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INTERORGANIZATIONAL LEARNING IN THE BRAZILIAN BIOETHANOL INDUSTRY

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Abstract:
The following paper introduces the theoretical background and the industry-case of a PhD research. The research aims to analyze the interorganizational learning that occurs among companies of the Brazilian bioethanol chain, focusing on the transference of the Brazilian bioethanol flex-fuel cars technology. Brazilian FFVs (flex-fuel vehicles) are available in the market since 2003, and consist of cars that run with both gasoline and bioethanol produced from sugarcane. Developed to provide more energy security to the country, this technology is now gaining more international attention due to the fact that it can contribute with the reduction of CO2 emissions in the automotive sector. Therefore, through qualitative case studies, this research will use the organizational learning and transference of technology literature to investigate how the process of technology transfer occurs among companies involved with the Brazilian FFV technology, in order to expose case-particularities and gaps in knowledge transfer, identify factors that foster or hinder this exchange process, and evaluate inter-firm cooperation aims towards sustainability in the mobility sector.

Keywords: Interorganizational learning, knowledge management, technology transfer, bioethanol, and flex-fuel vehicles.

1. INTRODUCTION

The actual debate about climate change has raised many questions about how to maintain a global model of development which is at the same time economically, environmentally and socially sustainable. While global-north nations are debating about how to generate new and "green" sources of energy and are increasing the criticisms against the mainstream global development model (which they created themselves) based on continuous use of natural resources, the global-south emergent nations seem to be struggling to find a "green" production standard that fits with their increasing economical and consumption growth. The expansion and investment in new and renewable technologies seems to be one of the answers to this debate and the Brazilian initiative with the bioethanol production, that later led to the rise of advanced car engines in the country, may fit into that.

In this sense, taking into account debates about organizational learning and knowledge management in the renewable energies sector, the research questions of this PhD work are: concerning the flex-fuel vehicles (FFV) technology developed in Brazil (1) how did this technology come about? (2) How was this technology transferred to other firms? (3) What was the role of business partnerships and social environment conditions in transferring this technology?

2. THE BRAZILIAN BIOETHANOL INDUSTRY AND THE RISE OF THE FLEX-FUEL VEHICLES

The Brazilian bioethanol sector, derived from the sugarcane industry, has received increasing support from the Brazilian government as part of the national development strategic plan towards reduction of CO2 emissions (which are already very low in the country) and energy security. It is well accepted nowadays that increasing use of petroleum, together with concerns about climate change, demands CO2 reductions and alternative ways of generating energy based on non-fossil fuel resources. Brazil considers its bioethanol a potential alternative towards this path. More than anything, as well pointed by Goldemberg (2013), ethanol in Brazil was and is still seen as an instrument of national independence. Recently, the country became the largest producer of sugar (approximately 25% of the world's production). According to De Cerqueira Leite et al. (2009), Brazil is responsible for about 33% of all the ethanol produced in the world (more recent studies point to 53% of production share). The production of ethanol increased from 0.6 billion liters in 1975 to 27.6 billion liters in 2010. Presently, bioethanol replaces around 50% of the gasoline that would be used in Brazil if such an option did not exist (Goldemberg, 2013, p.13). Besides, Brazil is the second biggest consumer of ethanol in the world, behind only The USA. The country claims the sustainability of the bioethanol production in its territory, among other factors, as a consequence of vast available land and natural resources, and minimal irrigation necessity which allow the growth of large amounts of energy crops in the South and Central regions without directly influencing food production and deforestation in the Amazon region. This is still a very controversial topic though.

