

## **ACTOR-NETWORK THEORY: Uses in Management and Organizational Studies**

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## **Introduction**

The Actor-Network Theory (ANT) represents a social theory that search to understand science and technology, i.n. the technoscience (Sismondo, 2010). John Law, Michel Callon, and Bruno Latour originally developed this theoretical framework. The ANT represents a perspective in which the construction of the reality is uncovered by practices and interactions of human and nonhuman actors. The analysis through the ANT does not begin from previously defined assumptions about the social phenomenon. The slogan of the ANT is “to follow the actors themselves” (Latour, 2005, p. 12), but taking care to observe when they multiply or reduce actors. ANT can identify the actors, and it is still possible to understand their roles, associations, and interaction with other heterogeneous actors which create networks (Sismondo, 2010). “To put it simply, ANT is an argument not about the ‘social’ but about the associations which allow connections between non-social elements” (Latour, 2003, p. 35). That way, when one does a job for ANT of reflections of the associations is possible to understand a social phenomenon (Latour, 2003; 2005). Latour (2005) emphasizes that be possible to understand the social as a kind of non-permanent association.

When studying a social phenomenon from the perspective of ANT, it is common to across with three core principles (Callon, 1986). These principles represent attitudes to be adopted by a researcher when using this framework. They are: “agnosticism (impartiality between actors engaged in controversy), generalized symmetry (the commitment to explain conflicting viewpoints in the same terms) and free association (the abandonment of all a priori distinctions between the natural and the social)” (Callon, 1986: 196). Terms like inscription and the translation must be considered when performing a search by the optics of the ANT.

The popularization of the term is evident, mainly when conducting a search of the ‘Actor-Network Theory’ in the Google search system and the ISI Web of Science® (Thomson Reuters). The results of these two sources indicated 9,920,000 and 1,382 entries, respectively, by ‘Actor-Network Theory’ (in December 2015), still filtering the result of the ISI Web site is 1,099 scientific articles. Being that of this total 117 has that term in its title.

The use of ANT has grown out of science and technology studies and emerges in the most diverse areas of knowledge. For example, there are studies in the field of management, sociology, geography, computer science, environmental studies, education, information science, philosophy, communication, economics, anthropology, culture, music, and more. Immersed in this context for the use of ANT as a theoretical framework to study innovation, we asked, as a research question: how the ANT has been performed in Management and organizational studies? To guide our actions to clarify this issue, we delimit as research objective: to map ANT uses in Management and Organization Studies (MOS), through a systematic review.

For achieve this purpose, the study presents a preliminary theoretical reference to define on the one hand origins and core concepts; and on the other the relations with the organization studies. After this part, we define methodological procurements for the systematic review. The results are in the following, with the analysis of the principal findings of the issue. In conclusion, there are some reflections which can promote the more clarification in the appropriation of the ANT by the organization studies.

## **Theoretical Reference**

### **Definitions, origin, and concepts**

The article Law (1992) represents one of the most cited articles about the Actor-Network Theory (ANT). This article has 461 quotes by ISI Web of Science® from Thomson Reuters and 723 by Scopus. The ANT born with a group of sociologists associated with the *Centre de*

*Sociologie de l'Innovation* of MINES ParisTech. (Law, 1992). ANT authors “started out in the sociology of science and technology. With others in the sociology of science, they argued that knowledge is a social product rather than something generated by through the operation of a privileged scientific method.” (Law, 1992, p. 381). ANT authors they argued that ‘knowledge’ may be understood as an effect or a product of a network of human and nonhuman heterogeneous actors (Law, 1992).

The origin of the ANT related to the need of a new social set theory for Science and Technology Studies (STS) (Latour, 2005). It began with the following seminal works: John Law ‘*On the Methods of Long-Distance Control: Vessels, Navigation and the Portuguese Route to India*’, in 1986; Michel Callon ‘*Some elements of a sociology of translation domestication of the scallops and the fishermen of St Brieux Bay*’, in 1986; and Bruno Latour ‘*The Pasteurization of France*’, in 1988 (Law, 1992). A relevant substituting was done by ANT “[...] a new definition of what it is for a human to deal with a nonhuman for the old subject-object dichotomy.” (Latour, 1999, p. 108). In this context, the discovery of the object (invention) also has an opportunity to play roles, that is, nonhumans can also act (Latour, 2005).

Some concepts adopted by the ANT like symmetry, translation, rhizome and dispositif device originated from other authors. Generalized symmetry was a term derived from the pure symmetry concept of David Bloor (2009), “[...] but is considerably extended. The goal is not only to explain conflicting viewpoints and arguments in a scientific or technological controversy in the same terms” (Callon, 1986, p. 200). David Bloor was responsible for the creation of the Strong Program or Strong Sociology that influenced ANT with the principle of symmetry. The translation was a concept extracted from the French philosopher Michel Serres (Czarniawska, 2009). For Serres, translation as a generalized, not merely linguistic, operation that may involve displacement (Czarniawska, 2009). “Consequently, that which is involved in translation — be it knowledge, people, or things—has an uncertain identity. Each act of translation changes the translator and what is translated” (Czarniawska, 2009, p. 424).

