

# WHERE AND HOW MANY ARE THE PRODUCTION ENGINEERS WHO WORK IN BRAZILIAN FEDERAL PUBLIC SECTOR?

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*As other developing countries, Brazil has experienced an issue of establishing a high quality level of public management. On the other hand, production engineers have in their undergraduate curricula several subjects that develop skills such as quality, management, leadership and operational research that make production engineers alumni suitable to contribute to improve the quality of public management. In this scenario, a question appears: how many are the production engineers currently working in the Brazilian public sector? The main objective of this paper is to answer this question. This research is carried out under the construction of primary data by asking different instances of government. So, this research also presents data about where these engineers are working. Main findings of the research show that there are more than 1,000 production engineers currently working in Direct and Indirect Administration of Brazilian public sector. They are spread among many public agencies and public bodies, with a high concentration on Petrobras - Brazilian public company on oil exploitation. This work presents a relevant contribution to the community of production engineering by defining for the first time the amount of these professionals in the public sector. This data compilation will make possible to carry out some new research on this matter using a quantitative approach.*

*Palavras-chave: public sector, government, production engineering, public tender*

## 1. Introduction

Brazilian public sector has been passing through relevant changes in last decades. Rising of New Public Management (Jesus & Costa, 2014) as well as the increasing of complexity of relationships between public sector and its stakeholders (Pfeiffer, 2000) have made room for Production Engineering in public sector (Jesus & Costa, 2014; 2013).

Production Engineering remains as an area of constant rising, what can be seen in the increasing of courses in Production Engineering (PE) in Brazil (Borchardt et al., 2009). However, information about PE in Brazilian public sector is not very consistent.

Thus, this paper aims to fulfill a lack, and, for that, it tries to build an estimate of population universe of production engineers that act in federal public sector. Besides, it also presents other public bodies and public companies that may have PE in its staff.

So, the main purpose of this paper is to define where and how many are the production engineers that are currently working in the public sector, as well as to describe the methodologies have been used to build those data.

## 2. Literature review

Although there are some studies that relates the great area of engineering and the public sector, the relations between production engineering and the public sector remain as an area of not so many studies through the years. However, this scenario has been changing recently.

Jesus & Costa (2014) present a frame that tries to associate the concepts of New Public Management (Pollitt, 1990; Coutinho & Campos, 2001; Trosa, 2011) with the areas and the activities done by production engineers (ABEPRO, 2015).

Some activities that Jesus & Costa (2014) have prospected concerning to this interface are the use of triple bottom-line techniques (Oliveira et al., 2012), the Brazilian National Quality Awards – PNQ (PNQ, 2007) and the project management offices directed to governmental activities (Rego & Silva, 2011).

Another study of Jesus & Costa (2013) studies the role of production engineers in the public affairs. Main conclusions of their work is that the great opportunities for the professional actuation of this professional are associated with formulating and monitoring public policies,

innovation and technology issues, and systemic approach and holistic view. According to Jesus & Costa (2013), these three axis of actuation should drive the professional practice of production engineers into the public service.

It is worth mentioning that the participation of production engineering in the public sector is a discussion that is encompassed by a bigger one, which is the presence and the actuation of engineering (with its several specialties) inside the public sector.

About this, Apelian (2008) organized a roundtable to better understand the role of engineers in the 21st century. In this prospection work, there were many discussions about the role of engineering in society. One of them concerns to the “sociopolitical engineering”. It means that there is some sociopolitical knowledge and competence that must be together with the traditional technical competencies of engineers. According to Apelian (2008), the challenge of putting sociopolitical issues into the engineering will move our society and government into doing the right things.

This point is also reinforced by Acevedo et al. (2009). According to him, the new challenges of the present and the future demand engineers that worries about public issues. “Engineers, regardless of their specific field of work, are becoming more and more involved in dealing with their nation’s public sector. This role is no longer confined to economists, lawyers and political scientists. Public organizations need interdisciplinary teams where the engineers participate in an active role to analyze and take decisions. The engineer’s role in the public sector stems from the professional identity, associated with problem-solving through the use of scientific, mathematical and technological knowledge within a limited-resource framework. These competences are necessary for public sector engineers to make effective economic, political and social decisions. Public sector engineers focus on the analysis of complex situations by using analytical tools for decision making.” (ACEVEDO ET AL., 2009)

