

The challenge of building effective hybrid organizations in Brazil

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RESEARCH ARTICLE

Abstract

Since 1996, Petróleo Brasileiro S.A. – Petrobras, the biggest oil company in Latin America, has been supporting a programme for the design, customization, and implementation of tri-lateral collaborative arrangements called the Centres and Networks of Excellence (CNE) Programme, in areas which are critical to the company's competitiveness. This programme is aligned with the Open Innovation proposal, as it is designed to intensify the inflows and outflows of information and technology, from internal and external sources, in the RD&I activities of the participating organizations. This article presents qualitative research based on the case study of the Centre of Excellence (CE) in Engineering, Procurement and Construction (EPC), a hybrid organization which brings together oil companies, EPC companies, universities and technical schools, government entities, professional associations and industry bodies, in an effort to make the Brazilian EPC sector related to the oil and gas industry sustainable and competitive worldwide. The principal objective was to investigate the governance elements and managerial mechanisms that support or hinder collaboration among the parties. The work included the identification of collaborative activities within the organization and aspects of trust. Qualitative data was collected by means of in-depth interviews with staff and executive members of the CE-EPC. The case study highlighted the potential of the method to help set up hybrid collaborative initiatives among parties from different institutional spheres. However, the research identified some barriers to the full accomplishment of CNE. A weak culture of collaboration was the greatest difficulty found in the CE-EPC case. The lack of positive previous cooperation experiences together with a lifelong practice of market relations make it hard to get members to focus attention on a new work logic. Yet, despite the high asymmetry among members and the weak network culture, the results indicate that the CE-EPC has accomplished significant positive results in twenty months of operation and that its internal environment is supportive and favours the improvement and consolidation of the organization.

Keywords: hybrid organization, collaboration, trust, governance

1. Introduction

Having mastered the development of oil fields in deep water, Petróleo Brasileiro S.A – Petrobras, the biggest oil company in Latin America, is now facing the challenge of operating the new reserves found in the pre-salt layer. According to the company, operating such reserves requires a new exploratory model, which constitutes a huge call for research, development and innovation (RD&I) activities. To cope with this knowledge intensive enterprise, the oil company has to be able to count on a highly qualified and articulated network of suppliers and partners from different institutional spheres and knowledge fields. The company's traditional RD&I approach of running collaborative projects with universities, research institutes, suppliers and/or other operators in the oil and gas industry appears insufficient for such a challenge. The rapid development of the necessary expertise and favourable institutional environment calls for

the engagement of University, Industry and Government (U-I-G) in proactive Triple Helix (Etzkowitz, 2009) partnerships which favour the flow of information among the relevant players and help them generate ideas, optimize solutions and overcome technological and institutional barriers. But bringing these players together and having them collaborate efficiently requires special capacities, skills and schemes which have not yet been consolidated in Brazilian organizations. Investigating organizational and institutional solutions founded on U-I-G relations thus seems relevant and urgent.

Since 1996, Petrobras has been supporting a programme for the design, customization and implementation of tri-lateral collaborative arrangements – Centres and Networks of Excellence (CNE) – in areas which are critical to the company's competitiveness, such as geochemistry, oil well and pipeline technologies and engineering, and marine

engineering, or areas in need of improvement within the company, such as relationships with subcontractors, transport and asphalt. The programme, called *Prática Centros e Redes de Excelência* (PCREX) (Petrobras, 2008), is now coordinated by two Brazilian research groups: Ecentex and Espaço Redes Bahia, respectively from Coppe/UFRJ – the Coordination of Engineering Post-graduation Programmes at the Federal University of Rio de Janeiro, and UFBA – Federal University of Bahia. By applying the PCREX method, the Ecentex team has guided the structuring of over 15 CNE, which are either embedded in the company's structure or created as independent organizations.

The PCREX method presents guidelines, norms and architectural models, to help create permanent self-sustaining U-I-G networks or hybrid organizations whose mission is to maintain or reach supremacy in a certain field, be it technological, scientific, social, cultural or educational. According to the PCREX method, a CNE is a combination of knowledge and physical, financial, technological and methodological resources, put together for the development of high quality products, processes and services for the benefit of the partners and/or the society. The PCREX method is aligned with the Open Innovation proposal (Chesbrough, 2006), as it is designed to intensify the inflows and outflows of information and technology, from internal and external sources, in the RD&I activities of the participating organizations.

This article presents the case study of the Centre of Excellence (CE) in Engineering, Procurement and Construction (EPC) (www.ce-epc.org), a hybrid organization which brings together oil companies, EPC companies, universities and technical schools, government entities, professional associations and industry bodies, in an effort to make the Brazilian EPC sector related to the oil and gas industry sustainable and competitive worldwide. Proposed by Petrobras in the 4th Prominp (National Programme for the Mobilization of the Oil and Gas Industry) National Workshop in 2006, the CE-EPC was institutionalized in 2008 with the following vision statement: to be considered the main forum of the Brazilian EPC industry and a national and international reference for technological and business management in its field. The core idea was to create a consensus space, both physical and virtual, where the CE-EPC members could interact, identify critical issues and bottlenecks, discuss and develop projects of common interest for the improvement of the national EPC and the Oil and Gas businesses. This case study is part of the comprehensive research carried out by the *Espaço Redes Bahia* team in 2009/2010 on the performance of the CNE in which Petrobras participated. Despite its two-and-a-half years of

activities, the CE-EPC case was selected for its complexity and adherence to the PCREX conceptual model and also because it is the only PCREX CNE institutionalized as an independent networked organization.

This article comprises six sections. After this introduction, there is a methodology section, then an abridged literature review on the Triple Helix principles, the governance of hybrid organizations, management mechanisms for collaboration and the role of trust in collaboration. Section 4 brings the case study description, followed by results in Section 5. Finally, Section 6 presents the discussion and conclusions.

2. Methodology

This study used a qualitative research approach based on a case study. Data was collected at two different moments in time by means of in-depth interviews with staff and executive members of the CE-EPC. The interviews were mediated by a semi-structured guideline. The first and broader field study was carried out in November 2009 as part of the assessment work cited above; at that opportunity, the researchers interviewed the CE-EPC president (from Petrobras), three directors (one from academia, one from an industry body and one from another oil company) and the executive manager. In June 2011 new field work was carried out to follow the evolution of the organization; at that opportunity, only the new executive manager, who was already a staff member in November 2009, was interviewed. Documentary evidence was used as an additional source of information. It is important to highlight that it was an exploratory study: an initial effort to understand critical issues related to the operation of a particular kind of hybrid organization: a CE applying the PCREX method.