The notion of rhizome elaborated by Deleuze and Guattari (2005) was also an influence for ANT, mainly the principle of multiplicity that approaches the network concept of the ANT. The idea of dispositif (power) of Michel Foucault approaches the ANT about the translational process. Power in ANT is taken as a set of effects and not as a set of causes, a fact that brings the theory closer to Michel Foucault (Law, 1992).

Three principles support theoretic and methodologically the ANT. Callon (1986) presents them as the following: *agnosticism*, understood as the “impartiality between actors engaged in controversy” (Callon 1986, p. 196), without privileges and censures in the interpretation of understanding. Agnosticism also requires the researcher to establish the identity of the actors involved if their identity is still being negotiated (Callon, 1986). *Generalized Symmetry* is the second principle, an appropriate and extended concept of David Bloor (Callon, 1986). This principle has “the commitment to explain conflicting viewpoints in the same terms.” (Callon, 1986, p. 196). The rule of this principle is not to modify the records when we change from the technical to the social aspect of the research question (Callon, 1986). *Free association* concerns the third principle, that means “the abandonment of all a priori distinctions between natural and the social.” (Callon, 1986, p. 196). According to Callon’s (1986), it is necessary to keep track of all the variations that affect the alliances in which the actors (researchers) have seen forced to establish, without arresting them in fixed roles. These three principles enable that human and non-human being into account at the same time (Callon, 1986). These principles allow us to explain how to define identities of the actors, their mutual driving margins and the range of opportunities that are available to actors.

## ANT in Organizational Studies

ANT represents a contemporary theoretical tendency that may be considered as heirs (apparent) of the 'postmodern turn', ANT offering a specific contribution to organizational theorizing (Calás and Smircich, 1999). In the field of organizational studies, ANT has been used since the 1990 and gaining space as a clear research strategy for understanding organizations. "When we seek to translate an ANT approach into the sphere of Management and Organization Studies (MOS), we are involved in the analysis of alliances or networks" (Alcadipani and Hassard, 2010, p. 420). The authors point out that there are actors located outside the focal organization. In the view of ANT the phenomena are socially constructed, so cannot be overlooked and Yes explored and explained (Latour, 2005; Czarniawska, 2009). Calás and Smircich (1999, p. 663) highlight the "ANT is reflexive because it both constitutes and describes its object of interest.". These authors claim that ANT has been published in periodicals in organizational sociology and organizational studies in Europe for several years but with this theory in organizational studies rare journals in the United States.

A challenge for organizational studies, to Orlikowski (2007), would be how to make valid and reliable research that address the associations between humans and nonhumans, through an argument that transcends the debate between social and consecrated material. According to the author, a series of ideas, like the ANT, emerged in the STS making it possible to answer this question. Development of the concepts of ANT reconfigurable the notion of Agency (Orlikowski, 2007). The agency would be an essence of humans and nonhumans, with the capacity to realize interactions and associations of actors (Latour, 2005; Orlikowski, 2007), in a context of actors acting in which the distinction between humans and nonhumans is impossible. Orlikowski (2007) highlights the importance of dealing with the social and material as a dependent and undetermined in the life of the organization.

ANT has been used in organizational studies to understand technological relations in the workplace (Orlikowski, and Scott, 2008). There are also studies that focus on organizational practices and their relationships to understand the issue of knowledge from individuals (Nicolini, 2011). The ANT has been used in organizational studies research to understand a broad range of research questions, especially in studies of information technology and information systems (Alcadipani and Hassard, 2010). These authors assert that ANT has the potential to contribute to the development of a critical perspective on the organization (Alcadipani and Hassard, 2010).

The ANT represents an optic that makes it possible to represent and navigate the new places coming from contemporary technology in a reconfiguration of the time/space of organizations, as 'the Web,' 'virtuality' and 'social networking' (Calás and Smircich 1999). The work of Whittle and Spicer (2008) also speaks of ANT's contributions to organizational studies "The contribution of ANT to organization studies lies in recognizing that there is no such thing as a purely social actor or purely social relation (ibid)." (Whittle and Spicer, 2008, p. 611). The study of Whittle and Spicer (2008) tried to explore the limits of ANT as a critical theory of organization. Whittle and Spicer (2008) highlight the relevance of ANT for the understanding of the organizational process, but this theory with less explanatory power for a critical report of organizations. Still, Whittle and Spicer (2008) emphasizes the importance of ANT being used by the scholars of the organization in a reflexive and more focused way.

