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Paper proposal to *ISA World Congress of
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Engineers & Brazilian Capitalist
Development :
Trends and Fractions
Inside a Professional Group

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Engineers and Brazilian Capitalist Development: trends and fractions inside a professional group

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1. Introduction:

The reflexions presented here are part of my ongoing PhD research which studies the engineers' collective identity constitution and their political attitude. I will present here some partial results of this general research, especially some of them coming of my quantitative approach: an on-line survey of Brazilian engineers.

The objective of this paper is bring some elements to understand the professional group² of Brazilian Engineers in the post-1990 period. It focuses on the relationship between the engineers attitudes and the State policies towards Brazilian development, specially the industrial policy. I suppose the “modernization” of Brazilian capitalism has impacted the engineers' political profiles and their collective identities. This “modernization” was based basically on neoliberal policies and on the transformation of the productive structure: privatizations, public investment reductions and opening up of the economy on one hand; new management tools and a new draft of the productive space on the other hand, respectively.

The fundamental aspects of this capitalist “modernization” are presented in the items 1.1 and 1.2.. The implementation of the neoliberal policies and the rupture with the former interventionist development model are showed in the item 1.1.1. The impact of the new management tools on the productive space and on the engineering labor market is described in the item 1.1.2. In the end of this introduction, I present the historically political influence of Brazilian engineers over the Brazilian political agenda after the 1950's, especially the industrial policy.

The item 2 announces my hypotheses through the review of the Brazilian literature. The methodological approach of the research is showed in the item 3. In the item 4, the results are analyzed and discussed. Finally, in the item 5, I comment all the results of this article, its limits and the future directions of my research.

1.1 The 'modernization' of Brazilian Capitalism

1.1.1 Brazilian capitalist development and neoliberalism

In developing countries the engineers' fate is linked closely to the State. To the extent that the economy of these countries is not sufficiently developed, State intervention becomes crucial. Generally speaking, between the 1930's and the 1990's, Brazil's model for national development was guided by direct State intervention into the economy. Between 1990 and the 2000's, this model

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2 The “professional group” concept has not the same meaning that the “professionals”, more common in the Anglophone literature. For the professional group concept the social and historical context are underlined in the formation of individual and professional identities. This idea comes into conflict against the general idea of an « established » profession (Dubar and Tripier, 1998).

was gradually deconstructed.

The evolution of the engineers' job market and their collective identity has been strongly influenced by State development. In the 1930's, government aid sought to stimulate the steel, electrical energy and ore mining sectors. From the 1950's on, economic growth was fed by a consolidated industrial base and by the development of other productive activities such as heavy industry and consumer durables, especially the auto industry. This development strategy consisted of having a policy of substitution for imports and stimulating internal production. The government set up a national bank for economic development (BNDES) and created many public companies. One of them was a huge state oil company (Petrobras) which had – from 1954 until 1997 – a monopoly over the entire sector from oil refinement to controlling the distribution of derived products (Serra, 1982).

During the 1990's, this model of autonomous development was brought into question by the structural reforms implemented by successive governments. The previous period's policy of substituting imports by domestically-produced goods gave way to a policy of opening up the economy to international competition. This was the start of a strong ideological offensive neoliberal against public (state owned) companies and their employees, and resulted in a period of intense privatizations (Cano, 2000 ; Biondi, 2003). Both the opening of the economy and the privatizations had an effect on employment, especially in the industrial sector. In 1991 for example, jobs in the industrial sector were cut by 25%. The literature calls this period the « de-nationalization » of Brazilian companies in the productive sector. Foreign capital increased via acquisitions of privatized companies. We can also note several private industries whose bankruptcy was followed by their incorporation into foreign companies (Biondi, 2003 ; Boito, 1998 ; Carneiro, 2002). According to Carneiro (2002), this period was marked by a premature and regressive process of “de-industrialization” of the main Latin-American economies: industrial production fell as a percentage of the GDP, and the high technology in industrial processes was reduced.

Between 1985 and 1990, during José Sarney's presidential term, the official rate of employment of engineers rose by 3.6%, from 144 to 172 000 jobs. After the implementation of the first neoliberal policies – opening up commerce, privatization and reducing public investment – between 1991 and 1992, this rate fell by 11.5%. The drop in the employment rate of engineers continued until 1999, with a rate of under 2.7% (Lombardi, 2004, 79). Thus, between 1989 and 1999, about 30% of engineers' employment, or 53 166 engineering jobs, disappeared.

Despite the reversal of this trend since 1999, with an increase of 3.4% of jobs until 2002, a low rate of professional occupation persists for engineers compared with the creation of other jobs. If we compare 2002 and 1989 (a year when there were a great many jobs for engineers (177 000)), we realize that there was still a deficit of 38 000 jobs in 2002. If we take into account the number of new engineers graduating during that period, the situation appears even more serious. Between 1991 and 2002, the number of new professionals rose from 13 000 to nearly 20 000 per year (Lombardi, 2004, 96).

