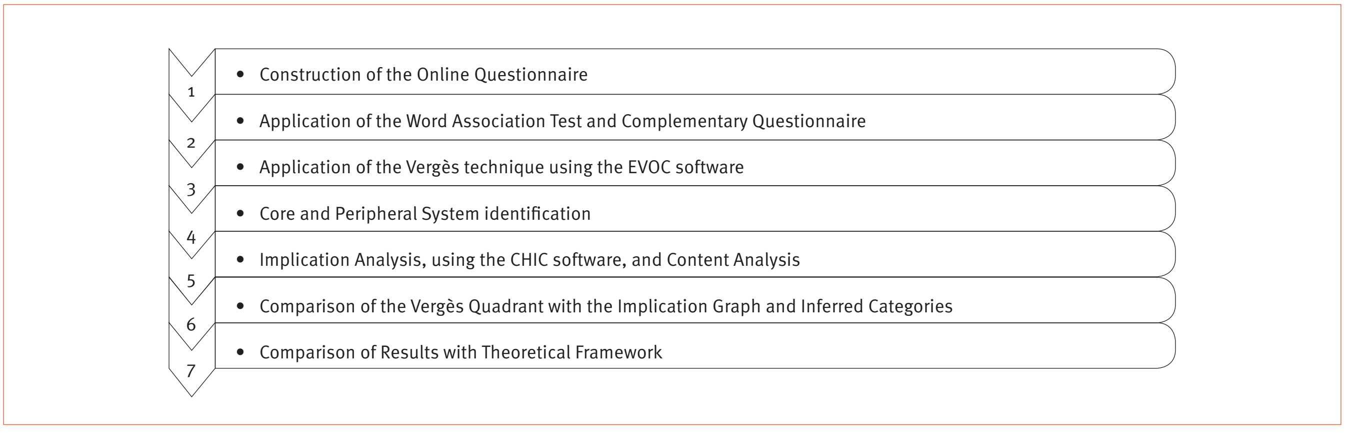
Figure 2. Data analysis plan



Source: Freitas and Janissek (2000).

Finally, the flow from the empirical research to data analysis is summarized in Figure 3.

Figure 3. Research Flow



RESULTS

Sample analysis

Using an online questionnaire, 291 responses were obtained, of which 221 (76%) were used, which is a sufficient sample size for obtaining a satisfactory result (Moscarola, 1990). Seventy questionnaires (24%) were excluded for containing blank answers because they were completed by professionals who did not work in the IT area or they contained incomprehensible words and/or those out of the context of the research. Exhibit 2 summarizes the general characteristics of the respondents.

Identification of the central nucleus and peripheral system

Before the core and peripheral system are generated, three parameters must be set. The first of is the minimum frequency that each evoked word must have to be considered by the software when calculating MRO. To this end, we used the frequency value that represents the mean of the evoked words, that is, 17.

Of the 1,091 evoked words, the EVOC software identified 213 different words, of which 15 words (7%) met the criterion of having a evokes frequency equal to or higher than 17, with an MRO of 2.99. Thus, the second parameter used by the software to generate the core and peripheral system was obtained – the mean order of evoked words, which was 2.90 – rounded off from 2.99 to 2.90, aiming at a greater rigidity in the analysis (Vèrges, 2003).

Exhibit 2. **Summary of sample characteristics**

Item	Summary of sample characteristics
1	Adequate sample size, with 221 valid questionnaires for the word association test
2	Data on gender and location of respondents according to the characteristics of the IT industry: most respondents were men (87.4%) and operated in the Southeast Region (84.1%)
3	Mean time of experience in the IT area was 15 years and mean age was 40 years, showing that the respondents have maturity and experience in the IT area
4	Respondents have, on average, 6.7 years of experience in their current position, showing stability in their profession.
5	Most of the interviewees have graduate/MBA education level (50.8%), aligned with the profile required by the market of IT professionals.
6	Most respondents are graduated (79.1%) and work (73.9%) in IT and Engineering areas.
7	Most respondents work in private companies (79%).
8	Respondents are equally divided between managers (52.8%) and non-managers (47.2%).
9	Most respondents (80%) believe that Cloud Computing is a technological paradigm, which is the same perception that market and academia have.
10	Most of the companies in which respondents work use Cloud Computing (54.5%), believing that their company is at least reasonably involved in Cloud Computing.