The ANT can be used to understand the organizational strategy in a pluralistic context, that is, of multiple objectives and diffuse power (Denis *et al.*, 2007). However, few empirical studies using ANT to understand how strategies can be created and to draw networks around technology definitions (Denis *et al.*, 2007). The authors report that the organizational strategy would be equivalent to a nonhuman actor. These authors emphasize that studies of this nature not be found in mainstream strategy literature (Denis *et al.*, 2007).

The ANT represents distinctive research strategy (Lee and Hassard, 1999). “This is because ANT's research strategy, as it bears on issues of expertise, boundedness and flexibility, appears peculiarly suited to the investigation of key contemporary developments in organizational thinking and practice” (Lee and Hassard, 1999, p. 393). By the of ANT, human and nonhuman relationship explain organizational practices (Lowe, 2001).

## **Methodology**

We objected with this map, through a systematic review, ANT has been used for research in Management and Organization Studies. In order to expose the viability of research, this section sought to point out your design.

A systematic review represents a planned review designed to answer a specific question. This type of review uses explicit and systematic methods to identify, select and critically evaluate the studies, and to collect and analyze data from these studies included in the review (Botelho *et al.*, 2011). Highlights as the survey was conducted in March 2016, so this year's data are partial.

Our study was conducted through four phases: (1) search and selection procedures; (2) inclusion and exclusion criteria; (3) analysis of articles; (4) analytical synthesis. The first phase was named search and selection procedures, which began in february 2016. This phase was operationalized by the search for scientific articles in the ISI Web of Science® database of Thomson Reuters, through a systematic literature review aiming to map the state of the art of ANT.

The study of Levy and Ellis (2006) define systematic review as sequential stages of collecting, knowing, understanding, applying, analyzing, synthesising and evaluating the literature, in order to provide a theoretical and scientific basis on a particular topic or subject researched. The main reasons for conducting a systematic review (Kitchenham, 2004): (1) summarize the existing evidence for a treatment or technology; (2) identify any gaps in current research to suggest new areas of future research; (3) provide a theoretical framework to position properly new research activities.

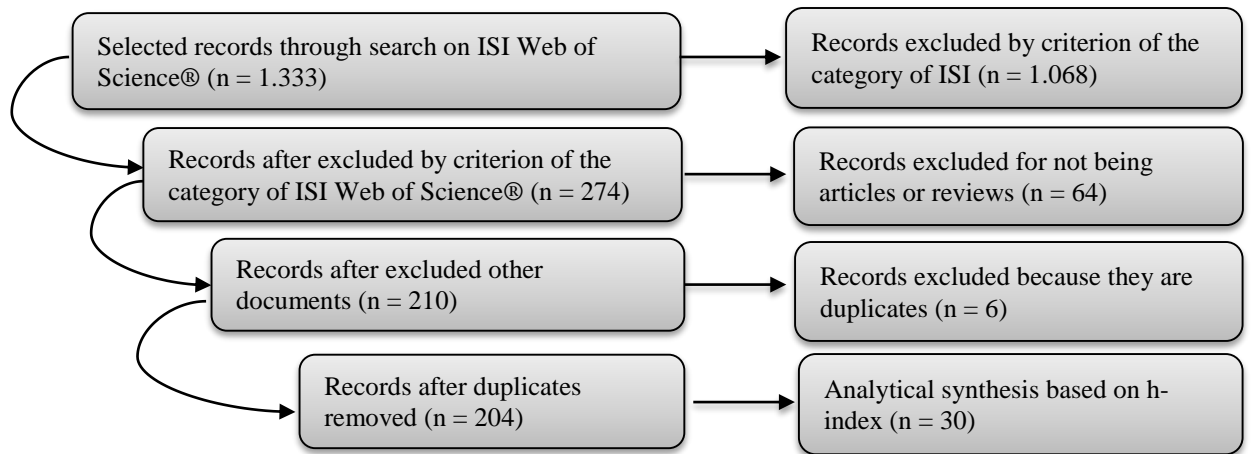
For this **first phase** was used the search criteria the use of the term ‘actor-network theory’. The filter that guided searches was the choice of the 'topic' search field, containing Title, Abstract, Author Keywords, and Keywords Plus®. Our search resulted in 1,333 entries (in March 2016).

The database from ISI Web of Science ® has been used not only because of its scope and use by academic and organizational means, but also by the fact that it is possible to export data in formats such as: ‘Save to Text File’; ‘Save to Excel File’; ‘Save to EndNote online’; ‘Save to EndNote desktop’; ‘Save to Other File Formats’. We emphasize that the last format of saving records, ‘Save to Other File Formats’, represents the alternative to the CiteSpace software (Chen, 2004, 2006). Our study also used the ISI Web of Science® ‘Analyze Results’ and ‘Create Citation Report’.