From 2004 until the end of 2008, the country underwent a new situation. The growth of the global economy made it possible to increase the volume of Brazil's exports (especially in the sectors of agriculture and mineral extraction). This situation also increased the liquidity of Brazilian capital in the world market. The Lula government, supported by the positive balance of payments, adopted several measures to encourage internal industrialization and the modernization of the country's infrastructure.

In 2007, the government created the Plano de Aceleração do Crescimento (PAC) to increase new public and private investment in industrialization and infrastructure. The government's forecast for investments is over 1 thousand billion R\$ (about € 300 billion) until 2010. According to government figures, investment in infrastructure compared to GDP increased by 0.64%, in 2006, to 1% in 2008. During the same period, the GDP increased as follows: 3.7% in 2006, 5.4% in 2007

and 6.4% in the first three trimesters of 2008. (Balanço do PAC, 2009).³

Figures for engineers' employment over this period are still unavailable. However, from information given by the profession's trade unions, it can be said that the economic bounce-back increased the level of employment of engineers. Until July 2008, some engineer's organizations proposed that the country double the number of graduate engineers over the coming ten years, especially in the sectors of production, mechanics and electronics (Procuram-se engenheiros, 2008).

1.1.2 Productive structure

According to the general literature, the strong relationship between engineers and the productive structure resides in the fact that their general conditions of work and employment have undergone profound modifications in this area. Changes in the organization of production, new configurations of technological innovation and the management of human resources have brought about structural changes that impact the professional group of engineers.

The change in the organization of production from huge factories and industries towards a system where products and services are sub-contracted also affects engineers' identity. In as much as they are no longer concentrated inside large units of production, the productive space is no longer a privileged place where a collective identity can be forged. Even when engineers work in the same physical space, the fact that they belong to different companies and have differing statuses affects their relationship.

These new paradigms in terms of management can affect the professional group in several ways. Although the new paradigms give engineers more autonomy for managing ordinary activities, this autonomy is restricted by the rigidity of the objectives imposed and the time pressure for achieving those objectives within strict deadlines (Paradeise, 2008).

According to Dubar and Tripiier (1998), for « professionals » in general, it means that former links are weakened in favor of another type of « professional identity » which is more closely allied to a company viewpoint. Charriaux et Jean (1997) consider this movement as a « broadening of the professional sphere »⁴ of engineers. The authors stress various levels of this, for example the purely technical and the functional levels (which is related to maintenance for those in charge of projects or products). This involves an enlargement of the work activity towards financial and economic management as well as technology and marketing (Charriaux et Jean, 1997).

In Brazil, we had two steps towards the modernization of the productive structure. In the 1980's, some industries started to implement any restricted measures to minimize the effects of the Brazilian economic downturn of that decade. The firms wanted to reduce the production costs and improve the quality of their products. So they tried to introduce measures like total quality programs, flexibility of some jobs and semi-autonomous working groups (Fleury, 1985). After 1985, the first implantations of technological innovations based on microelectronics (Rabelo, 1989; Alves, 2000) are noticed. The second step was made possible by governmental policies as the opening up of the economy. One of the "obstacles" to the systematically modernization of the productive structure was the strong trade unionism movement. The opening up of the economy aid any firms to surmount the trade union's resistance by raising the unemployment rate. It contributed as well to complete the process of technological improvement by importing foreign technology. In the case of the automaker industry, one of the most important of the country, this economic policy has allowed the restructuring of the suppliers by a "global sourcing". In the 1980's there were 2 000 auto parts suppliers in the country. In 1997 this number was reduced to 930 firms. The employment rate of this sector was down dramatically: 259 000 to 193 000, between 1991 and 1997 (Pinto, 2003).

3 The PAC thus met the demands of the National Federation of Engineers and its movement for the country's development « Cresce Brasil + Engenharia + Desenvolvimento ». In 2006, engineers in the organization issued a manifesto for the urgent uptake of several measures which were almost all satisfied by the PAC (*Manifesto Cresce-Brasil, 2006; FNE, 2007*).

4 « Un élargissement de la professionnalité » in the French expression.

The engineering labor market was affected as showed above. This process has transformed the engineers' professional profile as well. According to the literature, the engineer's normal activities involve more and more responsibilities. A whole gamut of new tasks must be accomplished within a short period of time : supervising workmen, dealing with employee administration and working conditions, negotiations with trade unions, managing financial reports, liaising with suppliers and customers, carrying out quality controls, checking deadlines etc. (Lombardi, 2004 ; Laudares, 2000).

1.2 Engineers and the Brazilian development agenda

Historically, engineers have gotten a strong influence on the delimitation of the strategical decisions in the Brazilian industrial development. The politic agenda has been influenced by engineers as technical bureaucrats and by their interest groups – trade unions and professional organizations.

As explained above, after 1930 the country underwent a deeper transformation in the State structure and concerning its creation of economic intervention towards industrialization. The literature shows that engineers were privileged players in this process, as the new technical bureaucratic elite of the State. Such technocrats have made up the government and its core agencies that administered industrial, agricultural and internal development functions. In addition, the most important public companies were managed by engineers between 1945 and 1965 (Dias, 1994).⁵

The engineers professional group exerts significant influence on the Brazilian political agenda trough interest groups.