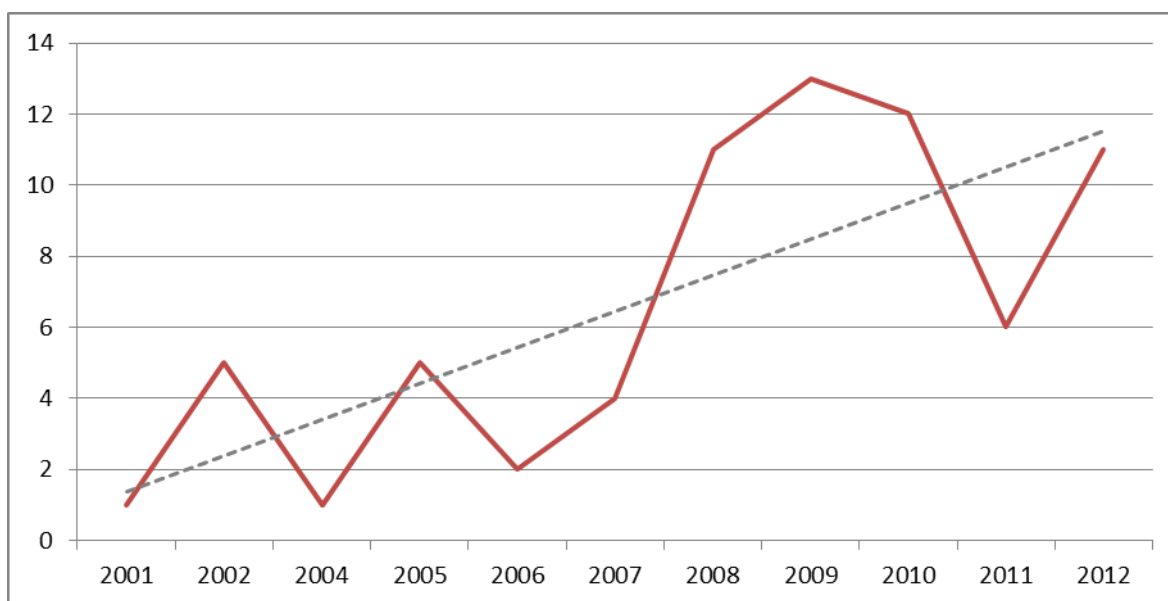
In Brazil, this discussion is being carried out by the political scene. Both legislative houses of Brazil, Parliament and Senate, are now discussing a project of law (PLC 13/2013) that intends to make the engineering a career of State. It means that engineering function must be considered essential to the working of State. In case of it is approved, this law has a potential of increase the amount of engineers working in the public sector.

In a discussion about this project brought by Ferrarini (2014), José Chaves says that the proposal, at the same time that ensure good conditions of career and wages, warranties to the

society the work of these professionals, essential to the development and welfare of population. Argumentations that agree with this project are also pointed out by Krüger (2014), who says that there is no reason for the federal government makes investments in logistics without having a well prepared staff of engineers. Also according to Krüger (2014), the composition of this staff of public sector engineers must be treated as a priority in federal, state and municipal spheres.

Despite the academic and political interests about the interfaces between production engineering and the public sector, there is also a practical point of view that should be considered: the increasing of public tenders for hiring production engineers. Data collected from 2001 to 2012 (Pciconcursos, 2013) of public tenders for hiring production engineers to work in public institutions (direct and indirect administration and also by public and mixed capital companies) shows the level of this increasing. Data compilation on public tenders are presented in Figure 1.

Figure 1 – Amount of public tenders for production engineers



Source: Compiled by author, with data from Pciconcursos (2013)

So, the answers to the questions of where and how many production engineers of Brazilian Federal public sector are currently working interest simultaneously to academic, political and practical entities who are involved with this interface.

### 3. Methodology

#### 3.1 Setting target audience

First step is to clearly set what population should be covered by this research. So, we have established that our target audience could be defined as: production engineers that are presently working in the federal public sector, wherein included public bodies, autarchies and foundations, and the public companies and mixed economy companies. In other words, one can understand target audience of this research are production engineers that have fulfilled a position for that production engineering undergraduate course is an explicit requirement to the job, even if the position present a different name (for example: researcher, analyst, specialist, and so on).

In the following lines, we will present some doubts that might occur regarding the target audience, and is respective answers:

- High school level public employees which are bachelor in Production Engineering are part of target audience? *No, because they do not work as PE;*
- Production engineers which tendered to positions which college graduate in any field was required are part of target audience? *No. Fiscal auditors, for example, and road police, who are professionals that are framed in this situation, work in functions that are not related to PE competences, even if they own a bachelor's degree in PE;*
- Outsourced employees of public bodies or public companies are part of target audience? *No, only the ones that are public servants, which have tendered to that position through public selection;*
- Product engineers that are filling commissioned positions are part of target audience? *Yes, since they have tendered to public service through public selection. Ones that are in commissioned positions due to political indications, as they are not fixed in staff, were understood as not being part of target audience;*
- Other field professionals that pursue Master or Doctoral degrees in Production Engineer and act in public service are part of target audience? *No, only the ones that pursue bachelor degree in PE;*
- University professors who teach in Production Engineering courses are part of public audience? *Yes, independent of the course they teach, since they pursue a bachelor*

