

# THE LIMITS OF INSTITUTIONS: FROM TECHNOLOGICAL PROGRESS TO DEVELOPMENT

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**Abstract:** Institutional theory explains the social functions implemented by individuals on society. The new institutionalism proposed by Douglas North, Oliver Williamson e Ronald Coase suggests that the environment has influence in organizations. North states: "if institutions are the rules of the game, organizations and their entrepreneurs are the players". In this context, this paper analyzes the institutions of the Brazilian Shipbuilding and Offshore Industry with the aim of analyzing the influence and the limits of the institutions of the generation of technological progress to development. Based on a qualitative approach (interviews with key actors and secondary data analysis) were identified important aspects that can influence the development and determine the technological limits of this industry. Initially, it was discovered greater influence of institutions stimulating stock market to the detriment of science and technology (technology-based). Next, we identified three institutional limits generated from the development of the industry: 1) lack of technological capability, 2) workers without qualification and 3) institutional crisis. Finally, practical implications to contribute to competitive industrial performance and the creation of public policy.

**Keywords:** institutions, development, industry.

## 1. Introduction

There is a growing body of literature that recognizes the importance in understanding the role of institutions in the quest for economic development in industrial sectors. A key aspect of institutional theory is explain the social functions implemented by individuals on society. This is of interest because the institutions play important roles in facilitating technological process progress (Vitola & Senfelde, 2015). Technological progress is widely acknowledged as the main driver of economic growth (Farmer & Fafond, 2016), and is defined as new, and better ways of doing things, and new techniques for using scarce resources more productively (Binswanger, 2001).

Institution is a term frequently used in the literature, but to date there is no consensus about your definition. This occurs because there are different theoretical traditions which implies in different discourses about the importance of institutions. However, this different theoretical traditions do not invalidate the developed theoretical constructs, but give greater value to concepts (Nelson, 1995). The New Institutional Economics (NIE) literature has lately

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paid great attention to understanding how institutions change and how they cause economic growth. NIE shows strong relationship with the theory of transaction costs, its foundation on microeconomic issues and the emphasis on theory of the firm (Coase, 1937; Williamson, 1996). North (1990, 1991, 1994) defines institutions as “humanly devised constraints that shape human interaction” (i.e. the rules of the game).

The purpose of this paper is to analyze the influence and the limits of the institutions of the generation of technological progress to development. The Brazilian Shipbuilding and Offshore Industry provides a particularly interesting case because: is a manufacturer of complex products, considering high investments, long production time, low annual production volume and especially its reliance on production for orders.

This paper is organized as follows. First we discuss the literature on Institutions, distinguishing two major approaches: old institutions economy and new institutions economy. Second, we present the institutional intervention concepts. Third, we present the research procedures of this study, followed by the discussion and conclusion.

## **2. Institutions**

In the literature, Thorstein Veblen (1919a; 1919b), John Commons, (1931) e Wesley Mitchell (1929) are present in the origin of authors institutional economics (Old Institutions Economy – OIE). (Hodgson, 1998; Hodgson, 2006a; Hodgson, 2006b; Williamson, 1996). Veblen (1919a) uses the term “institutions” to refer to the influence that institutions have over instincts, being able to act on the human thinking habit (Samuels, 1995). In the same way, to Commons (1931) institutions are collective actions that have control (predictability) of individual action (Hodgson, 1992; Hodgson, 2003).

The Veblen's thoughts are directly related to the evolutionary idea arising from the possibility of biology application to economics (Conceição, 2002a). This evolutionary idea shows that the institutions are able to change. Therefore, the institutions are pushing the system into which they are inserted generating the change of attitudes and actions (Conceição, 2002b).

In recent years, a few authors have begun a new theoretical school: the new institutional economics<sup>3</sup> (NIE). NIE it was built based on the old institutionalism of Commons (Conceição, 2002) and the strong relationship with the theory of transaction costs (Coase,

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<sup>3</sup> To Coase (1998), Oliver Williamson coined the term "New Institutional Economics", to differentiate themselves from the "old institutional economics" of Commons, Mitchell and his followers. To Hodgson (2009), the choice of the term was deliberate, to distance themselves from the old institutionalists.