Finally, the central evokes value of the 15 words that comprise the social representation of Cloud Computing was found to be 35.2 (mean) or 26 (median). The median (third variable) was used as it is the best measure of the mean number of evokes, considering that the evokes frequency is not evenly distributed (Sarubbi, Reis, Bertolino & Rolim, 2013). Thus, the third and last parameter was obtained, generating the Vergès' framework of four quadrants presented in Exhibit 3.

Exhibit 3. **Distribution of words according to the framework of four houses of Vergès**

Frequency	MRO less than 2.9 (mean)	MRO greater than or equal to 2.9 (mean)
Frequency greater than or equal to 26 (median)	Storage (54; 2.444) Availability (47; 2.851) Internet (27; 2.481) Cloud (90; 1.500) Virtualization (26; 2.269) **Central Nucleus**	Accessibility (40; 3.150) Cost (36; 3.444) Security (67; 3.015) **First Periphery**
Frequency greater than or equal to 17 (minimum) and less than 26 (median)	Data (20; 2.650) Flexibility (18; 2.500) Mobility (22; 2.545) **Contrast Zone**	Sharing (24; 2.917) Scalability (25; 3.520) Easiness (22; 3.545) Network (20; 3.150) **Second Periphery/Peripheral System**

ISSN 0034-7590

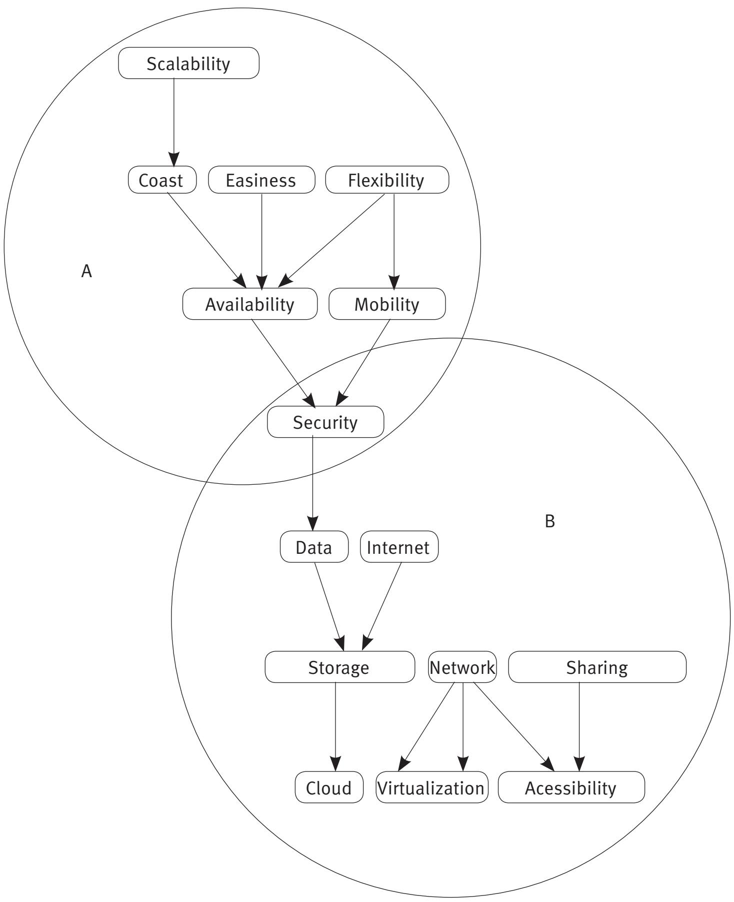
Implication analysis

To understand how the association occurs among the words that are part of the social representation of Cloud Computing, an implicative analysis was performed (Gras & Almouloud, 2002; Pereira, 1997).

According to Pereira (1997), through the implicative analysis, the possible weaknesses of the investigative technique used in this study are eliminated, since, in the evocation of words, it is often not clear what distinguishes representation from what is exclusive to language. Thus, by analyzing the association between the words that make up the social representation of Cloud Computing, we sought to strengthen the investigative method used by associating the words unconsciously evoked by respondents. This enabled the construction of implication graphs that can be analyzed and compared with the elements of the social representation generated by the EVOC software. The relational analysis of the words may even suggest changes in the core identified by the EVOC software. Thus, by using the CHIC software version 4.1, we constructed the implication graph presented in Figure 2.

Thus, two large associations were identified – circulated in Figure 4 – and named associations A and B for having words with the highest confidence indexes individually. Association A is formed by a core group comprising the words scalability => cost => availability => safety <= mobility. The core group categories are surrounded by the words flexibility and ease. Association B is formed by a core group comprising the words data => storage => cloud <= network. The core group is surrounded by the words security, internet, virtualization, sharing, and accessibility.