Based on the fascist concept of the relationship between trade unions and State, the Getúlio Vargas administration (1930-1945) has transfered State powers to unionized engineers. It created the “Conselho Federal de Engenharia, Arquitetura e Agronomia” (CONFEA – The Federal Council of Engineering, Acrchitecture and Agronomy). This is a professional organization which has a set of regulating powers: regulating engineers' labor market, stipulating and supervising technical standards. The CONFEA still exists today. Moreover, trade unionism system is based on a representation monopoly controlled by the “official-legal” trade union. This one must be recognized by the State as the legal spokesman of the professionals in a defined region of the country. Only the official trade unions can discuss and solve labor problems and conflicts (Boito, 1991).

During the military dictatorship (1964-1985), the engineers' organizations tended to move towards the industrial organizations attitudes, especially the Confederação Nacional das Indústrias (CNI – Nationl Confederation of Industries) and the Federação das Indústrias do Estado de São Paulo (FIESP – Federation of Industries of the State of São Paulo). In that period, their leaders estop corresponding with the aspirations of their bases; the typical work situation of these professionals was changed and engineers became salary workers (Bonelli, 1989). Due to the radicalism of the authoritarian period in the later 1960's, these “new” engineers disputed the directions of their legal organizations only in the end of the 1970's. Their movement was known as the “movimento de renovação” - the renovation movement (Kawamura, 1986). In general, they were connected to a large national movement which fought for democratic rights and greater political say. According to the literature, the growth rate of professionals associations (including trade unions) between 1978-1983 was remarkable: 37% for lawyers, 56% for teachers, 43% for civil servants, 69% for engineers, 44% for doctors, 23% for technicians, 31% for artists, 28% for journalists, etc. (Bosch, 1987).

The Brazilian engineers' trade unions and professional associations played a key role during the

⁵ According to Dias (1994, 53) these companies were: Companhia Siderúrgica Nacional (CSN, steelwork), Companhia Vale do Rio Doce (CVRD, ore mining), Companhia Nacional de Álcalis (CAN, caustic soda), Companhia Hidroelétrica do São Francisco (Chesf, electrical energy) and Petrobrás (oil&gas).

1980's. By arguing for the “defense of the national technology”, some of these organizations tried to influence the political agenda in favor of industrial protectionism and defense of public companies and strategic State monopolies (Kawamura, 1986; Larangeira, 1991). Moreover, the engineers' organizations have become in some regions (São Paulo, Rio de Janeiro, Rio Grande do Sul, etc) important local players through lobbying or electing regional deputies (Bittar, s/d).

2. Literature review and hypothesis

During the second half of the 20th Century, the development of Brazilian capitalism has been deeply influenced theoretically by the CEPAL.⁶ The CEPALs' most important contribution was the idea that there is no single “correct” model of economic development. With a competent staff of Latin-American economists and sociologists, they tried to explain Latin-American's underdeveloped situation and attempted to formulate alternative economic projects (Bielschowsky, 1995; Cardoso&Faletto, 1970). Amongst all of the different theoretical trends present in the Brazilian scenario, two had a deep impact into the governmental policies and public debates. According to Bielschowsky (1995), we can distinguish two nationalist trends that supported “public” and “private” development.

Both agreed with the need for protectionist policies and the concept of economic planning as essential, especially in terms of substitutions for imports and stimulating internal production. The point of contention was whether public or private development model should be pursued. Roberto Simonsen was the most important proponent of private development. Supporters of this school of thought thought that only the national private capital development would lead the country to economic development and social wealth. In terms of economic policies, they clamored for more industrial credit policies and commercial protection. Their goal was high private profit as source of economic and social investment. They accepted the creation of public companies, but only when the private national capital was not able to invest. The opposing point of view was represented by Celso Furtado, who championed public development. This trend called for state monopoly of strategic sectors and for a capitalist development based on public companies. According to this point of view, public investments should be based on taxes. These policies – stimulating public companies and taxing – both oppose the policies proposed by the supporters of private development. Moreover, the advocates of public development thought economic growth and reduction of social/regional inequalities was not a natural result of a private sector development, which they thought should be guaranteed by an effective State intervention (Bielschowsky, 1995).

As indicated by the literature, the engineers' political attitude was diversified as well. Some engineers' professional organizations advocated for protection of the “national technology”. According to Kawamura (1986), behind this proposition they claimed protection for the private engineering design firms against the “foreign technology” and against the “state bureaucracy” (i.e. for tax reductions). At the same time, these organizations supported the State monopoly of strategic sectors and requested the end of private monopolies and its take over by the State. This paradox can be explained by the fact that the most part of the engineers worked for the State (companies and bureaucracy) and for small engineering design firms dependent on public demand.

My first hypothesis is the engineers' political attitudes have been modified after 1990.

Hypotheses 1: (1) The privatizations of public productive companies, (2) the replacement of the project of State as core of technological development and (3) the new management tools associated with a new configuration of the productive structure have contributed to redefine the engineers' political attitude.