Model of analysis

The main objective of this exploratory qualitative research is to analyze the governance elements and management mechanisms which favour or hinder collaboration at the CE-EPC. The authors assume that governance elements and management mechanisms which favour the evolution of trust among players broaden the possibility of high quality, effective cooperation. Learning acts as the connecting link that activates the virtuous cycle of cooperation (Figure 1) which leads to the consolidation and development of the collaborative endeavour.

The model for the case analysis was developed based on the literature review presented above. The CE-EPC governance elements analyzed by the researchers were: integration

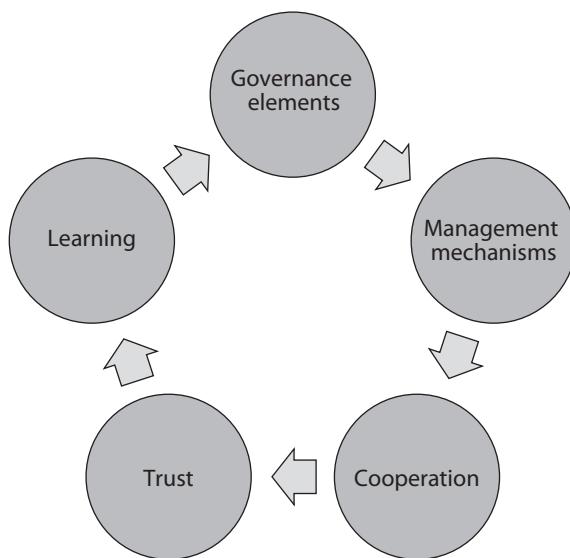


Figure 1. Virtuous cycle of cooperation.

orientation, integration mechanisms, institutional arrangement and management focus. The analysis of the management mechanisms focused on the three coordination features discussed in the literature review: communication, conflict management and leadership. The case study proceeded to the identification of collaborative activities carried out within the initiative and considerations concerning trust among members, which help understand the impact of governance elements and management mechanisms on the work of the CE.

3. Literature

The triple helix

The Triple Helix approach (Etzkowitz, 2009) focuses on U-I-G collaborative initiatives to foster socioeconomic development through technology, science and innovation activities. The Triple Helix thesis defends the notion that the university is increasingly central to discontinuous innovation in knowledge-based economies as it is the traditional locus of knowledge generation and diffusion.

Etzkowitz (2009) argues that U-I-G has complementary resources and competencies which should be brought together in a concerted effort to improve the knowledge flow within society. According to him, traditionally rigid university, industry and government boundaries are changing into more porous lines, allowing for enhanced information, knowledge and circulation. A vigorous

interaction of these three institutional spheres favours the creation of Knowledge, Consensus and Innovation spaces. Knowledge spaces consist of a concentration of related R&D activities – universities, research centres, technology institutes, technical institutes – in a local area. Consensus spaces are privileged forums where people from different perspectives (public and private sectors and academia) come together to generate, and brainstorm new ideas. Innovation spaces are arenas where the goals articulated in the consensus space are materialized. The existence of these three spaces outlines the triple-helix model of regional innovation (Etzkowitz, 2002).

The dynamic interconnection of U-I-G also favours the emergence of hybrid organizations such as technology transfer offices, business incubators, science parks, collaborative research centres and centres of excellence, which facilitate communication, knowledge flow, innovation development, and the identification of new business opportunities among the interacting parts. These organizations are hubs that connect university and industry and, sometimes, funding entities, in a collaborative effort to accelerate the rhythm of innovation. They work as consensus spaces where key stakeholders meet, get to know each other better, identify opportunities, build trust and plan joint actions for the future. The government's main role in this arena is to provide an appropriate institutional environment – laws, policies, funding mechanisms, etc. – that offers collaborative initiatives, legal support and an effective incentive to work. Considering the networked nature of the postmodern economy and society, helping local players connect with foreign ones is another key role for the government in this agenda.

The emphasis on university-industry relations highlights the relevance of the debate about University Intellectual Property and Technology Transfer Policies, institutional mechanisms which are crucial for the success of U-I collaborative projects (Van Looy *et al.*, 2006). Issues concerning patenting and licensing activities, appropriability, knowledge sharing and the secrecy-publication dilemma are part of any U-I relationship; the partners' ability to deal with these issues may either strengthen or weaken the links of high potential U-I knowledge and innovation networks.

Despite the apparent benefits of U-I-G interaction, hybrid organizations such as collaborative research centres and centres of excellence are difficult to set up and manage: they require a whole new set of institutions, practices and values, which support and promote collaboration among independent players that frequently hold divergent interests and viewpoints, different cultures and languages,

high technological, financial and knowledge-related asymmetries. The performance of this kind of enterprise depends heavily on the consistency between the type of organization and the governance elements, institutions and management practices in place as they are key elements for the promotion/intensification of effective collaboration among players.

The governance of hybrid organizations

Inter-organizational networks, which bring together key stakeholders and facilitate the flows of information, resources and trust necessary to secure collaboration and generate learning and innovation, have emerged as a key growth strategy in the knowledge-based economy. Keast and Hampson (2007) argue that the blending of organizations, resources and purposes creates new, hybrid institutional forms that usually draw on a mix of contract, structure and interpersonal relationships as integration processes: the network-organization. The governance and management of the responsibilities, relationships and interactions within these networked arrangements are critical issues for their development.

According to Keast and Hampson (2007), through the interactions between people and organizations in inter-organizational networks, a relatively stable pattern of relationships is formed in which members come to know more about each other and their organizations, common goals are established and trust and reciprocity begins to develop. These interpersonal aspects of networks act as an integrating mechanism to bring together previously disparate and even competing players and their resources and enable members not only to secure resources, take advantage of economic efficiencies or tap into their partners'

opportunities but also to draw on and leverage off the synergies that are formed to create new and innovative solutions and ideas.

In order to bring different players into transactions, administrators can draw upon three main governance modes or mechanisms of social integration: the hierarchy, the market and networks (Keast and Hampson, 2007). Table 1 sets out the key aspects of each of these governance modes and their idealized associated integration process and management foci.