The **second phase** named inclusion and exclusion criteria. The inclusion criterion were: (1) articles with full texts, in English, Spanish and Portuguese; (2) publications involving the period of each year. The exclusion criteria were as follows: (1) Incomplete articles or in languages that have not been selected; (2) Articles with access only to title and summary ; (3) Articles about ANT doesn't work management research; (3) Articles on ANT that are not of the area of research in management.

The **third phase** consisted in the analysis of the articles. In a first moment, we performed the reading and analysis of titles and abstracts, which resulted in a total of 204 documents (Figure 1).

After the exclusion of the articles that did not fit the scope of the research, the main characteristics of the articles were systematized.



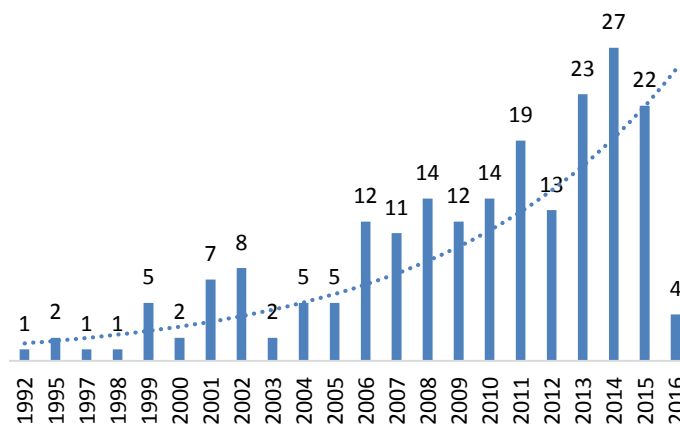
**Figure 1** - Flow diagram of the study selection process for the systematic review.  
Source: Prepared by the authors.

For the study we elaborated four tables, in which the first contained the identification of the selected articles (names of authors, titles of articles, titles of journals, research centers, year and country); In the second, data on the theory; In the third analysis of the data obtained.

The **fourth phase** represents an analytical synthesis, in which we perform a qualitative analysis of the studies in research in management that use the ANT. In this phase, 31 articles selected for semantic analysis were selected using the ISI Web of Science® h-index (Thomson Reuters). However, we exclude an article for not working with ANT, although he has mentioned as one of your keywords. Thus, we selected 30 articles for analysis, after the selection the articles were analyzed their contributions and deficiencies.

### Application of the ANT on the Studies

This section we present an overview of the studies (Figure 2). We analyzed 210 articles that made it possible to observe that the publication of studies that address the ANT in the Management and Organization Studies (MOS) presented a great oscillation, with the years of 2013, 2014 and 2015 having the highest frequencies.



**Figure 2** - Articles published over the years  
Fonte: Dados da pesquisa.

The first publication in the context of *Actor-Network Theory* (ANT) and administration research occurred in the year 1992, entitled ‘Systems and Organizations: Distal and Proximal

Thinking’ by Cooper (1992). Journals with higher frequency of publications include the ‘*Organization*’ with a total of 20 articles published, the ‘*Organization Studies*’ with a total of 10 studies, and with each work 8 the ‘*Accounting Organizations and Society*’ and the ‘*Scandinavian Journal of Management*’ (table 1). The ten journals together account for 39.5% of total articles published on the thematic (table 1).

Table 1 - Periodicals with the highest frequency of publications

Journals	Frequency	%
<i>Organization</i>	20	9,5
<i>Organization Studies</i>	10	4,8
<i>Accounting Organizations and Society</i>	8	3,8
<i>Scandinavian Journal of Management</i>	8	3,8
<i>Human Relations</i>	7	3,3
<i>Accounting Auditing &amp; Accountability Journal</i>	6	2,9
<i>Critical Perspectives on Accounting</i>	6	2,9
<i>Journal of Information Technology</i>	6	2,9
<i>Journal of Organizational Change Management</i>	6	2,9
<i>Journal of Strategic Information Systems</i>	6	2,9

Source: Research data.

The researchers with the greatest number of work were: John Hassard (4 articles) from the University of Manchester, François Cooren (3 articles) from the *Université de Montréal*, Thanos Papadopoulos (3 articles) from the *University of Southampton*, Peter Skærbæk (3 articles) from the *Copenhagen Business School* e from the *Trondheim Business School*, and Andrea Whittle (3 articles) from the *Cardiff Business School*. In relation to research institutions with greater amount of publications on the actor-network theory focusing in the field of Management and Organization Studies, the Copenhagen Business School with 15 articles, the Lancaster University with 9 articles, the University of Manchester with 8 articles, and the University of Warwick with 7 articles (Table 2).