⁶ Comisión Económica para América Latina y Caribe.

- 1.1 The concept of public companies and public management characteristics of the former period could not find a fairly support amongst engineers as in the past. All of these three changes would have introduced a trend amongst Brazilian engineers towards the private political field. The introduction of the new management tools – completely – into some privatized companies and – partial – into some public companies play a key role in this process. Brazilian engineers are increasingly stimulated to have an individual career management and to be closely linked to the performance and financial results of the companies.
- 1.2 Besides that the outsourcing strategy has connected many different actors – national and international, depending on the sector⁷ – as stakeholders in the same productive process. Engineers, coming from different working environment – connected in design projects, production, sales. This way would have had a high influence on any engineers stance concerning industrial protectionism mechanisms. I suppose that these kind of policies, depending on the sector, have no more engineers' support like in the past.

My second hypotheses is the general movement of the productive structure evolution would have touched the formation of the engineers' professional and collective identities.

According to the literature which analyzes the Brazilian engineers in the 1980's, the productive hierarchical position had an influence on the formation of the engineers' identity. Based on a survey, Simões (1992) shows as their professional identity and political profile had a narrow relationship with the hierarchical position. Based on the Eric Olin Wright (1978) concept of “contradictory class position”, the author uses three categories to understand the engineers identity formation: managers, supervisors and no managers. Simões asserts Brazilian engineers had not a professional homogeneous conservative position such as conceived by Larsons and Goldthorpe. Engineers no managers, for her, were closer to a salary professional identity. Moreover, the author shows they had a trend towards the workers' trade unions and their collective actions based on strikes.

I suppose that the contemporary transformations of the Brazilian productive structure have had impacts on this former framework. The introduction of the concept of “project manager” – and “product engineer” – would inflect the constitution of the professional and collective identities.

Hypotheses 2: It would be possible to use the “project manager” position as an analytical category to comprehend the professional and collective identities of Brazilian engineers.

Adding this category to the engineers' hierarchical and ownership/salary position could improve the sociological analyze.

In this terms professional and collective identity could vary depending on new categories: entrepreneurs, general managers, general managers-project manager, intermediate managers-project manager, intermediate managers, project managers and engineers. As the hierarchical position means control of production process and labor process – from yourself or from others –, the project manager would mean a resource – beyond the engineering degree – in terms of controlling a technology, a know-how or a specific skill. This resource might be seen as a relatively autonomy in the labor process or in the production process.

- 2.1 In this situation it is possible to mind a conflict between which the engineers want to do as the “best project” – in terms of material supply, human resources, deadline, etc. – and the real work condition with restricted budgets and short deadlines. So the conditions of the project conduction would be an instrument capable to measure the precariousness sentiment and professional dissatisfaction.

⁷ In aeronautics, for example, the Brazilian aircraft production is highly integrate on the international production chain of suppliers and design projects (Oliveira, 2008).

- 2.2 Depending on the salary level and the personal trajectory, these sentiments could be apprehended in terms of distancing engineers project managers from the ruling class perception – which in some cases, could approach them toward a sense of popular classes belonging.
- 2.3 However, it would remain boundaries between engineers and the working class beyond the engineering degree. The engineers project managers would tend to see themselves more as professionals than salary workers. In this case, it could be plus an argument to help to explain the weakness of workers' strategy of action – as trade-unionism and strikes – amongst some of these engineers.

3. Methodology

This paper is a partial result of my ongoing PhD research. The discussion is based on some results of my survey of Brazilian engineers. The proposal of the completely research is combine the quantitative data – the survey – with a qualitative data – companies' case studies and interviews with the engineers' organizations leaderships. In accordance with this, the survey analysis has more an indicative value than a statistic contribution.⁸

3.1 Survey

The survey contained about 90 questions based on French studies, in particular the socio-economic situation of engineers and working conditions of executives⁹. Taking an average of 20 minutes, more than 400 engineers responded to four groups of questions: 1) personal information and the characteristics of their company for those still in employment, educational background, employment history; 2) activity and professional profile, type and level of remuneration, involvement with the financial market, satisfaction and autonomy in the work situation; 3) political profile, trade union and association membership; and 4) social origin and professional mobility.

The survey was carried out in three phases. Firstly, we talked with the French researchers. Then the questionnaire was translated into Portuguese and discussed with the Brazilian researchers. The third phase consisted of testing the questionnaire on several engineers and representatives of trade unions and associations.

The questionnaire was put on line at the beginning of June 2009 and remained active until the end of August. For its diffusion, we relied on the wide support of associations, trade unions and other organizations representing the professional category nationwide.

3.2 Sample

I collected 403 hundred completely responses. In carrying out the questionnaire and in view of the responses, the most populated regions of the country were over-represented. I tried to reinforce the diffusion of the questionnaire in the regions and areas of activity which were under-represented in the sample. Although the final regional representation has been close to the regional economic developments (*Estado de São Paulo*, 2005), the North East region is over-represented in the sample and the South region is under-represented: South East, 48%; North East, 21%; South, 8.5%; North, 3%; and Central West, 2.5%.