Since Brazilian colonial times, sugarcane has played an important role in this South American economy (sugarcane has been cultivated in Brazil since the sixteenth century). Due to its favorable climate conditions, its 365-day growing season, its ample rainfall, and its abundant and productive land, Brazil can produce over 30 million tons of sugar and 20 billion liters of ethanol annually (De Cerqueira Leite et al., 2009). When it comes to its institutional setting, this industry has received much government support and for more than 30 years the country has been implementing biofuels policies to reduce the dependence on fossil fuels and to develop an alternatively national energy strategic plan. Initiatives from the producers and from the Government together with the engagement of research institutions and think-tanks are all linked to develop the best possible technological solutions, both industrial and agricultural, to increase yield, efficiency and sustainability in the sector (Corrêa do Lago A et al., 2012). The Brazilian experience of more than three decades in the production of sugarcane-bioethanol can be considered an example of development model based on one´s own resources, demands and knowledge, as Brazil developed an efficient sugarcane-based fuel technology and industry, becoming the sole country to implant a large-scale alternative fuel to petroleum (Zanin et al., 2000). In 1931 the Government decided that all the gasoline used in the country (mostly imported) should contain 5% of ethanol from sugarcane (Goldemberg, 2013, p.13). In 1973, when there was the first oil crisis, the Government initiated three important projects: (i) national oil exploration and production; (ii) large-scale expansion of hydro-electricity generation; and (iii) development of substitutes for the three major oil derivates: diesel, fuel oil and gasoline (De Cerqueira

Leite et al., 2009, p.656). Following this, in 1975 The Brazilian National Alcohol Program, Pro-Alcohol Program, was implemented, contributing significantly to the impressive increase in ethanol production in Brazil. This program was created to help the country to deal with the high trade deficits resulting from the high imported crude oil prices - Brazil was spending exceedingly large cash reserves on imported oil (The import bill with oil, 80% of which was imported, went from 600 million dollars in 1973 to 2.5 billion in 1974, approximately 32% of all Brazilian imports and 50% of all the hard currency that the country received from exports) (Goldemberg, 2013, p.14). Also, the program enabled Brazil to depend to a much lower degree on imported energy (Brazil imported 34% of its total energy consumption in 1973 in the form of crude oil. This figure dropped to 18% in 1986, after the implementation of the Pro-Alcohol Program) (Zanin et al., 2000, p.1149). Finally, this program was implemented because international sugar prices had a significant drop. As sugar mill owners in Brazil have always exerted a strong influence on the federal government's decisions, the alcohol program represented the ideal solution to their problems (Zanin et al., 2000, p.1149). Under these conditions, and in order to reduce gasoline consumption and oil imports, the Government supported the acceleration of ethanol production with the decree 76,593 in 1975 (Goldemberg, 2013). The Pro-Alcohol Program was divided in two phases. In the first phase of the program, the Government took advantage of the structure and capacity of existing sugar mills to produce only hydrated alcohol (to be used in its pure form). In the second phase of the program, after 1979, hydrated ethanol began to be produced for direct use as automobile fuel, which required a complete modification of the vehicles´ engine. The second oil crisis in 1979 directly influenced the drastic move towards the introduction of cars with motors designed to operate exclusively with ethanol in order to increase ethanol consumption (Goldemberg, 2013). In 1985, the scenario changed completely as petroleum prices fell and sugar prices recovered in the international market. Subsidies were reduced and ethanol production was not seen as an advantage anymore. As a consequence, the production of ethanol decreased while the consumption remained relatively the same. Hence, by 1990 there was not much ethanol available in the market anymore and a serious supply crisis occurred (Goldemberg, 2013). In 2003, however, the flex-fuel vehicle (FFV) technology was developed and introduced in Brazil and ethanol consumption rose. These cars are built to run with pure gasoline, pure ethanol (hydrated ethanol) or with any mix proportion of ethanol and gasoline, from zero to 100%, as they have sensors that can detect the proportion and adjust the ignition electronically (Goldemberg, 2013, p.18). In other words, these are vehicles that can run with 100% gasoline, 100% bioethanol, or any blending standard – in the Brazilian case, E25.

The introduction of the FFV was a very important step for the bioethanol market in Brazil and a very interesting example of innovation in this industry. Some important figures may give an overview of the success of this technology and of the huge importance of this industry in Brazil: in the first year, 48,000 FFV were sold, about 4% of sales. In 2006 ethanol provided 44% of the energy used for highway transportation. In 2010, the vehicle production by fuel type in Brazil was strongly based in the bioethanol fuel: 81,8% of the new vehicles registered were produced with the FFV technology, 10,2% with diesel, and only 8% with gasoline. Nowadays, the flex-fuel vehicles represent more than 90% of all new cars sold in the country, Brazil continues to produce bioethanol at low cost, and the fuel production and use are increasing (De Cerqueira Leite et al., 2009). Its market share has been increasing steadily and, only in 2010, 2 million new vehicles were produced with this technology. Hence, it is argued in this thesis that the Brazilian bioethanol industry can be considered an example of an innovation cluster which is situated outside the global-north region, where traditionally all the R&D (research and development) efforts for technology development are encountered.