Figure 4. **Implication graph**



It is observed that association A is related to the characteristics of Cloud Computing, that is, those that mainly express the features considered important as well as the aspects related to the economic benefits provided by this type of system. Conversely, association

B mainly expresses aspects related to the application and use of Cloud Computing, including those related to connectivity between user and system, as well as the conceptual aspects of the computational paradigm under study.

From the analysis of the associations, it can be observed that the word security, from a relational point of view, is fundamental for the social representation of Cloud Computing, since, once deleted, it completely disarticulates this representation. Thus, the word "security" is the common link between the two associations, that is, it is the link between various elements that comprise the core of the social representation of Cloud Computing. Thus, based on this analysis, it is concluded that the word "security," although not included before, should be included in the core of the social representation of Cloud Computing.

Lexical and content analysis

The lexical and content analysis techniques are used in a sequential, recurrent, and complementary manner for categorizing research data (Freitas & Janissek, 2000). According to Freitas and Janissek (2000), lexical analysis "consists of moving from text analysis to lexical analysis (the set of all the words found in the statements or answers)" (p. 29). Conversely, according to these authors, content analysis "consists of an in-depth reading of each of the answers, and by codifying each one, one gets an idea about the whole" (Freitas & Janissek, 2000, p. 29).

Thus, the elements of the Vergès quadrant, obtained using lexical analysis, were used as the basis for categorizing open questions contents, generating a list of categories. This categorization identifies the dimensions to be tested, in this case, the core of the social representation of Cloud Computing.

One hundred eight-nine complementary questionnaires (85.5%) were considered in all from 221 respondents who answered two questions that sought to identify the definition and characteristics of Cloud Computing. Exhibit 4 summarizes the categories associated with the elements that comprise the social representation associated with Cloud Computing.

DISCUSSION

By using the four quadrants technique of Vergès (Exhibit 3), it is observed that the social representation of Cloud Computing from the perspective of Brazilian IT professionals comprises the following elements at its core: cloud, storage, availability, internet, and virtualization.

However, according to Figure 2 and by using implication analysis, other words in addition to those identified in the core were considered relevant from a relational point of view: scalability, cost, mobility, network, and security. The word "security" was fundamental for the stability of the social representation of Cloud Computing, with characteristics that suggest its positioning as part of the core, because its removal would disrupt the social representation identified. Its inclusion in the core could, therefore, be explained not from the perspective of the evokes order, but from the perspective of relationality and frequency.

Ryan (2013) and Younis and Kifayat (2013) state that security is, today, the dimension that most applies to the concept of Cloud Computing, since, if not achieved, it impairs its full use, even considering the various benefits that this computational paradigm brings to the user and the organization. In line with this, we observed how respondents' placed importance on this dimension, through the content analysis performed.

Some considerations can be made regarding the words included in the core. The word "cloud" was the most evoked, totaling almost a third of the evoked words considering the elements of the core. However, it is only a translation of the word "cloud." According to Correia and Joia (2014), it is common for respondents to evokes the inductive word itself or similar expressions when using the word association technique. It is worth mentioning that, in the implication analysis, the term "cloud" was also indicated as part of the core, from a relational point of view.

Two other words, "availability" and "storage," also stand out for their large number of evokes, totaling together more than a third of all the evoked words, considering the elements of the core. Thus, IT professionals understand Cloud Computing as a large storage center for data, programs, solutions, systems, or applications that have high availability, that is, they cannot fail. The implication analysis, despite placing these words in distinct association groups A and B, also suggests that both words are part of the core because they are strongly implicated with other words comprising social representation, with a value above 85.

The interpretation of the word "storage" follows from Mell and Grance (2011) and Marston et al. (2011), who consider information a commodity with remote storage within a shared structure of computational resources. Similarly, Mell and Grance (2011) and Ryan (2013) state that Cloud Computing is based on the idea of storing data and programs remotely within a central shared structure of computing resources accessed from anywhere and from any device.