⁸ This is due to the fact that there are more than 400 000 people who have the engineering degree in Brazil.

⁹ Particularly the following : « 20^e enquête du CNISF sur la situation socioéconomique des ingénieurs en 2008 »; « Travail en Question – Cadres 2002 » CFDT; « Histoire de vie » INSEE; also a study of the executives of the SNCF (French National Railways). In our study, we thank the following people for their remarks and suggestions: Chantal Darsch, Maria Rosa Lombardi, Patrícia Trópia, Marcia Nori, Rafael Machiaverni, Eduardo Guerra Ibarra and Marcos Paulo da Silva.

The gender representation has been in balanced. In accordance with other researches (Lombardi, 2004), 17% of the sample is made up by engineer women.

A second limit to the initial sample was the over-representation of unionized engineers. This can be explained because this population was the first to have responded to the questionnaire. I tried to correct this distortion by reinforcing the diffusion of the questionnaire to associations representing excellence within the profession and to organizations of professional branches. So the final sample is made up by 34% of unionized engineers.

3.3 Measuring instruments

3.3.1 Dependent variables

The survey analyses are based on three kinds of dependent variables. The first one is the age. In the questionnaire I asked the engineers to write the year of birth. Then all the responses were gathered by decade of birth. For the eldest engineers I gathered them on two decades of birth: 1920-1930 and 1940-1950.

The second dependent variables is the sector of employment. I distinguished the engineers by private sector, non-governmental organizations (NGOs) and public sector. The last one was discriminated between public companies and bureaucracy.

The third group of dependent variables is related to the hierarchy, ownership and salary condition, and control of projects.

There were two questions on the survey concerning hierarchy activities. They asked the engineers if 1) they had hierarchical responsibilities, as management or chief; and if the response was positive, it asked 2) what kind of hierarchical responsibilities the engineer had. There were three possibilities of response: 1) management of a small team, 2) management of a whole department or service, and 3) general management.

Concerning the ownership or salary condition, there were two main questions. First I asked what was the labor condition of the engineers: in activity or out of activity (unemployed or retired). After there was a second question which asked what was their labor relationship. The possible answers were entrepreneur (ownership) or salary worker.

Concerning the variable related to control of projects, there were two questions. First: if the engineers were project managers, yes or not; then, second, what kind of control they had over the project, total or partial control.

3.3.2 Independent variables

Amongst the independent variables on the survey, I used here two type of them. One is related to the political profile of the engineers: the preferences concerning nationalism/interventionism, public/private management and economics policies.

Concerning the engineers' political stance related to the Brazilian large companies, the questionnaire asked what should be done with his firms. On the question there were the names of some historical important Brazilian public companies, as Petrobras, Embraer and Vale (CVRD). There were five possibilities of responses:

- 1) a liberal point of view, “the government should not intervene. Let them be regulated by the laws of the global market”;
- 2) a nationalist interventionist point of view for state intervention and management, “the Brazilian State should re-nationalise these companies and take over their management”;
- 3) a nationalist interventionist point of view, “the Brazilian State should nationalise them and

try to be a major shareholder”;

- 4) a “diffuse nationalist” point of view, “they [the firms] should still be Brazilian with national capital, whatever public or private”;
- 5) and “another opinion”.

In these responses, I did not refer to the different types of nationalism. The responses were presented in a different order for each new respondent. Moreover, all questions in the survey concerning the political profile of engineers could be left unanswered.

Regarding their attitude concerning what of private or public management is the most efficient, there was one another closed question with four possibilities of response: private, public, both were similar, they were not comparable.

Concerning the economic policies, the questionnaire asked them what should be done to stop unemployment growth and to stimulate economic development in Brazil. There were any possibilities more or less closed to the main political groups (private capital, trade unions, etc.): interest rates reduction, less labor right costs, taxes reduction, general reduction of work journey, general reduction of salaries, more State investment on infrastructure and technology, trade protectionism, employment guarantee for a period, another policy.

The second group of independent variables used on the survey concerning to their professional profile, revenue and their collective identities. I used questions related to class identity, professional identity and professional autonomy and satisfaction.

To know the engineers sense of class belonging the survey had two question. The first one asked them if their had a sense of class belonging, with responses “yes”, “no” and “I don't know”. Then, if the response was “yes”, there was an another open question which demanded them to fill in the class name they thought.

Concerning the level of their autonomy and satisfaction related to production decisions the questionnaire stimulated them to choose among five possibilities concerning organizational decisions, technological and financial decisions: “I have influence and I am relatively satisfied”, “I have influence but I think I should have more”, “I have not enough influence but I don't worry about it”, “I have not enough influence but I should have more” and “another opinion”. The professional trajectory satisfaction was measured using a five-point scale: (1) a “successful” trajectory and (5) a “disappointing” trajectory.