This huge national industry includes different organizations throughout the productive chain: bioethanol producers (sugarcane industries), technology developers in the upstream of the chain (biotechnology companies responsible for genetic improvement, and crop technology developers for machinery, land use, and agricultural solutions), technology developers in the downstream of the chain (flex-fuel vehicles, storing and distribution of the fuel), energy multinationals (biomass importers and exporters, financiers and consultancies), sustainability certifiers, and aviation and automotive companies. Among all these organizations, the automotive companies are important players in the chain. The light and commercial cars are responsible for a great amount of CO2 emissions in developed and non-developed countries, and there are initiatives being done in order to find a more sustainable fuel technology and in order to further develop advanced engines. Nevertheless, apart from the big amount of criticisms against the production of biofuels worldwide, Brazil's flex-fuel technology, based on bioethanol fuel, and its strong national market is a success case.

3. THE ORGANIZATIONAL LEARNING DEBATE

In general, the bioenergy industry is based on highly complex and specific knowledge which is still emerging, unlike the mature knowledge structure of some more traditional industries. With such an emergence of new technology, companies in the bioethanol sector cannot rely solely on internal knowledge development. They need to absorb relevant knowledge from external sources (through their absorptive capacity) and this emphasizes the importance of organizational learning processes and technology transfer among companies in the chain. As Decarolis and Deeds (1999) mention, innovation is the result of both internal knowledge development and the acquisition and application of external knowledge. Process and product innovation do not occur in the isolated confines of a firm's research and development department. External sources of knowledge are equally critical to innovation. Innovation then, to a large extent, is dependent on a firm's ability to absorb information from the external environment. Therefore, the firms involved in the bioenergy industry should learn in ways to challenge rather to maintain the status quo and this characterizes an innovation process. In addition, Easterby-Smith et al. (2000) point out the fact that there is a growing interest in deepening the understanding of how knowing and learning take place within large and often globalized networks and alliances, like in the bioethanol industry. There is not much understanding of how these learning processes occur in this relatively new industry though.

Companies in the bioethanol sector not only influence the economic, political and socio-cultural context in which they operate, but are also affected / influenced by this context. Due to the climate change and its expected environmental issues, these companies have been "forced" to go more international and global and have to deal now with the changing structure of the industry: new markets, new technologies, new social, cultural, economic and consumption standards. This scenario has intensified the necessity of integration and cooperative actions among nations, regions and organizations, and it makes a direct impact on the companies of diverse sectors and in special those involved with renewable resources and their technologies. These organizations in order to achieve better results have to focus not only in their internal resources and market position but also in their relations with other outstanding companies. In fact, these firms are stimulated directly and indirectly by internal and external factors to learn constantly. They have to learn from and with different organizations and increasingly adapt to new situations and it is especially through interorganizational learning processes that they are able to do so. Analyzing this sector from a learning literature perspective, though, turns out to be a valid alternative.

The literature about organizational learning (OL) is characterized by many authors (Brown and Duguid, 1991; Huber, 1991; Easterby-Smith et al., 2000; Elkjaer, 2004, among others) as being very ample and largely studied from the individual and organizational point of view, with many studies that analyze the "what is learning" and "how to learn" inquiries. The topic is currently the focus of considerable attention, and it is addressed by a broad range of literatures. Organization theory, industrial economics, economic history, and business, management and innovation studies all approach the question of how organizations learn (Dodgson, 1993). However, it is still limited the understanding of how the learning processes occur in organizational environments, especially the ones vulnerable to big changing situations (Gherardi, Nicolini and Odella, 1998), like the bioenergy sector.