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Exhibit 4. Inferred categories - central nucleus

Inferred category	Description	Words composing social representation
Ability to store data and applications	Cloud Computing's ability to store or host data, documents, files, information, applications, or any content remotely. It is associated with space. E.g. "Possibility of **storing data** and content of any kind in a cloud environment."	Storage
Availability of computational resources and data/ information	Cloud Computing's ability to deliver remote computing resources seamlessly and ubiquitously to all users. It is related to Service Level Agreement (SLAs) and continuity of service. It also includes equipment and access systems, such as links and broadband. E.g. "24 X 7 **Availability**".	Availability
Network connectivity and access to computing resources	All the necessary resources related to the connection or interconnection of the user with the remote computing resources, the physical medium, i.e., data network, links, broadband, the Internet, and the Intranet, whether public or private. It is also associated with the dependence of Cloud Computing on access connectivity because if it does not exist or is of poor quality, effective use of Cloud Computing is not possible. E.g. "Use of several applications via **the Internet** anywhere regardless of the technological platform."	Internet and network
Remote computing resource pool	This is Cloud Computing on its own, understood as cloud, computing, cloud computing, online, i.e., all the availability of integrated remote infrastructure and its physical components, equipment, etc. that are part of the system: machines, memory, servers, processors, and data centers, recognized as remote computing resources. Example: "**Use of memory** and storage capacities of computers and servers shared and interconnected through the Internet."	Cloud
Data/Information Virtualization and Systems	Cloud Computing's ability to locally simulate the entire environment necessary for the execution of the service, which is effectively provided remotely. Virtualization is critical for Cloud Computing. Otherwise, there would be no possibility of using remote computing resources. Example: "**Access to applications virtually,** not needing to install an application on the machine."	Virtualization
Data/information security	All aspects related to data security, information, software, applications, in short, everything that is remotely maintained in the Cloud Computing environment, to try to ensure the privacy, secrecy, and confidentiality of user information. It also corresponds to the tools used by users to keep their data safe, such as backup and redundancy. Examples: "Availability of data on any Internet access. **Data security**."	Security
Sharing of computational resources and data/ information	Capacity of simultaneous or parallel use of remote computing resources interconnected by several users independently. It also includes the possibility of remote file sharing and collaboration between users. E.g., "**Sharing processing power** for the common purpose of streamlining tasks."	Sharing
Scalability of computational resources	Meaning is close to elasticity; however, it is differentiated by the fact that it relates to the ability of Cloud Computing to grow as the user's need increases, not allowing to decrease. It aims at increasing the work to be processed, ignoring the use or non-use of available resources. E.g. "Cloud Computing is a technology that is mainly associated with the easy and fast **scalability** of a given environment. With this, it is possible to resize it according to the need of use, generating savings, because one needs to pay for only what one consumes, different from a physical server within a company, dedicated exclusively to a particular system and/or service.	Scalability
Ease of use of computational resources	Cloud Computing users' ability to use, implement, hire, or manage remote computing resources, in a simple, practical way, and with minimal effort. E.g. "Dynamic provisioning of resources on demand, with **minimal effort**."	Ease of use

Although the word "data" does not appear as an element of the core, its presence, both in the implicit and in the content analysis, indicates its function within the social representation. After content analysis, we understand that the word "data" is more frequently associated with the word "storage" and then, in a lesser frequency, with the word "processing." Thus, Cloud Computing continues to be recognized by IT professionals as just a data storage system or a data repository, dating back to an early stage of its use.

The word "availability" refers to service availability, uninterrupted, online, 24 hours a day, and 7 days a week. According to the content analysis, this expression includes not only system availability and remote computing resources per se, but also data network (Internet) availability, which links the user and the elements of Cloud Computing (servers, storages). Thus, it is similar to what was presented as one of the main features of Cloud Computing according to Younis and Kifayat (2013), Brian et al. (2012), and Mell and Grance (2011): service provision through a high-performance connection, always available.

The presence of the words "internet" and "virtualization" reveals that the understanding of IT users is that Cloud Computing is a service available remotely through the internet, using virtualization as a tool for emulation of these services, without the need for proprietary infrastructure. Through content analysis, we observed that the word "Internet" is always mentioned as the means by which the user connects remotely to the cloud computing resources. Therefore, the Internet is seen as the enabler of connectivity between the user and the Cloud Computing resources. It is even possible to combine the word Internet with the word "network," which appears as an element of the peripheral systems. Marston et al. (2011) had already stated that virtualization is the key technological aspect that enables the full use of Cloud Computing, because it enables the use of computing resources by individual or multiple consumers, which simulates infinite and automatic provisioning of computing capacity on demand (Armbrust et al., 2010; Brian et al., 2012; Mell & Grance, 2011).