The professional identity was measured by asking them to choose and to rank over multiples possibilities of professional profiles. The engineers might identify themselves among these possibilities: executive, stakeholder, chief, team leader, manager, leader, professional, employee, colleague, salary work or another.¹⁰

The question concerning engineers’ revenue related to the gross revenue for the whole of 2008 (salaries, advantages, bonuses etc.). I used 5 levels of remuneration. Without mentioning this on the questionnaire, I used the value of the Brazilian minimum salary for June 2009 (R\$ 465,00) as a reference for the various levels of revenue : (1) under 5 salaries accumulated during one year ; (2) between 5 and 10 ; (3) between 10 and 20, (4) between 20 and 30 and (5) over 30 salaries.

This research was made up of different phases using open source software. Lime Survey was used for the creation and diffusion of the questionnaire. For statistical data, R software, especially « R Commander » was invaluable. Then for word processing and tables I relied on Open Office.¹¹

¹⁰ In Portuguese, respectively: executivo, colaborador, diretor, responsável de equipe, líder, profissional, funcionário, colega, trabalhador assalariado, outra.

¹¹ During this phase, we relied on the support of the Lest technicians, particularly Sara Famiglietti, Patrice Cacciuttolo

4. Results and Discussion

A analysis of the survey shows that the engineers have a fairly strong political attitude towards a “diffuse nationalism” concerning the Brazilian largest companies. If we take into account the age, almost all the age groups have responded prefer that this company still Brazilian whatever the origin of the shareholder – private or public. According to the table 1, over than 40% off all age groups concord with the diffuse nationalism (marked in blue). However the only group which has supported a substantial public intervention – direct or indirect in the companies – to accomplish it is those who were born in the 1960's. I suppose this stance (about 30%, marked in orange) is due to the fact of these engineers are those who more suffered the effects of the reengineering in the 1990's. Aged over 30 years, they would have lost their jobs or have had more difficulties to maintain themselves in the engineering labor market.

Table 1 : Political Stance concerning large companies according to decade of birth

	Diffuse Nationalism	Nationalism Interventionist	Liberalism	Others	Total	Total%
1920-30's	44%	11%	39%	6%	18	100%
1940-50's	44%	20%	28%	8%	114	100%
1960's	35%	30%	26%	9%	66	100%
1970's	42%	26%	21%	11%	89	100%
1980's	51%	24%	20%	5%	116	100%
Total					403	

Source: Survey *Radiografia dos Engenheiros no Brasil*, 2009.

Considering the engineers stance according to their employers, it is remarkable an existence of a fraction inside the engineers who work for the public sector. This cleavage could be found comparing those who works for public companies to those who are allocated in the public bureaucracy. The first one, whose would have undergone a deep change in their work situation, have not opted for a public intervention as they have done for the diffuse solution, 31% and 43% respectively (*cf.* Table 2). As showed in the table 2, only the civil servants have supported mostly public intervention (52%). This cleavage persist comparing their preference by public or private management. As evident the engineers from the private sector opt mostly for the private management (66%, *cf.* Table 3). However, one third of the engineers of public companies (34%) have chosen the type private of management. The most part of the public servants (70%) have not preferred compare the both kind of management, opting for the answer “they correspond to different reasons of management” (table 3).

Table 2 : Political Stance concerning large companies according to public/private sector

	Diffuse Nationalism	Nationalism Interventionist	Liberalism	Others	Total	Total%
Private Sector	47	15	31	7	193	100%
Public Sector Companies	43	31	15	11	110	100%
Public Sector Bureaucracy	30	52	15	3	27	100%
NGOs	27	27	27	19	15	100%
Total					345	

Source: Survey *Radiografia dos Engenheiros no Brasil*, 2009.

Table 3 : Political Stance concerning public/private management according to public/private sector

	Private management	Public management	Different reasons	Indifferent	Total	Total%
Private Sector	66	2	27	3	193	98%
Public Sector Companies	34	2	54	8	110	98%
Public Sector Bureaucracy	22	4	70	4	27	100%
NGOs	47	0	53	0	15	100%
Total					345	

Source: Survey *Radiografia dos Engenheiros no Brasil*, 2009.

The survey results show as the engineers are closer to the Brazilian private development concept. As we can see in the table 4, the engineers have had a high preference for the traditional policies supported by the private capital: taxes reduction, more credit (interest rates reduction), reduction of the costs of the labor protection and more public investments in infrastructure and technology. This position is similar taking into account the sector public and private, presenting some particularities preferences: tax reduction amongst the engineers from private firms, 36.8%; more public investment amongst the engineers from public companies, 32.7%; and interest rates reduction amongst the civil servant engineers, 29.6%.

Table 4: Political Stance concerning State policies

	Firs option	Second Opt.	Third Opt.
Taxes reduction	31	27	17
Interest rates reduction	18	18	21
More State investment	23	18	18
Less labor right costs	18	19	12
Protectionism	3	8	7
Others	6	5	13
Total %	99	95	88

Source: Survey *Radiografia dos Engenheiros no Brasil*, 2009

The tables 5, 6 and 7 propose a engineers classification based on the ownership, hierarchy and control of projects.