Studies about OL have expanded in volume of publication and diverse perspectives in the past two decades (Fenwick, 2008). The 1990s have seen exponential growth in interest in the topic, in which not only more articles were written, but also the number of journals publishing organizational learning studies has increased significantly (Crossan and Guatto, 1996). Not solely in the literature but also among large organizations the concept of learning is gaining currency. As Bapuji and Crossan (2004) emphasizes, organizational learning is central to the survival, adaptation and renewal of companies. Firms are attempting to develop structures and systems which are more adaptable and responsive to change as they increasingly accept learning as a key to competitiveness (Dodgson, 1993). Organizations are more aware of the profound influence that rapid technological change is having on them. The turbulence engendered by technological change in products, processes and organizations increases the uncertainties facing firms and the conflicts within them. As a consequence, this forces them to constantly adapt to their environment through different learning processes (Dodgson, 1993).
The 'metaphor' of organizational learning is not new. It has attracted attention at least since Chandler (1962) (Blackler, 1995). After its first definition as a theoretical term in the study of Cyert and March in 1963, the concept of organizational learning has been used in different ways and in different literatures, embracing very diverse theoretical perspectives (psychology, organizational theory,

strategy, anthropology, sociology, and managerial sciences) with different philosophical assumptions. This raises difficulties to reach theoretical and methodological consistency. However, as it is suggested by Pawlowsky (2003, p.63), the aim and the heterogeneity of these diverse traditions are necessary to describe the concept of organizational learning from diverse perspectives.

Although interest has grown dramatically in recent years, a general theory of OL has remained elusive. There is poor consensus regarding definition of learning and how to measure it, poor understanding of how social interactions influence learning and vague notions of how social environments shape learning (Crona and Parker, 2012). Fenwick (2008) argues that "there is a tendency not to define learning as the term has been used to refer to process as well as to outcome, and to a wide range of phenomena that are fundamentally different: cultural transformation, individual personal development, everyday participation in practice, information and technology acquisition, innovation and so on" (Fenwick, 2008, p. 239). Brown and Duguid (1991) also affirm that the organizational learning processes can be verified in a great variety of actions, such as the external business environment, the social relations in the company and the history features, fact that hinders the definition of OL. Convergence, thus, has not occurred because learning occurs in many ways, from loosely defined social networks to more or less formalized arenas (Crona and Parker, 2012), and because different researchers have applied the concept of OL, or at least the terminology, to different domains or perspectives (Crossan et al., 1999). Despite best efforts to measure, coordinate and assess, learning frequently ends up to be a slippery concept. As there is rarely agreement within disciplines as to what learning is, and how it occurs (Fiol and Lyles, 1985), some authors like Huber (1991) take an information-processing perspective of organizational learning, others like Nonaka and Takeuchi (1995) explore the product innovation domain, and March and Olsen (1975), for example, were concerned with cognitive aspects. In this research, that analyses the interorganizational learning that occurs among companies in the bioethanol sector, technology transfer is identified as the underlying phenomenon of interest.

In the early literature, organizational learning is defined as individuals' acquisition of information and knowledge, analytical and communicative skills (Elkjaer, 2004). The studies about individual learning, whose origin comes from the psychology research, were responsible for the first insights in the organizational learning literature. Gherardi, Nicolini and Odella (1998) affirm that this traditional approach is not sufficient to understand the learning which occurs in organizations because it does not consider the social interaction and the organizational context as significant factors to the learning process. Therefore, a collective approach emerges in which the organizational learning is considered to be a result of the participation of individuals in social practices. Here, the initial notion of OL as a result of individual and formal education is substituted by the notion of daily participation in the social and organizational life (Elkjaer, 2004). The collective approach of organizational learning appears together with the emphasis in the practice in the social sciences, and considers that the learning in the group level involves the collective construction of new knowledge and the interaction with multiple systems and actors (Vasconcelos and Mascarenhas, 2007). This participation metaphor has been known under several names in the field of organizational learning, such as "situated learning" (Brown and Duguid, 1991), "social learning" (Elkjaer, 2004), "learning as cultural processes" (Cook and Yanow, 1993), and as "practice-based learning" (Gherardi, 2000) (Elkjaer, 2004). It is derived from studies of learning in which no teaching was observed, and takes learning out of the individual mind and formal educational settings and places it into the everyday organizational life and work (Elkjaer, 2004). In sequence, the organizational learning approach appears as a continuous of the individual and collective learning in which the final knowledge acquired by the firm will be the sum of the learning processes developed in the company. According to this approach, firms have memories and cognitive systems which allow them to make sense of the changes and different situations in their environment. OL is considered to be a social process affected by contextual factors, organizational structure, information, communication and control processes (Antonacopoulou, 2006).