However, as markets are perceived as unable to adequately bring together the relevant resources and capacities between science and industry, and complete vertical integration of the hierarchy restricts flexibility and incentives, and the networks of relationships based on trust and reciprocity are often insufficient forces to secure necessary directed outcomes, a mix of governance modes is often employed. Such hybrid arrangements allow for the interaction, often simultaneously, of governance modes resulting in combinations and recombinations of contracts, formal structure and interpersonal relations as the linking process for these new institutional arrangements (Keast and Hampson, 2007).

These authors argue that the ability to mix governance and management elements has engendered hybrid arrangements with some unique characteristics, such as simultaneous competition and cooperation, highly complex structural arrangements, and power and loyalty tensions, that challenge pre-existing management strategies and skills because they are not always synonymous with conventional management approaches. The ability to deploy a proper mix of governance and management strategies for effective

Table 1. Governance, management and integrating mechanism scheme (Adapted from Keast and Hampson, 2007).

Relevant features	Governance mode		
	Hierarchy	Market	Networks
Integration orientation	authority relationships	exchange relationships	social/communal relationships
Key integration mechanisms	centralized and legitimate authority, rules, regulations, procedures and legislation	formalized, legal contractual arrangements, arms-length transactions, bargaining	interpersonal trust, mutuality and reciprocity
Institutional arrangements	committees, working parties, interdepartmental committees	business associations, corporate boards	networked arrangements, collaborations, social charters and roundtables
Management focus	administration	contracts	relationships

outcomes in hybrid organizations is a big challenge for managers who dare coordinate such initiatives.

Building an appropriate institutional environment is critical for fostering collaboration in hybrid organizations. According to Coriat and Weinstein (2002), institutions – laws, rules, contracts, norms of conduct, customs, taboos, etc. – play a central role in developing collaborative enterprises because they ‘regulate’, both in tacit and explicit terms, the partners’ behaviour. Institutions affect people’s evaluation of the risks and advantages of engaging in cooperative initiatives, an important element when defining the formal institutional mechanisms to guide relations between the players.

Coriat and Weinstein (2002) distinguish between two types of institutions: institutions as constraints, ‘rules of the game’, according to which agents operate and coordinate themselves; and institutions as resources to be used by agents in developing new models of production and reproduction of collective goods. Coriat and Weinstein (2002) argue that, even in given institutional constraints, a certain level of ‘discretion’ is always observable and some organizational choices are always still open, particularly as regards the modes of coordination of information and knowledge inside the organization. Far from being only a system of constraints imposed on the agents, some institutions engender entirely new fields of action or new environments where individuals are able to develop their abilities. Searle’s distinction (1995 cited by Coriat and Weinstein, 2002) between ‘standardizing rules’ (like the Highway Code) and ‘constituting rules’ (like the game of chess) help understand the transforming nature of institutions: while some institutions aim to establish rules for already existing activities, others seem to be cut out to create the conditions for new activities to emerge. This is true for a good many economic institutions. Such is the case for many collaborative research centres which, once structured, offer new types of activities, new strategic environments and create new ‘patterns of behaviour’. Building an appropriate institutional environment is a *sine qua non* condition for the creation of a new collaborative pattern of behaviour which is essential for a hybrid organization to achieve its goals.

Besides governance and institutions, management mechanisms are critical aspects for developing collaboration among parties in hybrid organizations. Getting the parties to collaborate openly is allegedly the biggest challenge in hybrid organizations; therefore, the next section focuses on understanding the collaborative dynamic in organizational settings.

Management mechanisms pro collaboration

Although the focus of this article is inter-organizational cooperation, the authors assume that cooperation is primarily a human activity, therefore any effort to understand its nature and dynamic should look at collaboration between individuals. Although the rational choice approach seems appropriate to discuss inter-organizational cooperation, Ostrom (1998) points out its shortcomings in explaining the collaboration phenomenon. She emphasizes the relevance of subjective matters, in particular trust, in collaboration studies. Therefore, the idea in this section is to investigate what interferes with people’s willingness to collaborate in organizational settings.

Collaboration occurs when two or more people interact and work together towards the achievement of a common goal. According to Barnard (1938, cited by Deutsch, 1949), the persistence of cooperation depends on two conditions: effectiveness and efficiency. Effectiveness refers to the fulfilment of the social purpose of collaboration. Efficiency refers to the satisfaction of individual motivations. The test of effectiveness is the fulfilment of a common purpose. The test of efficiency is getting enough individual will to continue cooperating. The survival of cooperation, therefore, depends on two interrelated and interdependent classes of processes: (1) those that refer to the system of cooperation as a whole towards the environment; and (2) those that refer to the creation or distribution of satisfactions among individuals. According to the literature (Deutsch, 1960; Smith *et al.*, 1995), the two features which most affect collaboration effectiveness and efficiency at work are coordination and trust. Coordination enables the strengthening of trust among parties, which is the *sine qua non* condition for intensifying collaboration in hybrid organizations.

Coordination

Since the old classic work of Fayol (1990), coordination has been considered a management function, along with planning, organizing and controlling. As noted by Thompson (1967), the activity of coordination arises from the need to manage the interdependencies generated by the division of labour. Also according to this author, when rationality prevails, the organizational structure is geared towards reducing the costs of coordination. In his work on the structuring of organizations, Mintzberg (1995) agrees with Thompson (1967) on the relationship between the structure of the organization and the coordination of the interdependencies caused by the division of labour. Mintzberg (1995) proposes five basic mechanisms of coordination:

1. Mutual Adjustment: coordination is accomplished by the simple process of informal communication. It is used in both very simple processes – such as coordinating the handiwork done by two people – and in very complex situations, such as shared research projects.
2. Direct supervision: coordination is performed by a person who has responsibility for the work of others, providing instructions and monitoring actions.
3. Standardization of work processes: the activities that make up the task are specified in pre-programmed procedures.
4. Standardization of outputs: the results of the process are specified and can be controlled, such as the dimensions of a particular product.
5. Standardization of workers' skills (and knowledge): the type of training required to perform the job is specified.

Based on this categorization of coordination mechanisms, Mintzberg (1995) proposes a dynamic approach for the changes in the coordination process. According to him, as work grows more complex, the coordination mechanism changes to facilitate it in such a way that an initial mutual adjustment choice changes into a direct supervision model, and then to standardization alternatives, finally reverting to the original mutual adjustment mode if the work becomes very complex.