Table 2 - Most frequently published research institutions

Journals	Frequency	%
<i>Copenhagen Business School</i>	15	7,4
<i>Lancaster University</i>	9	4,3
<i>University of Manchester</i>	8	3,8
<i>University of Warwick</i>	7	3,3
<i>University of Exeter</i>	6	2,9
<i>University of Gothenburg</i>	6	2,9
<i>University of Cambridge</i>	5	2,4
<i>Université de Montréal</i>	5	2,4
<i>Université Paris-Dauphine</i>	4	1,9

Source: Research data.

The articles were written in English (98.095%), with the exception of papers written in Portuguese (Albuquerque, 2012; Fornazin, and Joia, 2015). The countries of origin of the 204 articles were: 34.8% from England, 17.8% from the USA, 12.9% from Canada, 8.6% from Australia, 8.6% from Denmark, 6.7% from France, 6.7% from Switzerland, 5.2% from Norway, 4.3% from the Netherlands and 4.3% from Scotland.

A cloud of words was elaborated to identify more concepts related to application of the ANT in the research of Management and Organization Studies, and which appear with greater frequency. For this, we used the titles and keywords of the 210 articles analyzed, through the web tool Wordle™ (www.wordle.net). The words ‘theory’, ‘management’, ‘research’, ‘accounting’ and ‘actor-network’ were the most representative in the articles analyzed, as shown in Figure 3.





Table 3 - Main co-citations used in the studies.

Citations	References
103	Latour (1987). <i>Science in Action: How to Follow Scientists and Engineers Through Society</i> .
95	Latour (2005). <i>Reassembling the social: an introduction to actor-network-theory</i> .
55	Callon (1986). <i>Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of Saint Brieuç Bay</i> . In J. Law (Ed.) <i>Power, Action and Belief: a new Sociology of Knowledge?</i>
41	Law (1992). <i>Notes on the Theory of the Actor-Network: Ordering, Strategy and Heterogeneity</i>
34	Latour (1993). <i>We Have Never Been Modern</i> .
31	Law, J. (1999). <i>After ANT: Topology, Naming and Complexity</i> . In J. Law and J. Hassard (Eds.) <i>Actor Network Theory and After</i>
31	Latour (1996). <i>Aramis, or the Love of Technology</i> .
31	Law (1994). <i>Organizing Modernity</i> .
27	Latour (1999). <i>Pandora's hope: essays on the reality of science studies</i> .

Source: Research data.

As the main research areas classified by Web of Science®, we highlight that 95.2% of the studies were from the Business & Economics area, that is, 200 articles worked with the area expected for the study. Other areas were addressed, but less frequently, such as: Public Administration; Information Science & Library Science; Computer Science; Social Sciences Other Topics; Engineering; Operations Research Management Science; Environmental Sciences & Ecology; psychology; and Science Technology Other Topics.

The list of ten articles most cited in the review we present in Table 4, these studies represented 37.57% of the total citations (3,778). We pointed out that 171 out of a total of 204 papers were cited at least once. Although the article by Callon and Muniesa (2005) is the most cited article in the context of the present study and elaborated by one of the creators of ANT, this work only makes a small mention of ANT. In this context, Fox's article (163) represents, in fact, the first most cited article to work with ANT related to management research, we still note that this study mentions ANT since its title.

Table 4 - List of most cited articles in the review

Citations	References
280	Callon, M., and Muniesa, F. (2005). "Peripheral vision economic markets as calculative collective devices", <i>Organization studies</i> . Vol. 26 No. 8, pp. 1229-1250.
163	Fox, S. (2000). "Communities Of Practice, Foucault And Actor-Network Theory", <i>Journal of management studies</i> . Vol. 37 No. 6, pp. 853-868.
162	Walsham, G., and Sahay, S. (1999). "GIS for district-level administration in India: problems and opportunities", <i>MIS quarterly</i> . Vol. 3 No. 1, pp. 39-65.
161	Calas, M. B., and Smircich, L. (1999). "Past postmodernism? Reflections and tentative directions", <i>Academy of management review</i> . Vol. 24 No. 4, pp. 649-672.
138	Law, J., and Singleton, V. (2005). "Object lessons", <i>Organization</i> , Vol. 12 No. 3, pp. 331-355.
124	Gherardi, S., and Nicolini, D. (2000). "To transfer is to transform: The circulation of safety knowledge", <i>Organization</i> . Vol. 7 No. 2, pp. 329-348.
123	Lounsbury, M. (2008). "Institutional rationality and practice variation: New directions in the institutional analysis of practice", <i>Accounting, Organizations and Society</i> , Vol. 33 No. 4, pp. 349-361.
102	Mouritsen, J., Larsen, H. T., and Bukh, P. N. D. (2001). "Intellectual capital and the 'capable firm': narrating, visualising and numbering for managing knowledge", <i>Accounting, organizations and society</i> . Vol. 26 No. 7, pp. 735-762.
89	Denis <i>et al.</i> (2007). "Strategizing in pluralistic contexts: Rethinking theoretical frames", <i>Human Relations</i> . Vol. 60 No. 1, pp. 179-215.
81	Pentland, B. T., and Feldman, M. S. (2007). "Narrative networks: Patterns of technology and organization", <i>Organization science</i> . Vol. 18 No. 5, pp. 781-795.