Despite the high level of organizational and technological decisions autonomy amongst the engineers project managers (with no hierarchical functions), the survey shows they have a dissatisfaction related to their influence concerning financial decisions (table 5). Concerning the engineers (no entrepreneurs, no project managers and with no hierarchical functions) the situations is almost similar, exception for their lower technological decision autonomy (table 5).

I suggest that there might been a relationship between these scales of autonomy and their evaluation in terms of professional life.

Table 5: autonomy and satisfaction related to production decisions according to ownership/hierarchy/project manger

	Organizational decisions	Technological decisions	Financial Decisions	Total
entrepreneur	87 % as	82 % as	87 % as	23
general manager	71 % as 28 % ans	57 % as 14 % ans 29 % dis	57 % as 43 % dis	6
Total %	99	100	100	
gen. man-proj. man.	86 % as 13 % ans	77 % as 18 % ans 5 % dis	68 % as 18 % ans 14 % dis	9
Total %	99	100	100	
int. man-proj. man.	44 % as 41 % ans 14 % dis	48 % as 27 % ans 22 % dis	36 % as 21 % ans 40 % dis	59
Total %	99	97	97	
intermediate manager	48 % as 35 % ans 16 % dis	38 % as 32 % ans 30 % dis	24 % as 19 % ans 51 % dis	35
Total %	91	100	94	
project manager	31 % as 23 % ans 42 % dis	45 % as 33 % ans 19 % dis	11 % as 20 % ans 65 % dis	85
Total %	96	97	96	
engineer	29 % as 23 % ans 42 % dis	30 % as 23 % ans 34 % dis	14 % as 9 % ans 62 % dis	129
Total %	94	87	85	

Source: survey *Radiografia dos Engenheiros no Brasil*, 2009

as = engineers who have autonomy and are satisfied

ans = engineers who have autonomy but are not at all satisfied

dis = engineers who have few autonomy and are dissatisfied

Table 6 indicates a decrease of the sentiment of professional successfulness amongst the engineers no entrepreneurs and no managers. In the top of the table we can see a high successfulness level, from 43 % (entrepreneurs) to 100% (general managers). As we can see below, it is remarkable the reduction of this sentiment. In the base of the table there are 44% of the project managers and 48% of the engineers who do not evaluate their professional trajectories as positive.

Table 6: Professional trajectory evaluation according to ownership/hierarchy/project manager

	successful 1	2	3	4	disappointing 5	Total	Total %
entrepreneur	43	30	0	13	13	23	100
general manager	100	0	0	0	0	6	100
gen. man.-proj. man.	50	18	0	13	13	9	94
int. man.-proj. man.	29	45	10	11	5	59	100
intermediate manager	30	38	22	8	0	35	98
project manager	20	35	30	7	7	85	99
engineer	19	33	23	17	8	129	100

Source: survey *Radiografia dos Engenheiros no Brasil*, 2009

The analyses of the results show that each of these categories present fractions as well. Meanwhile, some trends can be observed comparing revenue, professional identity and class identity.

The biggest revenues are concentrated on entrepreneurs, general managers and general managers-project managers: 56%, 83% and 44% over 20 times the value of the Brazilian minimum salary, respectively (*cf.* Table 7). On the other hand, 40% of the intermediate managers, 45% of the project managers and 41% of the engineers receive under 10 minimum salaries. More precisely, 18% of the project managers and 15% of the engineers receive under 5 Brazilian minimum salaries (*cf.* Table 7). In this case, it is remarkable a correspondence between the lowest revenue level of both and their class identity, close to the popular classes: 15% and 9%, respectively. This situation does not repeat for the other categories. Even though the intermediate managers-project managers and the intermediate managers present both low strata of revenues – 20% and 40% under 5 minimum salaries, respectively –, this does not mean increase of the sense of popular classes belonging. Then we can presume the hierarchical factor still to have a strong element of heterogeneity amongst the salary workers.

Nevertheless the fact of this similitudes between project managers and engineers, they do not have the same professional identity. On one hand, project managers have seen themselves as professionals, team leaders, leaders and chiefs. Alternatively, on the other hand, engineers have considered themselves as professionals, team leaders, stakeholders and employees (*cf.* table 7). This means the group of engineers (no project managers and no managers) is closer to the salary identity. We can presume as well that the category of project manager correspond to a different perception of the reality, closer to the other groups.