There is relevant agreement nowadays that learning in work can involve formal or informal teaching but is practice-based and participative: embedded in action, not centered in an individual's head but distributed among activities, continuous interactions and relationships of people (Fenwick, 2008, p.228). There is also substantial consensus that organizational learning includes individual, group, organizational, interorganizational, industry / sector and society levels (Berends and Lammers, 2010). The level of analysis debate, initially focused on individual versus collective learning, has been extended to examine learning between organizations and communities (Easterby-Smith et al., 2000). The assumption is that organizations are more than simply a collection of individuals and that

organizational learning is different from the simple sum of the learning of its members. Although individuals may come and go, what they have learned as individuals or in groups does not necessarily leave with them. Some learning is embedded in the systems, structures, strategy, routines, prescribed practices of the organization, and investments in information systems and infra-structure (Crossan et al., 1999; Easterby-Smith et al., 2000).

Apart from the lack of convergence in the definition of learning described above, one of the most fundamental questions in organizational learning research is in fact: does / can an organization learn? Although many contributions in the field say it is not possible to talk about organizational learning because this would be reification, it is now commonly agreed that firms can indeed learn (Antonacopoulou, 2006; Cook and Yanow, 1993). Organizational learning describes a category of activity that can only be done by a group. It cannot be done by an individual (Cook and Yanow, 1993). Organizations preserve knowledge, behaviours, mental maps, norms and values over time (Daft and Weick, 1984, p.285). They can learn because they possess capacities that are identical or equivalent to the capacities that individuals possess that enable them to learn. Competence acquisition, experimentation, boundary spanning and continuous improvement are some of the learning abilities of the companies. Firms develop and accumulate knowledge in files, rules, roles, routines, procedures etc. Through their culture and structure they develop shared mental models, values and behaviors which constitute part of the organizational memory – firms do not have brains, but have cognitive systems and memories (Antonacopoulou, 2006).

Traditionally, the organizational learning field has generated many interesting questions. The field now intends to provide answers to organizational problems such as innovation, strategic choices and performance (how learning can yield innovation, strategy and performance) (Bapuji and Crossan, 2004). In this sense, there is nowadays a stronger emphasis on socially oriented approaches to the understanding of learning and knowing in companies (Easterby-Smith et al., 2000). Learning is a complex social process; it is intrinsically a social and collective phenomenon, emphasizes Brown and Duguid (2001, p.200). One of the questions addressed by this social perspective in the organizational learning literature is 'how social relationships affect learning?' Crona and Parker (2012) mention that it occurs through social and organizational factors mediating knowledge transmission, through cultural differences, through the type of learning desired and the alignment of the organizational interests, and through the different norms and values regarding the knowledge transfer process (Crona and Parker, 2012). However, there is relatively lack of research about the social, cultural, sectorial and local factors that impact the learning in different organizations. Tsai (2001) shares the same opinion and mentions that there is little systematic understanding of the social processes that underlie how organizations learn from each other.

The interorganizational level of analysis is also gaining more space in the learning literature. Continued investment in individual and even group learning may be counterproductive if the organization does not have the capacity to absorb or utilize it. If this is the case, future research in organizational learning needs to move from the reasonably well-developed understanding of individual and group level learning to understanding the flows of learning between the levels (Crossan et al., 1999). According to Bapuji and Crossan (2004) recent developments in the literature suggest that much learning occurs between firms and within a network or industry. The same authors, however, argue that there is not much research made in the inter-company unit of analysis and more studies should continue to investigate learning that occurs beyond firm boundaries at the levels of interorganization, industry and population (Bapuji and Crossan, 2004). But why should companies learn from other companies? To adapt its products to market needs, to respond to emerging market trends, and to deal with competitive challenges, says Tsai (2001), who adds that the ability to access external knowledge and to integrate it effectively is truly a source of competitive advantage. Interorganizational learning or learning beyond firms' boundaries is a valid topic because the external learning complements the firms' internal learning (Bapuji and Crossan, 2004). Normally firms learn more when the technology sharing partner possesses a similar knowledge base and a similar organizational structure as knowledge and ideas are shared and common meanings are developed through interactions. Different forms of knowledge move better through particular networks; innovation, for example, is best spread through dense interconnected social networks (Fenwick, 2008). Knowledge, though, is socially constructed among companies, and organizational learning involves a complex social process in which different firms interact with each other (Tsai, 2001). In addition, network position can promote social learning that makes linked firms more astute collectively than they are individually (Tsai, 2001). Strategic alliances, collaborations and joint ventures are the main