1937). In this way, the main authors who have supported this analysis were Ronald Coase, Oliver Williamson and Douglas North (Conceição, 2002b). In her interesting analysis of transaction costs, Coase (1937) identify the relationship between institutionalist approaches and neoclassical approach (Conceição, 2001).

Williamson (1998; 2000) observed considerable differences between Old Institutions Economic and New Institutions Economic. In her analysis of institutions, Williamson (1998) concludes concludes that OIE was based on criticizing the neoclassical behavior. To North (1991, 1994), institutions are also described as rules and norms that “enable” human interaction to take place. However, the institutions have only the power to affect the individual's behavior choices and constraints, not being able to shape the preferences and individuality (Hodgson, 1993). North states: "if institutions are the rules of the game, organizations and their entrepreneurs are the players".

The enlightening factor in this pattern of interaction is the formal and informal restrictions. Informal constraints are the rules generated in a society that arise as a security developed by the environment in which we operate, such as: penalties, taboos and customs (Moodysson & Zukauskaitė, 2011). In contrast, formal restrictions are officially declared rules, designed to serve the interests of people with transaction capacity and allow the creation of new rules, such as: constitutions, laws, property rights (Moodysson & Zukauskaitė, 2011).

In this sense, North (2005) argues that the rules, norms and beliefs that we inherit are able to shape the present and influence the future. Thus, to understand the evolutionary institutions as it becomes necessary to know the incentives that interfere with the organization's actions to destabilize the developed institutional environment. These actions are able to explain the need for institutional incentives, since the environments present obstacles or resistance to update. The incentives for development are approached as interventions.

### **3. Institutional interventions**

To better understand the mechanisms of institutional interventions and its effects, Bunker (1980) analyzed that modern institutions dealing with impositions of political means to ensure the promotion of economic change in the direction that was more favorable to the government. In her interesting analysis of institutional interventions, North (1990) identified that those impositions can be understood as the institutional level of intervention. Thus, impositions associations are made between attitudes and strategic coordination, so as to

enable an individual (or company) influence and control or the ability to change the rules of the game.

This shows a need to be explicit about exactly what is meant by the word institutional interventions. In this sense, we understand institutional interventions as a mechanism to control the use of authority, policies or regulations in the development of economic activities. This type of intervention is an interference mode regulatory state, which acts as mediator of the actions within society (Hodgson, 2002; Hodgson, 2009).

To determine the effects of institutional interventions, Puffer and McCarthy (2007) studied the interventionist role of the state in economic development. For these authors, there are two basic approaches currently being adopted in research into institutional interventions. One is the institutional-push approach and the other is institutional-pull.

### *3.1 Institutional-Push*

Considering the technological progress as the fundamental phenomenon of economic development, the institutional-push approach encourages the creation of conditions technical to achieve this development. These technical conditions are associated with the development of knowledge in science and technology. The development of science and technology is based on the use of scientific research, development of new products and the generation and dissemination of new technologies (Freeman & Soete, 2008; Brem & Voigt, 2009; Stefano, G., Gambardella, A. & Verona, G., 2012).

In this sense, we understand that knowledge enables the creation of incentives for environmental needs are met. In addition, to the industrial activity, when stagnant, reach a paradigm change (Chau & Tam, 2000). To better understand the mechanisms of institutional-push and its effects, Puffer and McCarthy (2007) argues that institutional-push approach occurs when the development of knowledge in science and technology do not have enough resources to supply its knowledge base and achieve technological progress of the institutions.

Thus, institutional-push approach is interventions that the regulatory state performs when it identifies the need to foster an unarticulated or off industry. Furthermore, is characteristic of this approach the promotion of scientific research, the creation of new technologies and the implementation of new practices. This type of intervention favors the research and development of the sector, generating new knowledge and technological progress (Coronel, D., Campos, A., Azevedo, A. & Carvalho, F., 2011).

A new industry must either build on the competencies already supported or find ways to encourage the provision of new ones. In technology based industries, the basic research on

which firms draw often has been generated in university laboratories a decade or more before it was commercialized (Link & Bauer, 1989).

### *3.2 Institutional-Pull*

The way markets deal with their capabilities will determine the development. Thus, institutional-pull approach studies the market as a source of ideas for the expansion of research and knowledge generation. In this way, when the demand generation and increase of infrastructure is not sufficient to generate development (Schmookler, 1966), it is necessary to understand the institutional environment in which it is inserted to understand the needs of this environment (Dosi, 2006).