The peripheral system of the social representation of Cloud Computing, from the analysis of Exhibit 3, consists of the following words: sharing, scalability, ease of use, and network. The presence of the word "sharing", as an element of the core, has two interpretations derived from the content analysis. The first, more evident, refers to the ability to share configurable computational resources through modern cloud computing platforms (Marston et al., 2011; Mell & Grance, 2011). The second refers to the perception that Cloud Computing is not only a remote, Internet-accessible, and individual-use data storage service, but also a means of promoting data and information sharing among individuals.

The word "scalability," in turn, refers to the ability of Cloud Computing to resize virtualized computing resources on demand, increasing the number of processing nodes (Verdi et al., 2010). Scalability should be transparent to the user, without the need to know data location and how data can be accessed, ensuring the level of service quality contracted by the user (Marston et al., 2011).

Finally, the word "ease of use", according to the content analysis, represents the ability of Cloud Computing users to use, implement, hire, or manage remote computing resources simply and practically and with minimal effort. Mell and Grance (2011) state that Cloud Computing is a model in which computing resources can be quickly provisioned and released, with minimal management effort or interaction with the service provider.

Thus, after using the word association technique, implication analysis, and content analysis, we suggest a reorganization of the core and the peripheral system of the social representation of Cloud Computing as shown in Exhibit 5.

Exhibit 5. **Final Social Representation of Cloud Computing**

Frequency	MRO less than 2.8 (mean)	MRO greater than or equal to 2.8 (mean)
Frequency greater than or equal to 26 (median)	Storage Availability Internet Cloud Virtualization Security **Core**	None **First Periphery**
Frequency greater than or equal to 17 (minimum) and less than 26 (median)	None **Contrast Zone**	Sharing Scalability Easiness **Second Periphery/Peripheral System**

ISSN 0034-7590

CONCLUSIONS

Based on the results obtained, especially considering the central nucleus, it may be concluded that the perception of Brazilian IT professionals toward Cloud Computing – in agreement with a part of the scientific literature on this concept - is focused on its operational and functional aspects, especially on the availability, storage, and security dimensions. Thus, Brazilian IT professionals lack understanding about the strategic value of Cloud Computing, as proposed by Wirtz et al. (2014), and of the new business models provided by this new paradigm, as suggested by Marston et al. (2011).

Thus, from the elements of the core of the social representation of Cloud Computing, it was possible to generate a new definition of this computational paradigm. Thus, Cloud Computing is a business model based on its consideration in IT as a data storage service, comprising a pool of remote computing resources, which are accessible to users via the Internet and which use virtualization. Computational resources need to be fully available, that is, uninterrupted, secure, and risk-free regarding user data.

Management contributions

The first management contribution of this study – from the identification of the social representation of Cloud Computing according to IT professionals – is that it allows IT executives to share the best practices to be adopted for the correct use of this computational paradigm, with their internal and external customers, besides allowing them realize the stage in which their organization is situated in relation to this paradigm.

The second contribution of this study is that it reinforces the need for executives to focus on the development of Cloud Computing solutions based on security, availability, and storage. Since this study shows that the social representation of cloud computing by the respondents is highly focused on the risks associated with data security, as well as on data storage and availability, there is a need to invest hugely in effective and secure solutions with high availability.

The last contribution of this study is that it suggests how future Brazilian IT executives will have to align Cloud Computing to new business models and business strategies.

Academic contributions

This study opens room for an academic discussion on the use of implication analysis to confirm the core of social representation. We believe that this study makes an important methodological contribution since it uses implication analysis to show how the words that are part of the central and peripheral system are in dialogue with each other, strengthening social representation. Using implication analysis, this study attempts to change the position of one element – security – from the peripheral system to the core.

Furthermore, this study explains how the core and the peripheral system of a social representation can be identified using the EVOC and CHIC software.

Finally, the concomitant use of the four quadrants technique of Vergès, implication analysis, and content/lexical analysis leads to greater consistency in the results obtained, which is a methodological contribution of this study.

STUDY LIMITATIONS

An important limitation of this study refers to the organization of words – one of the steps used by the EVOC software to build the framework of four quadrants technique. No matter how many rules have been previously established by the referenced studies, mistakes can occur. Likewise, inference errors may have occurred when categorizing words, which was mitigated by including implication, content, and lexical analysis. A second limitation refers to the non-probability sample, which makes the conclusion of the study statistically less generalizable for Brazil. Despite these limitations, we hope to have contributed to a better conceptual definition of the Cloud Computing paradigm with this study.

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