stimulators of the interorganizational learning. Bapuji and Crossan (2004) add that culture, strategy, structure, environment, organizational stage of development and resource position are important learning facilitators among firms. On the other hand, the organizational quotidian has many barriers to the development of learning processes at the inter-company level, like excess of priorities, confusing objectives, fear of taking risks, focus on short-term performance etc. Interorganizational learning is a dynamic process. As Baum and Ingram (1998) argue, many organizational activities are intended to acquire information or knowledge. Normally learning is viewed as an organization-level phenomenon but some learning theorists, neo-institutionalists and network theorists suggest that often learning may be produced by interactions among firms, rather than by isolated individual companies (Baum and Ingram, 1998). According to these theorists, the context has a considerable influence in the interorganizational learning. It includes both social and material environments surrounding the firm, including other people, objects and technologies (Fenwick, 2008). As interorganizational networks are the most complex and take long period to develop, social dynamics are agreed to affect network effectiveness far more than technology (Zollo et al., 2002).

The organizational learning debate can then contribute significantly to the understanding of how firms in the bioethanol industry learn within its networks and manage their knowledge. The FFV technology, point of departure of this thesis, was developed and put into the market by a number of different companies throughout the bioethanol chain in which interorganizational learning initiatives have occurred. In order to transfer technology within the industry chain, processes of integration of external learning took place. An analysis of this scenario can raise interesting insights about this controversial and growing sector.

4. CONCLUSION

This paper introduced the theoretical background of a PhD research project which deals with the way companies manage their knowledge transference in terms of learning with each other how to transfer technology. The industry to be analyzed is the Brazilian bioethanol sector, more specifically firms involved with the flex-fuel cars technology developed to run with the ethanol produced in Brazil. Due to the expected climate problems and lack of availability of traditional resources, which forces countries to rethink its development models strongly based in non-renewable energy sources, this is an important topic nowadays.

REFERENCE LIST

1. Antonacopoulou, E. P. (2006). The relationship between individual and organizational learning: new evidence from managerial learning practices. *Management Learning*, *37*(4), 455-473.
2. Bapuji, H. and Crossan, M. (2004). From questions to answers: reviewing organizational learning research. *Management Learning, 35*(4), 397-417.
3. Baum, J. A. C. and Ingram, P. (1998). Survival-Enhancing learning in the manhattan hotel industry, 1898-1980. *Management Science, 44*(7), 996-1016.
4. Berends, H. and Lammers, I. (2010). Explaining discontinuity in organizational learning: a process analysis. *Organization Studies, 31*(08), 1045–1068.
5. Bierly III, P. E.; Kessler, E. H. and Christensen, E. W. (2000). Organizational learning, knowledge and wisdom. *Journal of Organizational Change Management*, *13*(6), 595-618.
6. Blackler, F. (1995).Knowledge, knowledge work and organizations: an overview and interpretation. *Organization Studies, 16*(6), 1021-1046.
7. Brown, J. S. and Duguid, P. (1991). Organizational learning and communities-of-practice: toward a unified view of working, learning, and innovation. *Organization Science*, *2*(1), 40-57.
8. Brown, J. S. and Duguid, P. (2001). Knowledge and organization: a social-practice perspective. *Organization Science*, *12*(2), 198–213.
9. Cohen, W. M. and Levinthal, D. A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152.
10. Cook, S. D. N. and Yanow, D. (1993). Culture and organizational learning. *Journal of Management Inquiry, 2*(4), 373-390.
11. Coopey, J. and Burgoyne, J. (2000). Politics and organizational learning. *Journal of Management Studies*, *37*(6), 869-885.
12. Corrêa do Lago, A. Bonomi, A. Cavalett, O. Pereira da Cunha, M. & Pinheiro Lima, M. A. (2012) Sugarcane as a carbon source: The Brazilian case, *Biomass and Bioenergy*, *46*, 5-12.