Recent attempts to develop more intense forms of cooperation, including the use of Web 2.0 tools, invest in making informal interactions easier and stronger to favour both mutual adjustment in the coordination of complex projects and spontaneous cooperation. Spontaneous cooperation and mutual adjustment have become distinguishing features of high performance teams focused on change and innovation (Yasir *et al.*, 2011).

In the context of a hybrid organization, three features of coordination are particularly relevant: conflict management, communication and leadership.

Communication

Ostrom (1998) argues that no other variable has as strong and consistent an effect on the level of cooperation as frank and direct communication between the potentially cooperating parties. With repeated opportunities to see and talk to others, a participant can assess whether he or she trusts the others enough to try to reach an agreement on the level of collective effort to be put into an initiative, its distribution and allocation. Only when people connect to each other and communicate, can trust be built, resources

brought together, information flow, new knowledge created and new business opportunities identified.

Communication is a particularly relevant instrument for coordinating cooperative enterprises: the exchange of clear information about the conditions of engagement in cooperative actions can make individuals who have an individualistic orientation, overcome barriers to cooperation. To accomplish such a goal, communication must be reliable for both parties; otherwise competitive behaviour tends to predominate (Deutsch, 1960). The same need for reliability is due to communication emitted directly from those who exercise the function of coordination in cooperative initiatives, as decisions can only be implemented if individuals accept them and are willing to cooperate and take them on.

Careless communication can exacerbate conflicts. Considering that communication is a highly cooperative process, Krauss and Morsella (2006) propose five principles to reduce conflict:

1. Avoid very noisy communication channels. If it is not possible, be redundant and send the message through different channels.
2. Effective communication requires a common knowledge base. The existence of this common ground should be verified before and during communication.
3. The communicator must take into account other people's perspectives when formulating his or her message. He or she must be an attentive listener.
4. In conflict situations, ensure that the conditions for effective communication are present.
5. Pay close attention to all forms of communication as content may easily be changed or obscured.

According to Chatterjee (2009), communication is the main element for the integration of a person in an organizational environment, followed by the leaders' attitude, reward systems and training. The author's research reveals that communication is perceived by people as the main factor impacting trust building in the workplace.

Conflict management

As cooperation coexists with competition in social settings (Deutsch, 1949), the occurrence of personal, intra-group and intergroup conflicts is expected. In organizational settings, in particular, where power relations and dispute for positions and prestige are embedded in people's mindset, conflicts are part of the game. Research shows that people who have a lot of power tend to appreciate power, use it, justify it and do everything to keep it. They pay little attention to powerless

people and have an innate tendency to dominate them. Groups with a lot of power tend to alienate those with less power thereby causing resistance. Groups with little power tend to develop limited vision and discontentment. They can express that discontentment by putting pressure on groups with less power than them, reducing the possibility of gaining power through cooperation and coalition with other groups.

According to Coleman (2006), power plays a central role in most conflicts. He distinguishes between two categories of power: (1) 'power over someone' is the possibility of compelling someone to do something – this viewpoint highlights the competitive and coercive nature of power; (2) 'power with someone' refers to the effectiveness of cooperative action and usually arises from cooperative conflicts.

Besides managing the conflicts from divergent interests and points of view, the coordinating group of hybrid organizations which bring together very asymmetric and heterogeneous parties, used to engaging with each other in market relations, has an additional challenge: helping players to overcome the usual 'power over' practice and learning the 'power with' logic. This learning process tends to be 'conflicted' and, therefore, requires special coordination abilities.

Leadership

Gratton (2010) points out that the conversion of a person's propensity for cooperation into effective collaborative action depends to a large extent on the signals that he or she receives from the organization. These signals are, to a great extent, conveyed by managers through the exercise of leadership. The author observes a strong relationship between leadership styles and the negative effects of failures in collaborative processes. Autocratic, centralizing leaders, used to leading in strict hierarchical environments, inhibit collaboration and the full use of individual skills (Schein, 2010). Changing behaviour and getting out of the comfort zone are major challenges for leaders who operate in complex environments, in situations of change and innovation.

In hybrid organizations, power is not a feature, quantity or capacity that can be delegated or distributed according to the will of the leading parties. Power emerges from a negotiation process through which individuals (representing organizations) demonstrate their own ability to act, react and interact in the network. Power has a relational nature. The influence of a node in a network can only be understood in

terms of its relational interdependence to the others (Beirne, 2006). In collaborative arrangements, sharing is the very first source of power: the more one shares, the more he learns, the more he knows. Network leaders must learn to share and to motivate parties to share as well, which requires the consolidation of a collaboration culture within the network. Schein (2010) argues that leadership is the fundamental process through which cultures are built and modified. In summary, leading collaborative arrangements requires new managing capabilities. These new competencies include the ability to lead in an environment of distributed power, which requires special negotiation skills and a willingness to share, and the ability to develop a culture of collaboration, to activate networks and successfully operate them.

The role of trust in collaboration

Trust can be defined as the willingness of a person to be vulnerable to someone else's actions, based on the expectation that the other will do a specific action which is important for the person who trusts, without him or her having to monitor or control the trustee (Mayer *et al.*, 1995). From this definition, one can infer that an environment of trust supports cooperation by reducing the uncertainties and risks in interpersonal cooperative relationships. Confidence in the trustee's reciprocation is a founding element of collaboration: if the interacting parties try to obtain maximum gains with minimal personal costs during a collaborative process, regardless of the costs and gains of the other parties, the process tends to be interrupted.

Jones and George (1998) propose that trust is a psychological construct, the experience of which is the outcome of the interaction of people's values, attitudes, and moods and emotions.

1. Values are general standards or principles that are considered intrinsically desirable ends, such as loyalty, helpfulness, fairness, predictability, reliability, honesty, responsibility, integrity, competence, consistency and openness. According to Rokeach (1973, cited by Jones and George, 1998) people typically incorporate values into their value system and prioritize them in terms of their relative importance as guiding principles. A person's value system guides behaviour and the interpretations of experience by furnishing criteria that the person uses to evaluate and make sense of events and actions in the surrounding world. That value system determines which types of behaviours, events, situations or people are desirable or undesirable. Values contribute to the generalized experience of trust and can even create a propensity to trust (Mayer *et al.*, 1995) that surpasses specific situations and relationships.