To better understand the mechanisms of institutional-pull and its effects, Puffer and McCarthy (2007) argues that institutional-pull approach occurs when the market puts pressure on institutions to strengthen regulatory institutions in pursuit of their own interests. With the emergence of a need in the market, the expectation is that producers seek ways to serve it as soon as possible. (Rothwell, 1994; Peters, M., Schneider, M., Griesshaber, T. & Hoffmann, V., 2012).

Next, it is the generation of public policies that serve to develop and strengthen the industry. Are characteristic of this type of intervention approaches the regulatory state performs in industrial sectors, through the development of regional and national public policies.

## **4. Research Method**

This paper uses case study as the research methodology to analyze the influence and the limits of the institutions of the generation of technological progress to development. A case-study approach was used to capture the complexities of the phenomenon (Yin, 2003).

According to Eisenhardt (1989), the case study is a powerful mean to contribute to the construction of theories. They support the replication and extension among individual cases. In this sense, Yin (2003) also adds to this argument, saying that cases must be carefully selected, so they can produce similar (literal replication) or completely opposite results, but for predictable reasons (theoretical replication).

Yin (2003) adds that case studies are appropriate for situations in which multiple sources of evidence and prior theoretical propositions are considered to guide data collection and analysis. Therefore, data collection was based on two sources: (i) extensive literature review; and (ii) in-depth interviews with key industry and institutional players. Primary data were

collected from a series of structured interviews conducted between Feb 4th and Feb 11th of 2015. The interviews were conducted with sector experts who represent a range of interests. In total, we interviewed 8 people: one project manager from state-owned company; three members of regulatory institutions; two union representatives, one director from a shipbuilding firm; and one member of research center.

We chose the naval sector, considering its historical and political institutionalization recognized that industry. Furthermore, consider also the accessibility and typicality of the shipbuilding industry and offshore Brazil, relying on the idea of a re-emerging sector.

## **5. Institutions of Brazilian Shipbuilding and Offshore Industry**

### *5.1 Historical industry context*

The Brazilian shipbuilding industry began more than a century ago. However, the economic instability culminated in the failure of Brazilian shipyards. The sector has undergone through growth and rapid decline cycles. Since the 2000, it is has been facing a new opportunity to reemerge backed by the opportunities in the offshore oil exploration and production activities and institutional incentives.

The starting point for this new institutional level was the opening of the Brazilian market and the creation of the Law of Oil in 1997. Thus, new players could participate in oil exploration and production (Barat, Neto & Paula, 2013). These actions enable the participation of the private sector in research activities, exploration, extraction, refining, export, import and distribution of oil and its derivatives.

Petrobrás is the leading company in the national market and its constant development meant that there was an increase in demand for new vessels. In a scenario where the economy has stabilized and there are institutional incentives, Petrobras created renewal programs of their fleet that allowed contracting and construction of vessels in Brazilian shipyards.

Thus, shipbuilding and offshore industry has created strategic importance for the development of the country due to the large volume of labor that attracts, and large financial investments. The offshore segment stands out for its relevance in intensive exploration and production of oil and natural gas offshore, creating demand for construction support vessels, drilling rigs, production and transportation, as well as drill ships and submarines (Barat, Neto & Paula, 2013; Foster, M., Alonso, P., Junior, E. & Cima, F., 2013)

With the heating of the shipbuilding and offshore industry and strong investment in the sector Petrobras reaped the first signs of oil in pre-salt layer in 2005 (Foster et al., 2013).

In this way, with the pre-salt announcement began a new stage in the Brazilian Shipbuilding and Offshore Industry. Accordingly, the federal government stepped up its participation in the industry through the creation of public policies for training, the labor qualification, development of industrial policy and business performance (Barat, Neto e Paula, 2013).

Investments for the development of the shipbuilding industry from the pre-salt exploration needs emerged with increased hiring of support craft services, and contracting services for construction of exploration and production platforms. However, the perspective for the shipping industry and Brazilian offshore are tiny. The political and economic crisis that the country faces does not allow the generation of employment and income. Therefore, market and technology development is not an assurance for the industry.