13. Crona, B. I. and Parker, J. N. (2012). Learning in support of governance: theories, methods, and a framework to assess how bridging organizations contribute to adaptive resource governance. *Ecology and Society*, *17*(1).
14. Crossan, M. and Guatto, T. (1996). Organizational learning research profile. *Journal of Organizational Change Management, 9*(1), 107-112.
15. Crossan, M. M.; Lane, H. W. and White, R. E. (1999). An organizational learning framework: from intuition to institution. *The Academy of Management Review, 24*(3), 522-537.
16. Cyert, R and March, J. (1963). *A behavioral theory of the firm.* New Jersey: Prentice Hall.
17. Daft, R. L. and Weick, K. E. (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review*, *9*(2), 284-295.
18. De Cerqueira Leite, R. C. Verde Leal, M. R. L., Barbosa Cortez, L.A. Griffin, M. W. & Gaya Scandiffio, M. I. (2009) Can Brazil replace 5% of the 2025 gasoline world demand with ethanol? *Energy, 34*, 655-661.
19. Decarolis, D. M. and Deeds, D. L. (1999). The impact of stocks and flows of organizational knowledge on firm performance: an empirical investigation of the biotechnology industry. *Strategic Management Journal*, *20*(10), 953-968.
20. Dodgson, M. (1993). Organizational learning: a review of some literatures. *Organization Studies, 14*(3), 375-394.
21. Easterby-Smith, M.; Crossan, M. and Nicolini, D. (2000). Organizational learning: debates past, present and future. *Journal of Management Studies, 37*(6), 783-796.
22. Elkjaer, B. (2004). Organizational learning: the third way. *Management Learning, 35*(4), 419-434.
23. Fenwick, T. (2001). Tides of change: new themes and questions in workplace learning. *New directions for adult and continuing education,* 92, John Wiley & Sons, Inc.
24. Fenwick, T. (2008). Understanding relations of individual collective learning in work: a review of research. *Management Learning, 39*(3), 227-243.
25. Fiol, C. M. and Lyles, M. A. (1985). Organizational learning. *The Academy of Management Review, 10*(4), 803-813.
26. Gherardi, S. and Nicolini, D. (2000). To transfer is to transform: the Circulation of safety knowledge. *Organization*, *7*(2), 329-348.
27. Gherardi, S.; Nicolini, D. and Odella, F. (1998). Toward a social understanding of how people learn in organizations. *Management learning, 29*(3), 273-297.
28. Goldemberg, J. (2013) Sugarcane ethanol: strategies to a successful program in Brazil. In: J.W. Lee (ed.), *Advanced Biofuels and Bioproducts,* Springer - New York.
29. Huber, G. P. (1991). Organizational learning: the contributing processes and the literatures. *Organization Science, 2*(1), 88-115.
30. Levinthal, D. A. and March, J. G. (1993). The myopia of learning. *Strategic Management Journal, 14*, 95-112.
31. March, J. G. and Olsen, J. P. (1975). The uncertainty of the past: organizational learning under ambiguity. *European Journal of Political Research*, *3*, 147-171.
32. Pawlowsky, P. (2003). The treatment of organizational learning in management science. In: Dierkes, M.; Berthoin, A. A.; Child, J. and Nonaka, I. *Handbook of Organizational Learning and Knowledge,* Oxford, University Press.
33. Tsai, W. (2001). Knowledge transfer in intraorganizational networks: effects of network position and absorptive capacity on business unit innovation and performance. *The Academy of Management Journal*, *44*(5), 996-1004.
34. Vasconcelos, I.F.G. and Mascarenhas, A.O. (2007). Organizações em aprendizagem. *Coleção Debates em Administração,* SP: Thomson Learning.
35. Weick, K. E. (1991). The nontraditional quality of organizational learning. *Organization Science, 2*(1), 116-124.
36. Zanin, G. M. Santana, C. C. Bon, E. P. S. Giordano, R. C. L. de Moraes, F. F. Andrietta, S. R., De Carvalho Neto, C. C. Macedo, I. C. Lahr Fo. D. Ramos, L. P. & Fontana, J. D. (2000) Brazilian Bioethanol Program, *Applied Biochemistry and Biotechnology*, 1147-1161.
37. Zollo, M.; Reuer, J. J. and Singh, H. (2002). Interorganizational routines and performance in strategic alliances. *Organization Science, 13*(6), 701-713.