2. Attitudes are the means through which people define and structure their interactions with others. Attitudes are composed of knowledge structures that contain the specific thoughts and feelings one has about other people, groups or organizations. The attitudes that people form toward each other in an organizational context are likely to contain information concerning the other party's trustworthiness.
3. Moods and emotions capture how people feel as they go about their daily activities, including interacting with other people; they are affective states or feelings that provide people with information about their ongoing experiences and their general state of being. Moods and emotions affect ongoing processes either positively or negatively. Experiencing positive moods or emotions may cause one to have more positive perceptions of others, resulting in a heightened experience of trust in another person. Conversely, negative moods and emotions may add a negative tone to interactions and may result in an individual perceiving others as less trustworthy than they actually are.

These components are interactive, *i.e.* they reinforce each other. Values provide standards of trust that people strive to achieve in their relationships with others. Attitudes provide knowledge of another person's trustworthiness, and current moods and emotions are signals or indicators of the presence and quality of trust in a relationship. An environment of trust, which favours high quality cooperative processes, comprises shared values, confidence in each other's trustworthiness, favourable attitudes and positive experiences in the context which generate positive moods and emotions towards each other.

Viewing trust from a symbolic interactionist perspective, Jones and George (1998) assume that: (1) people act in social situations based on the meanings that they have learned to associate with them; and (2) these meanings are acquired by interactions with other people so that a definition of the social situation is created over time. More specifically, in any particular encounter two (or more) parties mutually develop and negotiate a definition of the social situation. This joint creation of the definition of a social situation involves each party trying to understand the other party's expectations, needs, and goals. Each party brings its own set of interpretive schemes to the social situation. To the extent that they use or develop similar interpretive schemes to define the social situation, the parties will tend to agree on their perceptions of the level of trust present in the social situation, so adjustment to each other takes place.

Based on these assumptions, Jones and George's model of the evolution of trust identifies three levels of trust:

1. Distrust: since people use their own value system to decide if the stranger is fit to transact with, perceptions of value incongruence can quickly lead to distrust. Nevertheless, there may be cooperation even in the presence of distrust. That might happen in the case of two political parties that, even in the absence of trust, decide to cooperate to form a government. In the organizational environment, however, distrust negatively affects the quality of cooperation.
2. Conditional trust: a state of trust in which both parties are willing to transact with each other, as long as each one behaves appropriately, uses a similar interpretive scheme to define the situation, and can take the role of the other. In conditional trust attitudes of one party toward the other are favourable enough to support future interactions; sufficient positive affect and a relative lack of negative affect reinforce these attitudes. Conditional trust is usually sufficient to facilitate a wide range of social and economic exchanges; it is consistent with the idea that one of the foundations for trust is knowledge or positive expectations of the other. Indeed, the most common form of trust existing in organizational settings is probably conditional trust.
3. Unconditional trust: shared values now structure the social situation and become the primary vehicle through which individuals experience trust. With unconditional trust, each party's trustworthiness is now assured, based on confidence in the other's values which is backed up by empirical evidence derived from repeated behavioural interactions. Positive affect increases as positive moods and emotions strengthen the affective bonds between parties and bolster the experience of trust. When unconditional trust is present, relationships become significant and often involve a sense of mutual identification. In organizational settings, unconditional trust is associated with cooperation within high performance work groups.

It is important to understand that this approach to trust is dynamic. In social situations people can move from lower levels to higher levels of trust, and vice versa. In fact, trust can evolve positively if the parties meet their expectations about each other's behaviour throughout a cooperative process. Situations are understood and negotiated favourably, creating an environment where positive attitudes and moods and emotions lead to significant recognition and respect for mutual values. Conversely, changes in attitude, motivated by negative moods and emotions, can alter people's perception of shared values and understanding and push interaction from an unconditional trust environment to a conditional

trust or even distrust context. Considering this dynamism, the three levels may be seen as references in a potentially useful scale to diagnose and manage the level of trust in work situations.

Once someone accepts that the intensity and quality of cooperation depends upon the level of trust among participants, he or she can infer that unconditional trust is more appropriate when a company relies on highly cooperative teams for competitiveness gains. According to Jones and George (1998), the effects of unconditional trust on interpersonal cooperation and teamwork are the following:

1. Broad role definitions: parties tend to go beyond their formal duties.
2. Communal relationships: based on mutual help and individual responsibility for the group's well being.
3. High confidence in others: necessary to develop synergy within the group.
4. Help-seeking behaviour: no fear of negative evaluation.
5. Free exchange of knowledge and information: knowledge and information are not considered power instruments but rather endless resources of change and innovation: the more they are shared, the more they grow.
6. Subjugation of personal needs and ego for the greater common good: confidence in reciprocity.
7. High involvement: feeling that everybody is working towards a common goal and that everyone's contribution is strongly related to accomplishing that goal.

Coordination and trust mutually reinforce each other. While on the one hand coordination may favour the strengthening of trust, on the other the effects of trust on interpersonal cooperation and teamwork may facilitate mutual adjustment and the coordination activity, and reduce management 'costs'.

4. Case study descriptive

The PCREX method

The first version of the PCREX method, developed by Petrobras with academic support by Coppe/UFRJ, was presented in 1996 and the last review was performed in 2011. PCREX presents guidelines to create Centres / Networks of Excellence which compulsorily bring together university, industry and government institutions, both national and foreign, in an effort to reach and maintain supremacy in a chosen field, be it technological, scientific, social, cultural or educational (Petrobras, 2008).

PCREX recommends the creation of self-sustaining permanent trilateral networks primarily focused on RD&I, education and training. A PCREX CE should carry out actions and projects to: (1) solve existing problems; (2) maintain or reach a leading position in local and/or global level; and (3) introduce scientific or technological breakthroughs in the market. The PCREX method claims that cooperative, interactive processes between collectives of key stakeholders generate better distributed results. At the firm level, a PCREX CE should strive to be the technological vanguard and promote the expansion of company participation in technology and innovation markets.

A PCREX CE is described as a combination of knowledge and physical, financial, technological and methodological resources, organized by leaders that may come from any of the three institutional spheres, so as to promote social and economic development. According to its coordinators, the method applies to a wide spectrum of themes from firm-related issues to national priorities and global challenges. By bringing together U-I-G, a PCREX CE attempts to optimize and multiply tangible and intangible resources, stimulate technical cooperation, access strategic information, diversify sources of information and knowledge, reduce project time and cost, access new markets, enter new businesses, create high-tech institutions and laboratories, invest in professional and academic education, participate in a greater number of technical-scientific events, trade fairs and forums and publish technical-scientific papers. Interaction with the government is considered vital to the success of a PCREX CE for the participative development of efficient incentive programmes and a supportive regulatory environment, access to public and foreign funding, alignment with public industrial and social policies, etc.