Source: Research data.

The ANT is based on three principles (agnosticism, generalised symmetry and free association) presented by Callon (1986). We emphasized through the literature review, it was

found that only three works presented the three principles. Munir e Jones (2004) cita os três princípios, mas não faz menção ao estudo de Callon (1986). The second work is authored by Lee and Chen (2011) who presented and defined the three principles, and even stated that these principles provide a good ontological description for online social network (OSN), in terms of structure and interrelation between human and nonhuman actors of the OSN. Bylund (2012) cited and conceptualized these principles, stating that the three principles are essential ANT utility to investigate planning practices. The work of Burgess, Clark and Harrison (2000) presents and conceptualizes the generalised principles of symmetry and free association, but about agnosticism is treated, named as the principle of impartiality.

The principle of generalised symmetry is mentioned in the works of Beekhuyzen, Hellens and Nielsen (2015) and Farquharson, Örtenblad and Hsu (2013), being reported the importance of this principle for the ANT, but we find that both articles do not mention the other two principles. but we find that both articles do not mention the other two principles. A possible justification for not mentioning the principles or partial mention of the principles may be related to the fact that the studies focus on the design of Latour's ANT. Or because these principles represent concepts internalized and consolidated in the theory that has implications with the conduction of the researcher in his investigation.

The agnosticism represented the principle of Callon (1986) more cited, and 210 works just five cited only this principle. The principle of agnosticism understands that reality is not out there, but is produced in what we're doing (Skærbæk, 2015). This principle ensures that researchers keep impartial towards the arguments used by the protagonists of the controversy explored (Blanchet and Depeyre, 2016). Ivakhiv (2002) reports that the substitution of actors by acting ontologically neutral serve as a good example of ontological ANT agnosticism. Whittle and Spicer (2008) to treat this principle makes a caveat that the gap between the complex neologisms used by ANT and the terminology used by the actors is not unique to that theory. However, agnosticism the ANT means that the researcher is in risk of disrespecting the cultural distinctions that are meaningful to members of a particular social group (Whittle and Spicer, 2008). An agnostic approach makes it possible to understand the concept of controversy, in which researchers must refrain from postulates about actors, events, organizations, and rather than simply describe the managerial controversy (Hussenot, 2014).

The process of translation is treated by Callon (1986) through four times, which are: problematization, interessement, enrolment or enrollment, and mobilization. The translation was cited in 94 review articles. The studies that addressed the translation through the design of four moments of Callon (1986), were: Fox (2000), Davies (2002), Harrison and Laberge (2002), Lee and Oh (2006), Denis *et al.* (2007), Alcibar (2008), Alferoff and Knights (2009), Winięcki (2009), Boelens (2010), Elbanna (2010), Knights and Scarbrough (2010), Whittle and Mueller (2008), Bruce and Nyland (2011), Bergström and Diedrich (2011), Lee and Chen (2011), Yang and Wang (2013), Bruzzone (2013), Dery *et al.* (2013), Christiansen and Thrane (2014), Bettany, Kerrane and Hogg (2014), Jong and Boelens (2014), Cucciniello *et al.* (2015), Ezzamel and Xiao (2015), Weaver *et al.* (2015), Blanchet and Depeyre (2016), Dezuanni (2016) and Picard (2016).

We highlight that many of these studies only present and conceptualize the four moments of translation. On the other hand, studies how the Knights and Scarbrough (2010) use these moments on the result of your analysis, and still presented a table summarizing the results for the two cases discussed in the work. The work of Lee and Chen (2011) proposed a new framework of qualitative research study for the online social network (OSN), by associating the appreciative inquiry (AI) and actor-network theory (ANT). Thus, the authors's research framework includes the four moments of translation. The work of Picard (2016) addressed the introduction of marketing concepts to the field of accounting, in which the systematization of work occurred on the presentation and discussion of the time of translation.



interactions, rather than existing merely in the order of things (Latour, 1987, 2005b; Law, 1992, 1999b). (Alcadipani and Hassard, 2010, p. 425).