### *5.2 Types of institutional intervention*

To measure the institutional interventions in this industry, this study was limited to the period 1997-2014. This study adopts this period of analysis considered only a new opportunity to reemerge backed by the opportunities in the offshore oil exploration and production activities and institutional incentives. During this period were identified 19 institutional actions interventionist. The interventions identified in these study are shown in Table 1.

This institutions interventions are laws and institutional actions (political, economic and science and technology) that stimulated the development of the Brazilian shipbuilding and offshore industry. Analyzing this interventions we identify 12 institutional-pull interventions, 3 institutional-push interventions and 4 institutional pull and push interventions. These interventions are, in most part, public policies designed to ensure the development of labor and income generation. Stand out the Program of Revival of the Maritime Support Fleet (PROREFAM) and Program for Mobilization of the National Oil and Natural Gas (PROMINP) programs where the focus was on demand generation in the industry from the construction of oil platforms and qualification of available labor.

In this way, one interviewee, when asked about the stance adopted by the federal government, said: “everything that can be made in Brazil should be made in Brazil”. This statement allowed the development of the whole chain and began to warm the industry.

**Table 1 – Institutional Interventions**

<b>YEAR</b>	<b>INTERVENTIONS</b>	<b>DESCRIPTION</b>	<b>CLASSIFICATION</b>
1997	Law of Oil 9.478/97	Has enabled companies other Petrobras, acting in all links of the chain oil, provided under concession.	Institutional-pull
1997	Oil National Agency	Regulator of oil, natural gas and fuel, with the aim regular hiring and supervision of economic activities of the oil industry.	Institutional-pull
1998	Transpetro	Establishment of Petrobras transport company. The company operates in the import and export service of oil and oil products.	Institutional-pull
2000	Navigates Brazil Program	Political program that determines a set of actions which changed the craft of funding rules.	Institutional-pull
2000	Program of Revival of the Maritime Support Fleet (PROREFAM 1)	Renewal of the national fleet from the contracting and construction of 18 new vessels in Brazilian shipyards.	Institutional-pull and Institutional-push
2003	PROMINP - Law 4.925	The institution of the Program for Mobilization of the National Oil and Natural Gas (PROMINP), which aims to enhance the participation of national goods and service industry, competitive and sustainable manner, the implementation of oil and gas projects in Brazil and abroad.	Institutional-push
2004	Program of Revival of the Maritime Support Fleet (PROREFAM 2)	Continuing the fleet revival process. In this step, the requirements are now 60% local content for the hiring of 35 new vessels.	Institutional-pull and Institutional-push
2005	Program for Modernization and Expansion of the Fleet (PROMEF)	Program for Modernization and Expansion of the Fleet (PROMEF), whose objective was to modernize the national fleet through the construction of new vessels with increasing local content, more than 65%. This type of program seeks to encourage the growth of the national fleet.	Institutional-push
2005	Resolution 495/2005	Regulation of water transport, ensuring preference to Brazilian flag companies in the contracting freights and support services in port and maritime operations, as well as coastal shipping and inland national route.	Institutional-pull
2007	National Program of Logistics and Transport (PNLT)	National Program of Logistics and Transport (PNLT). PNLT is a government plan in order to recovery the planning process of the transport sector.	Institutional-pull
2007	Growth Acceleration Program (PAC1)	Growth Acceleration Program (PAC1). PAC1 promoted the resumption of the planning and execution of great works of social infrastructure, urban, logistics and energy in the country. PAC1 was a government program which considered the Brazilian naval industry as the most relevant industry, to make it possible to generate employment and income.	Institutional-pull
2008	Program of Revival of the Maritime Support Fleet (PROREFAM 3)	Continuing the fleet revival process. In this step, the requirements are now 50% and 70% local content for the hiring of 146 new vessels.	Institutional-pull and Institutional-push