In principle, a firm-led PCREX CE represents a hybrid organizational mechanism which facilitates the development of human potential, the company innovation process, company-society integration, and current company business and new opportunities, leading to better corporate results. A PCREX CE must be aligned with the company's strategic plan and able to contribute to achieving corporate goals.

The start-up of a PCREX CE includes: (1) the self-selection of Strategic Partners or 'Anchors'; and (2) the setting up of a Management Council and an Executive Committee whose members are chosen by the founders of the new enterprise and may include professionals indicated by the Anchor Organization(s). Depending on the complexity of the case, the structuring of a Technical Support Group or a group of recognized experts is also suggested. The coordination of PCREX initiatives can be networked, centralized on

the strategic partners, or attributed exclusively to the lead organization (the entity which proposed the creation of the initiative), depending on the agreement of the parties involved. A PCREX initiative may be a traditional physical organization or a virtual entity; one way or another, it should define its mission, vision and unifying goals clearly. The operation of a PCREX CE is based on the development and realization of structural projects by a network of partners of recognizable competence in the area.

The CE-EPC

The CE-EPC, structured according to the PCREX method, is a public interest civil society organization which brings together three oil companies – Petrobras, Shell and Statoil, 47 EPC companies, 19 universities and technical schools, and 19 government entities, professional associations and industry bodies, in a collective effort to make the Brazilian EPC sector related to the oil and gas industry sustainable and competitive worldwide. The project benchmarks were the American Organization Construction Industry Institute, based at the University of Texas in Austin, and the Independent Project Analysis Institute, and the Petrobras CE in Pipelines. By bringing together players that share common interests and complementary knowledge and resources, the CE-EPC is designed to develop synergy in a collective effort to generate solutions for a wide variety of problems faced by the EPC supply chain in planning and executing projects. It is expected that the interaction within the CE facilitates the identification of bottlenecks, and the development of innovative approaches to human resources qualification, and the application of new technologies and best management practices.

The CE-EPC founding assembly took place on June 23, 2008 at Petrobras headquarters in Rio de Janeiro, Brazil, after a one-and-a-half-year planning process led by Petrobras, the proponent of the initiative. At the assembly, the parties signed the CE-EPC statute. The CE was established under Prominp (www.prominp.com.br), a governmental programme for the mobilization of the national oil and natural gas industry, coordinated by the Brazilian Ministry of Mines and Energy. Prominp was institutionalized by the Federal Government in 2003 to maximize the participation of national goods and the service industry in the implantation of oil and gas projects in Brazil and in other countries, on a competitive and sustainable basis. Besides the significant support from Prominp, other entities whose support was of great relevance for the consolidation of the CE were IBP (Brazilian Petroleum Institute), FIRJAN (Rio de Janeiro Industries Federation) and SENAI (the arm of the National Industries Confederation System dedicated

to generating and diffusing knowledge for industrial development).

The CE-EPC is installed in a set of offices lent by FIRJAN, a member of the CE. The organizational structure is composed of the general assembly, an advisory council, a supervisory board, a board of directors, an executive director and a support team, a project management committee, and a committee of technology transfer and communication. The GA appoints the members of the board of directors, among whom the president and the vice-president, who are elected for a two-year period.

The CE-EPC strategic focuses are: (1) to reach international standards of excellence in EPC; (2) to expand the participation of its members in the global market; and (3) to generate and preserve relevant knowledge. The strategic focuses guide the definition of the project themes and training activities. The CE management guidelines are: (1) strong strategic alignment of the portfolio of projects; (2) participation and accountability; (3) intense communication; (4) integration of university, EPC and oil companies; and (5) the application of knowledge.

Regarding funding, the administrative costs are covered by the payment of annuities by members, and the sale of services, namely, lectures and online mini-courses on topics of interest to the EPC industry. As for the annuities, the oil companies sponsor 50% of the total annual budget and the other entities pay the other 50% (two different fees are established, according to the organization income). Universities and technical schools are free of charge. The projects have their own budgets: most of them are funded by the operators, but public funding is also accessed through projects presented by universities. Until June 2011, Petrobras offered additional support by having three of its employees and four of its interns working for the CE. To make up the staff, the CE-EPC hired three other employees, including its executive manager. The CE-EPC is an articulation arena; its staff do not participate in project development.

5. Results

Governance elements

The CE-EPC enterprise has a dual hybrid nature: firstly, it is hybrid because it brings together players from different institutional spheres (industry, academia and government), and secondly, it is a network organization, which configures a hybrid mode of governance. The organization is given great integrative responsibility. The players brought together by the CE-EPC initiative used to interact in market-like relations

but then realized that only a cooperative, integrative effort could generate the collective improvement necessary to meet the national challenges and to compete in the global market. Bringing such a diverse set of actors together in an environment that stimulates the combination of resources, the flow of information and knowledge creation required the development of a mixed hierarchy-market-network governance model and new management strategies and practices.

Regarding integration orientation, in the CE-EPC case, integration is mainly motivated by a shared belief and interest in self-improvement through collective development. There is a common understanding among players that a joint effort is the most effective way to improve individual and collective productivity and competitiveness. The participation of the oil and gas companies (the main contractors) in the endeavour is a relevant source of motivation for EPC firm membership. On the business side, it is considered a unique opportunity to connect with key players in the oil and gas industry and its supply chain, multiply businesses, broaden personal networks and strengthen existing links. On the knowledge side, it configures a potentially effective way to access relevant knowledge, learn and develop technical competencies. In this business-oriented network, membership is not influenced by social or communal relationships, but by utilitarian rational interests, which favours the emergence of conditional trust in a business context.

The CE-EPC relies on formal rules and legal contractual arrangements as integration mechanisms. The rules and regulations which mould the parties' participation and interaction within the CE-EPC are institutionalized in written documents. The parties' rights and obligations, as well as the expected behaviour, sanctions and penalties, are defined in the CE-EPC statute and bylaws, and membership requires the signature of a formal 'membership term'. Although the formal instruments used for member integration explicitly mention that collaborative behaviour is expected from all parties, the respondents realize this has not been enough to ignite synergy in the network and push the CE into dynamic operation: an additional effort has been made to develop interpersonal trust, mutuality and reciprocity, essential elements to spur optimal levels of information flow and resources combination.