The ANT enables the understanding of all the complexicade of an organization because it considers this type of organization as something non-static, mobile and as result of interactions, inscriptions and translations of yours heterogenos actors. Alcadipani and Hassard (2010) understand that the approach of ‘ANT and after’ can put the organizing in the first place of anaysis. In this understanding, the authors state “[...]to analyse organizing rather than organization is not just a methodological issue, it is also a political one.” (Alcadipani and Hassard, 2010, p. 426). As such, Czarniawska (2009) to recommend reading the book authored by Latour (2005) the organization theorists, she recalls the quote “the social has never explained anything; the social has to be explained instead.” (Latour, 2005, p. 97), and her attempts to paraphrase Latour, “organizations have never explained anything; organizations have to be explained.” (Czarniawska, 2006, p. 1557). The ANT that contributes to understanding the field Management and Organization Studies (MOS).

Table 5 - List of articles that have the title Actor-network

Citations	Author(s)	Title	Objective
56	Whittle and Spicer (2008)	Is actor network theory critique?	“In this essai, we would like to explore the limits of ANT as a critical theory of organization. Our target is not ANT as an entire body of thought. Rather, we seek to interrogate how ANT has been used in the field of organization studies.” (Whittle and Spicer, 2008, p. 611)
47	Lee and Hassard (1999)	Organization unbound: Actor-network theory, research strategy and institutional flexibility.	“[...] our present introductory article makes some speculative suggestions about how ANT can contribute to the genefal development of organization studies in the years to come; i.e. in the era defined as 'after ANT'. In so doing, we trackle basic issues of ANT's research philosophy in relation to the study of organizational form.” (Lee and Hassard, 1999, p. 393)
40	Doolin and Lowe (2002)	To reveal is to critique: actor-network theory and critical information systems research	“The question this paper addresses is whether actor–network theory provides another suitable vehicle for critical theorizing in IS research.” (Doolin and Lowe, 2002, p. 71)
39	Alcadipani and Hassard (2010)	Actor-Network Theory, organizations and critique: towards a politics of organizing.	“[...] our article assesses if ANT is really incapable of offering ideas and insights that may help to develop a critical perspective on management and organizations.” (Alcadipani and Hassard, 2010, p. 420)
163	Fox (2000)	Communities of practice, Foucault and actor-network theory.	“In this paper, I will argue that community of practice theory (COPT) has specific weaknesses in the way it addresses power in its analysis of the learning process. I will also show how the conceptions of power in Foucault and actor-network theory may be made relevant to community of practice theory and organizational learning.” (Fox, 2000, p. 854)
52	Sarker, Sarker, and Sidorova (2006)	Understanding business process change failure: An actor-network perspective.	“In this paper, we use concepts from actor-network theory (ANT) to inter- pret the sequence of events that led to business process change (BPC) failure at a telecommunications company in the United States.” (Sarker <i>et al.</i> , 2006, p. 51).

Source: Research data.

We observe that the studies explored in table 5 can be grouped into two groups. The first with the works of Fox (2000) and Sarker *et al.* (2006) using ANT in conjunction with another theory. The other group is formed by articles by Alcadipani and Hassard (2010), Doolin

and Lowe (2002), Lee and Hassard (1999), and Whittle and Spicer (2008), who explore ANT as critical theory.

The study by Doolin and Lowe (2002) argued that the ANT, with its careful tracing and registration of heterogeneous networks, is well suited for the generation of detailed and contextual empirical knowledge about the information system. The study of Fox (2000) discusses the possibility of the contribution of the ANT and the concept of Foucault's power, as a basis for a constructive criticism for the community of practice theory (COPT). The integration COPT and ANT can enrich both approaches contribute, and to the understanding of organizational learning (Fox, 2000).

The article by Lee and Hassard (1999) makes some speculative suggestions on how ANT can contribute to the development of organizational studies in the coming years. The authors conclude that ANT's research strategy may be use in studying contemporary organizational form (Lee and Hassard, 1999). The ANT can serve as a useful theoretical lens to understand the socio-political phenomena, such as Business Process Change (BPC), especially where technology plays a critical role (Sarker *et al.*, 2006). The authors sought to use the ANT as an interpretative perspective to analyze the BPC, they applied the ANT in a case study of a telecommunications company in the USA (Sarker *et al.*, 2006). The study by Whittle, and Spicer (2008) aimed at discussing the extent to which ANT provides a significant contribution to the development of critical theories of organization. The authors argue that the use of ANT in organizational studies does not contribute to the development of critical approaches to Organization (Whittle and Spicer, 2008). However, the authors did not discourage the adoption of ANT in organizational studies, but encourage the use of the theory, and respecting the epistemological and ontological, political commitments that brings with it.

In the article by Hardy *et al.* (2001) expand work on reflexivity in organization and management theory (OMT). The authors use ANT to incorporate the research site, the researcher and the community research in our analysis.