2008	Law 11.774/2008	Exemption of tax (IPI) for industrial production on parts and materials for the construction of ships in domestic shipyards. Zeroing of PIS/PASEP and COFINS taxes on equipment for the marine industry.	Institutional-pull
2008	Program for Modernization and Expansion of the Fleet (PROMEF 2)	Continuing the Program for Modernization and Expansion of the Fleet, PROMEF 2, where the goal was the construction of 26 vessels and the creation of the Productive Development Policy (PDP).	Institutional-push
2009	Program Brazilian Companies Navigation (EBN)	Program Brazilian Companies Navigation (EBN). EBN is an action of Petrobras seeking to promote shipbuilding in the country. It is the construction of vessels made exclusively by Brazilian companies, in order to reduce dependence on foreign market.	Institutional-pull
2010	Law 12.276	Assures to Petrobras the right to research activities and oil mining in the pre-salt areas.	Institutional-pull
2010	Law 12.351	Ensures production and exploration in the pre-salt areas that are under control of the Union, so that determines Petrobras as the sole operator of the subsalt.	Institutional-pull
2011	Growth Acceleration Program (PAC2)	PAC 2 It was developed in order to continue the PAC 1, keeping the focus of the promotion of infrastructure, energy and transport.	Institutional-pull
2014	Support of the Merchant Marine Fund (FMM)	FMM confirmed the financial aid industry to carry out 207 projects to support the development of the shipbuilding industry.	Institutional-pull and Institutional-push

Source: adapted from Foster et al. (2013)

However, the labor force used in Brazilian shipbuilding and offshore industry is critical constant target for their training and skills. Thus, issues such as training, qualification and training were discussed during interviews. Talking about training an interviewed said: “a great number of employees who need to be able to get a job in this sector”. Some interviewed expressed the belief that “is terrible you have people with low skills, and it is amazing how it changes when you put people trained”.

The PROMINP results show that in the period 2006-2013 were more than 97,000 qualified professionals in various areas. Furthermore, rework rates are considered as a result of labor policy favorable to the development of the industry. Talking about this issue an interviewee said: “rework is the result of low labor qualification”. Beyond that, another interviewee, when asked about rework, said: “the qualification of the workforce have to get before the yard”. Thus, the qualification of employees should start even before the company start operating, (i.e. before the site starts operating).

In this sense, the executive coordinator from PROMINP argues: “Not just to be a great site operates in a specific geographic region of Brazil. It needs to have a supply chain around him”. To Petrobras, “Brazil is a country with continental dimensions and therefore requires greater attention on the integration of the supply chain that supplies the industry”.

In summary, for the informants in this study, It comes from government actions based on a government plan, thus allowing the building regulations. These regulations, whether pull or push, influence the development of the industry.

## **6. Concluding remarks**

The purpose of this research was to analyze the influence and the limits of the institutions of the generation of technological progress to development in the shipbuilding and offshore sector in Brazil. Technological progress is accepted as the phenomenon of economic development. Based on authors such as Bunker (1980) and Puffer e McCarthy (2007), this paper uses case study (Yin, 2003) as the research methodology to find how these firms organized their markets and technologies, considering the fact that they are part of an emerging industry in Brazil. The empirical contributions of this research are not only to set the analysis of the major vector and configuration status.

Thus, the historical context showed that the emerging Brazilian shipbuilding and offshore industry is a strong technology-based industry, and therefore lacks scientific and technological development. However, the prevalence of institutional-pull interventions shows focus on the market, which, in a way, coincides with the policies adopted by the government.

The highlights were interventions to promote the qualification of labor, regulation of trade, technological progress and development.

We understand that at first, the industry focus is on developing the transactional skills to then focus on technological progress, expanding research and development. The Brazilian Shipbuilding and Offshore Industry is a manufacturer of complex products, considering high investments, long production time, low annual production volume and especially its reliance on production for orders.

The efficiency of an industry goes beyond the simple adoption of a device or application of a technology, as it is hostage to the slow process of innovation, with new products or processes. Accordingly, it is necessary to further technological development associated with the management, making it possible to constant improvement and the identification of gaps that hinder the competitiveness of this industry.

However, it is necessary to consider that the Brazilian shipbuilding and offshore is a non-linear market, where the demands are not established and the trend is growing, from the emergence of the needs for new vessels. Thus, continuous review of local content index is a viable alternative, so that it can ensure the maintenance of the local industry and international competitiveness.

The influence that this industry has to develop part of the public policy change. This is an effort to change that involves all the institutional environment. However, are these actions that block the transition, or even improving, the institutional framework of an industrial activity sector, generating its limits: a) lack of technological capability; b) workers without qualification; c) institutional crisis.

Approaching the institutional crisis highlights the oil barrel price decline and the corruption scandals in the Brazilian political-economic scenario as limiting factors for technological progress and development. Therefore it is important that the issue identified in this research has theoretical implications to stimulate discussions on institutional theory, technological progress and development.

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