The CE-EPC institutional arrangement includes the General Assembly, composed of representatives from all member organizations; the Board of Directors, which comprises four representatives from the EPC industry, three from the oil and gas industry, two from academia and one from

IBP; the advisory council, composed of ten representatives from professional associations and industry bodies; and the supervisory board with its four members: one from the oil industry, one from university and two from industry bodies. The two technical committees report to the executive manager, who reports to the Board of Directors. The General Assembly (GA) is the supreme entity of the organization, the one that appoints and removes the Directors, the President and the Vice President. The GA also approves, proposes and modifies critical issues such as the budget, the strategic plan, the portfolio of projects, the statute and the other regulatory items. Another relevant institutional aspect is the fact that Oil and Gas companies and EPC players alternate in the presidency every two years. The competencies of all the administrative bodies are defined in formal instruments. The CE institutional arrangement reinforces the networked nature of the initiative, which clearly prioritizes participation and decentralization, despite the big technological, financial and managerial asymmetries among members.

Considering the CE complexity, much attention is given to its administration and legal contractual arrangements. However, the respondents understand that the most relevant management focus is the relationship among members within the CE. The success of collaborative arrangements depends greatly on the quality of the relationships within the organization. When parties engage in direct relationships with one another, the chances of identifying commonalities and complementarities increase as well as the possibility of building trust. Effective high performance cooperation, which involves sharing resources, co-deciding and co-creating, only happens in environments of trust, and good quality relationships, based on truth and ethics, favour the evolution of trust among collaborating parties in such a way that initial distrust may evolve to conditional trust and even to unconditional trust, the ideal situation in collaborative endeavours.

The CE-EPC institutional environment seems to favour the development of cooperative relationships. Not only does it enable and encourage the direct and indirect participation of all members in the CE activities, but it also emphasizes that participation and cooperation are duties of all members. Rather than constraining cooperation, the CE-EPC institutional environment supports it and therefore may be considered a relevant constructive resource, however, insufficient to have the network realize its full potential.

Management mechanisms

Considering the complex nature and mission of the CE-EPC, the respondents agree that mutual adjustment is the

preferred mechanism of coordination for the organization. In mutually adjusted collaborative initiatives, coordination is accomplished by the simple process of informal communication among parties, which emphasizes the significant role communication plays within the enterprise. As highlighted in the model of analysis, three aspects of coordination were investigated by the researchers: communication, conflict management and leadership.

The respondents understand the central role of free direct communication among members for the intensification of collaboration within the CE. The most used means of communication among members are the telephone, e-mail, video conference and website, where there is a discussion forum with password control, for members to discuss topics of interest, clear up doubts, develop suggestions, and learn with each other. In June 2011 about 150 messages had been posted on 52 topics, which reveals a suboptimal use of the digital tool. The online mini-courses are another opportunity for people to connect and interact using the web; 20 events happened in 2010. Opportunities for face-to-face communication include the annual meeting of the General Assembly, technical lectures by invited experts (seven lectures were delivered in 2010) and the participation in project development. The Board of Directors meets twice a month. In June 2011, the executive members and the Board were discussing other alternatives to promote interaction and communication among parties, including a monthly meeting of a few players with complementary competencies and a second GA a year. The researchers believe the CE coordination is aware of its role as a communication facilitator and recognize its effort to improve communication within the CE using a mix of virtual tools and face-to-face events.

The CE bylaws state that the Board is in charge of conflict management and the GA decides on the dissociation of members in case of inappropriate behaviour. However, despite the asymmetry, the heterogeneity and the varying needs among members, no conflict was reported by the respondents, which may indicate: (1) a shared belief in the relevance of the initiative; (2) recognition of the value of participating and the consequent association of high costs to opportunistic behaviour and exclusion; and (3) a tacit approval of its management. One of the respondents identifies a potential conflict in the relationship with the university, particularly in research financed by projects given funding through the university, as interests tend to vary significantly. According to him, managing this relationship requires some special negotiation skills.

Regarding leadership, the roles played by the executive manager and the Board are of extreme importance for the success of the initiative. The interviews reveal that the executive manager is aware of his role as a facilitator, an articulator and an interaction booster. He realizes his greatest challenge is to have people participate more dynamically in the CE activities and that a 'power with' approach is the only possible choice. The participatory method used to build the portfolio of projects, when all members were encouraged to suggest topics and vote on the proposals, confirms the prioritization of a 'power with' approach. The Board seems supportive of the manager's efforts.

The management practices observed by the researchers seem to benefit collaboration and reflect the CE management guidelines: (1) participation and accountability; (2) intense communication; (3) integration of university, EPC and oil companies; (4) knowledge application; and (5) strong strategic alignment of the portfolio of projects.

Collaborative activities

The two most important activities of the CE are research and development, and education on technical issues and management. Considering the first focus, the respondents mention some difficulty getting members to suggest project topics to build the projects portfolio, despite the coordination's efforts to encourage participation through repeated phone calls and e-mails. Poor participation limits the ability of the CE to identify and address relevant research issues, which would help arouse member interest in engaging more actively. Respondents say it has been difficult to get members to engage actively in the CE projects, i.e. get their employees to participate in the development of the projects; this poses an operational limitation for the organization as the CE has no fixed R&D staff or financial resources to hire experts to develop its projects (nor is this expected). The reason the companies give for not engaging in the development of the projects is high work demand back at the companies. However, low participation in project definition and low engagement in project development seem to be positively correlated. The CE projects have been carried out mainly by the associated universities; nevertheless, members have been cooperating with information and access to their facilities.

Concerning education, the CE coordination considered attendance at the lectures and online mini-courses to be good. Lecturers and instructors include experts from the member organizations and other entities, and university professors.

More collaboration means more engagement in the CE activities, which would enhance the pool of intellectual capital, information and tangible resources available for use. A directed struggle on the coordination side towards improving members' participation was noted by the researchers; however, no much improvement occurred between the two field studies, according to the respondents.