Drawing on ANT, however, we show that, to conduct reflexive research in organization and management theory, we cannot confine our attention to the relationship between researchers and the research subject, but must also examine the relationship between researchers and the research network of which they are a part. (Hardy *et al.*, 2001, p. 533).

The ANT supplies another way to comprehend this phenomenon, contribute to the discussion of reflexivity in OMT (Hardy *et al.*, 2001). The authors use the concept of translation of the ANT to explore the role of actors in the processes of social construction. The study of these authors point out the necessity of a redirection of the organizational studies, in which it reflects reflections. Thus, Hardy *et al.* (2001) report that the ANT is particularly useful in this case as she defies conventional categories explicitly actors and has been widely applied to social studies of science. This article works with the classical perspective of ANT and has 70 citations.

The article by Mutch (2002) examined the ANT from the perspective of the social realism of Margaret Archer.

Actor-network theory (ANT) has achieved a measure of popularity in the analysis of information systems. This paper looks at ANT from the perspective of the social realism of Margaret Archer. It argues that the main issue with ANT from a realist perspective is its adoption of a 'flat' ontology, particularly with regard to human beings. (Mutch, 2002: 477)

The author has analyzed some of the implications of ANT from the point of view of a tradition seen as diametrically opposed to the social realism of Margaret Archer, which has its roots in the development of critical realism by Roy Bhaskar (Mutch, 2002). The ANT and the social realism have common origin in concerns about the nature of science, but took different approaches (Mutch, 2002). The author began the process of attempted translation and inscription of parts of the ANT in realistic project (Mutch, 2002). The author suggests that it is

possible the constructive involvement of the two approaches, despite the adopters of ANT can reject this possibility (Mutch, 2002).

Another study that did do was scientific McLean and Hassard (2004).

An enduring concern within management and organization studies (MOS) is how to conduct research from perspectives deemed 'alternatives' to those of functionalism and positivism. Our aim is to address this concern with regard to an approach employed by Karen Legge in research on knowledge workers, namely that of actor-network theory (ANT) (or the 'sociology of translation'). (McLean, and Hassard, 2004, p. 493).

The authors report that while the ANT is an 'unconventional' approach to management and organization studies, we are increasingly living the role of contemporary technologies in new settings, and in this context the ANT provides new forms and meanings to represent the processes and associated practices.

## Conclusions

Studies on actor-network theory related to organizational studies have gained prominence in the literature after the year 2006, and reached top in 2014. The main journals that addressed this theme, were: Organization, Organization Studies, Accounting Organizations and Society, Scandinavian Journal of Management, and Human Relations.

The articles that published studies on the ANT in the context of Management and Organization Studies (MOS) were originated from: England, USA, Canada, Australia, Denmark, France, Switzerland, Norway, the Netherlands and Scotland. The main research institutions were: Copenhagen Business School, a Lancaster University, a University of Manchester, and University of Warwick.

The most cited books by cocitation analysis were "*Science in Action: How to Follow Scientists and Engineers Through Society*", published in 1987, "*Reassembling the social: an introduction to actor-network-theory*", published in 2005, both authored by Bruno Latour.

The three basic principles of ANT (agnosticism, generalized symmetry and free association) by Callon (1986) were explored in a few studies. He also had works that presented at least one of the principles. The low number of studies that explored these principles may be related to the fact that these principles are already internalized in ANT. The other justification refers to the fact that these principles are not coined by Latour, which represents the main author of the ANT.

Our study made it possible to see that many works have dealt with the process according to the design of Callon (1986). That fact enabled us to infer that work of Callon (1986) is still important and relevant to studies of ANT.

Based on our semantic analysis of the most cited articles in the ISI Web of Science® database of Thomson Reuters, we have identified that studies on the application of ANT in Management and Organization Studies can come in three different formats. The first way would be jobs that there are ANT integration with other approaches. The first one, it would be the works that integrate ANT with other approaches. The second is represented by studies that explore ANT with critical theory. The third by articles that addressed the "after ANT" design. The second way would be represented by studies that explore the ANT with critical theory. The third by articles that have addressed the design "after and ANT".

We observe that ANT represents an approach with applications and contributions of Management and Organization Studies. The ANT is a flexible approach with the potential to contribute to the understanding of organizations in a context in which contemporary technologies will gain more and more importance and use, and demand an adaptation of organizations (McLean and Hassard, 2004).

As a limitation of our study, we can cite the fact that it uses only ISI Web of Science® from Thomson Reuters. Another limitation is in the analytical synthesis, which should analyze the studies through the categories, such as: (1) concepts addressed and theoretical contributions;

(2) use of concepts; (3) methodology used in research; (4) criticisms of ANT. Thus, it would be important to conduct a qualitative analysis of studies in management research that use ANT.

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