Table 7: revenu, professional identity and class identity according to ownership/hierarchy/project manger

	Revenu*	professional identity (technical-managerial)	professional identity – 1rs. option	professional identity – 2nd. option	sense of class belonging	class identity
entrepreneur	30 (1) 26 (2) 13 (3) 26 (4)	48 t 43 m	43 executive 30 chief 13 manager 8 leader	21 executive 17 leader 17 team leader 17 professional	67%	33 rulling 33 intermid. 0 popular
Total %	95%	91%	94%	72%		65%
general manager	33 (1) 50 (2) 17 (3)	50 t 50 m	66 executive 16 manager 16 chief	33 leader 16 professional 16 chief 16 manager	50%	50 rulling
Total %	100%	100%	98%	81%		50%
gen. man-proj. man.	22 (1) 22 (2) 33 (3) 22 (4)	67 t 33 m	33 professional 22 executive 22 chief	22 executive 22 chief 22 professional	78%	22 rulling 44 intermid. 10 popular
Total %	99%	100%	77%	66%		78%
int. man-proj. man.	14 (1) 20 (2) 39 (3) 20 (5)	64 t 27 m	27 leader 22 chief 16 professional	29 team leader 22 leader 12 manager 9 chief	62%	10 rulling 46 intermid. 6 popular
Total %	93%	101%	65%	72%		62%
intermediate manager	9 (1) 6 (2) 34 (3) 40 (4)	69 t 20	31 manager 20 team leader 11 professional 11 leader	29 leader 20 team leader 14 manager	71%	6 rulling 54 intermid. 11 popular
Total %	89%	89%	73%	63%		71%
project manager	6 (1) 18 (2) 31 (3) 27 (4) 18 (5)	79 t 9 m	42 professional 14 team leader 9 chief 9 leader	17 team leader 17 leader 15 professional 13 stakeholder	64%	10 rulling 39 intermid. 15 popular
Total %	100%	88%	74%	62%		64%
engineer	5 (1) 14 (2) 40 (3) 26 (4) 15 (5)	74 t 6 m	39 professional 13 team leader 11 stakeholder	15 professional 15 stakeholder 15 employee	64%	7 rulling 48 intermid. 9 popular
Total %	100%	80%	63%%	45%		64%

Source: survey *Radiografia dos Engenheiros no Brasil*, 2009

* (1) = over 30 Brazilian minimum salary (R\$ 465,00), (2) = between 20 and 30, (3) = between 10 and 20, (4) = between 5 and 10, and (5) = under 5 salaries. Values of June 2009.

5. Conclusions, research limits and future directions

In this paper I developed the idea of contemporary Brazilian capitalism development has impacted the engineers' political profile and their collective identity formation. For this reason, I presented some results of my nationwide survey, *Radiografia dos Engenheiros no Brasil*. The hypotheses demonstrated here, are based on these results.

However, this paper constitutes an ongoing PhD research. It still limited concerning the representation of the Brazilian engineers. The research methodology relies on quantitative analyses plus qualitative analyses. In other words, to catch the engineers own interpretative constructions up is necessary non-directives interviews (Thiollent, 1982). In this way my survey proposition is to have an *indicative function* of the Brazilian engineers political profile and collective identity.

Another limit of this paper is not take the actions of the engineers representative organizations into consideration. There are important organizations that shall be analyzed, as the federal engineers' council (Confea), the two national – official – trade union associations (Federação Nacional dos Engenheiros and Federação Interestadual de Sindicatos de Engenheiros, FNE and Fisenge respectively) and other historically traditional professional associations (the Instituto de Engenharia and the Clube de Engenharia do Rio de Janeiro).

The paper introduced two new hypotheses attached to the contemporary Brazilian capitalism development. The neoliberalism policies combined with the productive structural changes have introduced a new scenario since the 1990's. My hypotheses are that engineers political profile and their collective identity have been undergone by the effects of this new scenario.

Based on the Brazilian literature I showed as there were two different State interventionism opinions of economics development after the 1950's. One of that based on a economic development focused on private capital development, another based on the public sector development. I presented how the literature see the emergence of a new movement of salary professionals linked with the end of the military dictatorship period (after 1978). it was showed as well how their organizations had a strong influence on the public and private development conceptions in the 1980's.

My first hypotheses introduced is that the neoliberalism (privatizations, reductions of public investment) and the productive structure transformation (new management tool, new productive configuration) would have impacted the political profile of the Brazilian engineers. These would be more and more closed to the private management and the private development nationalism. I explained how there would be a trend amongst Brazilian engineers towards a “diffuse nationalism” in prejudice of a more active State interventionism nationalism. I described how this impact could affect engineers differently. The private development nationalism as well as the private management would be become more influent element amongst the engineers of public companies.

The second hypotheses is based on the introduction of a new analytical category to understand collective identities formation concerning the work situations influences. The “project manager” would mean a new situation capable to change professional identity and to impact class identity. Some project manager engineers – with no hierarchical powers – would be closer to a popular classes identity as well as some salary engineers – no hierarchical managers and no project managers. I argued that this trend would be linked to the salary level. However these project managers engineers are not automatically converted into “merely” salary engineers: their work situation, based on new kind of responsibilities, would change their professional identity. Although amongst salary engineers there would be present a professional identity based on salary identities, the project managers would see themselves more as professionals and leaders.

Finally I would like to make a last important consideration. Despite the strengthening of the private

development nationalism and of the private management amongst Brazilian engineers, this would be regarded with prudence. The engineers' political attitudes concerning specific policies will depend on the political forces acting in the political conjuncture. In this way, the existence of popular identity trends amongst some engineers could be converted into a different political position, for example, towards some elements of a public nationalism development.

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