Trust

The respondents commented that most members refuse or refrain from sharing information about their business with the others, fearing that their 'competitors' could use that piece of information opportunistically. This competitive mindset reveals the prevalence of distrust among members, which definitely stops collaboration from evolving. However, as Jones and George (1998) argue, there may be cooperation even in the presence of distrust, and distrust may evolve into conditional trust and even into unconditional trust, depending on the quality of the relationship among parties. Connection and communication play determinant roles in trust building, since only when parties meet is there a chance to negotiate a common definition of the social situation, align interpretive schemes, adjust commitments, and develop trust. Good reputation also helps increase the level of trust within a relationship; however, the respondents see little influence of reputation on the flow of information within the CE-EPC. In addition, most of the CE members have engaged in previous businesses, and this background is not always supportive of collaboration. In spite of these bottlenecks, there seems to be a shared belief in the potential for collaborative action and a shared interest in the success of the initiative, which may help overcome distrust. Furthermore, the respondents believe that the positive results accomplished by the CE in education and R&D tend to strengthen general interest, spur motivation, and favour participation and the evolution of trust.

6. Discussion and conclusions

The case study highlights the potential of PCREX to help set up hybrid collaborative initiatives among parties from different institutional spheres. The resulting hybrid organization is institutionalized by the interaction, often simultaneously, of governance modes resulting in combinations and recombinations of contract, formal structure and interpersonal relations, as noted by Keast and Hampson (2007). In the CE-EPC case, the governance elements and the institutional environment are supportive of cooperation and therefore constitute a positive source

of conditions for a new kind of networked organization to emerge.

The research also identified some barriers to the full accomplishment of collaborative arrangements. A weak culture of collaboration was the greatest difficulty found by the researchers in the CE-EPC case. Collaboration competes with the demands of everyday routine. The lack of positive previous experiences with cooperation together with a lifelong practice of market relations make it hard to get members to focus attention on a new work logic. But collaboration has high transformative potential and since its practice is learned and exercised, a virtual feedback loop is activated and collaboration competencies are developed and consolidated. Trust is essential for collaborative initiatives to reach high performance and therefore communication and relationship management are core competencies for network managers.

Some of the CE-EPC strengths concerning the collaboration dynamic within the organization include: (1) supportive formal institutional mechanisms and governance elements, such as the presence of representatives from all the institutional spheres and industries on the board of directors and the participative decision making process the CE adopts; (2) supportive management practices, such as regularly scheduled meetings and reasonable use of digital media; (3) the leaders' awareness of their determinant role as articulators and collaboration boosters; (4) clear focus on knowledge creation and sharing; (5) the results achieved; and (6) high potential to align efforts and avoid redundancy and noise among partners.

The weaknesses include: (1) a weak network culture and consequent difficulty in releasing the full power of cooperation, which causes difficulty in getting the members' C (chief) level staff to participate in the centre's activities, difficulty in obtaining partner's commitment to the projects, difficulties getting the parties to provide qualified personnel to develop the projects; (2) prevalence of distrust among members; (3) high asymmetry among partners; (4) little experience among leaders in network management; and (5) little systematization of management practices.

The results obtained by the CE-EPC include an online training programme on best practices: 20 'webinars' – web seminars – were offered in 2010; regular courses; lectures: 7 events in 2010; and the definition (October 2009) of a collaborative projects portfolio containing nine projects: by June 2011, three had been finished and a book was about to be published, and three others had appointed the sponsor, the coordinator and the participating members (research

subjects, mainly). Other significant results concern the gradual and hard-to-measure development of managerial capabilities – relationship and network management, and the intensification of university-industry interaction.

Learning to cooperate and developing trust take time; however, once the network evolves into a dynamic environment of trust the rhythm of knowledge and innovation generation tends to grows significantly. Therefore, the intangible gains from interacting and networking are of extreme relevance in this kind of endeavour. The rational choice approach does not seem sufficient to explain why cooperation level is sometimes low among parties in collaborative arrangements. In the CE-EPC case, for example, although members seem to support the initiative and rationally recognize its innovative potential, simple communication among parties has not led to negotiation and collaboration. The researchers believe that studying issues which affect individuals' disposition to collaborate is of greater help for managers to develop new governance and management strategies for networks.

Despite the high asymmetry among members and the weak network culture, the researchers conclude that the CE-EPC has accomplished significant positive results in twenty months of operation (after the portfolio of projects was approved by the GA) and that its internal environment is supportive and favours the improvement and consolidation of the organization. To reach high performance, collaborative organizations should generate value, the coordination should be able to communicate value, and the parties should be convinced of the value of the initiative, and the CE-EPC seems to be succeeding in doing so. The new Board and president (from the EPC industry) took over in May 2011, a step forward towards the consolidation of a well-structured hybrid organization set up for the improvement of the Brazilian EPC industry.

Implications for the PCREX method

Although each CNE may have very peculiar characteristics, the results of this case study contribute to the development of the PCREX method primarily because it identified and explored some weaknesses which severely affect the effectiveness of collaborative arrangements in general, such as a weak network culture, high asymmetry among partners and little systematization of management practices.

The case study results suggest that the PCREX method give emphasis to practices that enable and promote cooperation and trust among partners, and favour the emergence of network culture. Another issue to be improved in the

method is discussing governance rules to manage power asymmetry among partners so that it does not become an obstacle for cooperation within the CNE. The authors of this paper recommend that the PCREX coordinators include best management practices of cooperative arrangements in the method guidelines and set up a network of CNE to encourage communication and learning among them.

The authors are convinced of the relevance of studying CNE initiatives and helping improve and disseminate the PCREX method so that soon the CNE movement becomes as prominent as the incubator movement in Brazil, making it easier for Brazilian companies to overcome practical and research challenges and deal faster with complex issues.

Limitations and implications for research

Further studies are recommended involving a larger and more comprehensive number of participating organizations in CE-EPC. A third research endeavour would help provide an understanding of how the governance elements and management mechanisms evolved over time and how they affected cooperation within the CNE. Despite the learning opportunities found in this research it is important to emphasize that the findings of this study cannot be generalized given the specificity of this unique hybrid organization, as well as the design of this research.

Although collaborative research centres are not exactly a new model of hybrid organization in developed countries (Stal, 1999), they are still not common in Brazil, despite government efforts to spur U-I-G interaction through the Brazilian Innovation Law (Law no. 10.973/2004). This study revealed the suitability of the PCREX method to foster Triple Helix partnerships. Therefore, the authors consider it very important that other CNE are studied and the results discussed.

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