*degree in PE and teach in a public institution. Teaching Production Engineering is one of the acting areas of PE, according to ABEPRO. (ABEPRO, 2015);*

- *Supposing that there is a position of logistic analyst which requires bachelor degree in production engineering or in business administration or in logistics management, how are they allocated in target audience? In this case, though activities and duties of positions are the same, only the PEs filling this position counts for target audience;*
- *Are the three spheres of power covered by the research? Although that was our first intention, there was only consistent and reliable information concerning to Union (federal sphere of power). Thus, data contained in this paper creates a reliable panorama of PE that work in public service in federal sphere.*

### **3.2 Strategies to quantitatively define the target audience**

It is important trying to precisely define the amount of people who is our target audience, the universe which we refer when we are talking in “production engineers that work in public sector”. In order to carry out this process, we have used some strategies.

First strategy is related to Access Information Law (AIL), which has recently been promulgated in Brazil (BRASIL, 2014). According to Mizukami et al. (2013), this law establishes some means to increase public transparency on providing information. Citizens can ask for information that had not been disclosed in their official websites and reports. Gruman (2013) presents some discussion about the creation of the law and Zancanaro et al. (2013) present a concrete example of using of this new law. We have asked for a list containing all production engineers that work in Federal Direct Administration, which includes all federal public bodies, foundations and autarchies. This requirement was answered quickly and satisfactorily by federal government, in a wide table from SIAPE – the system of human resources of federal government, which has provided name, agency, position, professional ability (undergraduate course) and graduate course (when it exists). There was some use of data management internally, due to some reasons. For example, fiscal auditors who are production engineering management counts in table, and they were manually excluded; only production engineering bachelors interest for the research, and not the ones who have Master or Doctoral level in PE.; checking some information at Curriculum Lattes platform, we have noted that some of them counts as production engineers in the table, but they actually have other professional degrees; due to some oversight in realizing initial filters,

some nurses (very close to engineers in alphabetical order in Portuguese; nurses = “enfermeiros”; engineers = “engenheiros”) were counting in the list and they have also been excluded. Naturally, managing table data, we could obtain precise numeric information concerning to the presence of PE in Federal Direct Administration.

Second strategy is also related to AIL, but it tries to get information about Indirect Administration, namely the federal public companies and mixed economy companies. To this second requirement, they have answered government has not a unified control about employees, because each of the companies has a certain level of autonomy in managing their human resources, and it makes that not so necessary transmitting detailed data to Federal Government. So, we decided to address many requirements asking to the amount of production engineering in each of the public or mixed economy companies. Although several federal companies have already had the implementation of AIL through forms, many of them still do not present this tool yet, which reduce the universe of possibilities. Nevertheless, among public companies available to query, requirement has only been sent to some of them, namely the ones who have any possibility of having production engineers in their staff.

Another strategy was the search for public selections. If all production engineers acting in public service have passed through a public selection, the hypothesis of existing a complete database of public selections would make the search for this universe an easier task. Despite the totality of public selections is published in Official Gazette, there is no such a database in governmental level. However, there is a database, fed by users, which helped us a lot to deal with the issue of setting a populate universe. This basis is “PCI Concursos” This website is one of the main tools used by those who regularly tender to public jobs, the “tender-a-holics”, to share information. Users feed this basis with information about public selection calls throughout the country, as well it has a repository of happened public selections exams. The website (Pci Concursos, 2014) presents a search tool whereby we have done some queries in Portuguese language using terms like “production engineering” and “production engineer”. During this process, we have found many public bodies, public companies and mixed economy companies that since 2000 open public selection to hire production engineers. Of course we cannot exactly say that all companies that come from this query now have production engineers in its staff. (we have to consider the dismissal processes, non-replacement of positions, etc.). In the same sense, we can also not affirm that this list encompasses all public companies and public bodies that have production engineers in its

staff. However, considering the wideness of the website and returns obtained by queries, which present not so obvious companies when we mention production engineering, we have opted to consider this one a relevant and reliable source in the building of research universe. We also have considered getting information about number of vacant positions of each call, but it does not represent the current situation of the companies, due to turnover. Public companies which had appeared in this query are the ones that after have been their information required in AIL forms (since they had already AIL forms enabled) about the amount of production engineers currently employed at them.

As a last strategy, we also have considered an exhaustive search, in other words, a trying to search for production engineers in all the possible public bodies. It would be used the system SIORG, which encompasses the totality of Federal Direct Administration structure. This system however, in a quick query, has provided the amount of 64.629 public bodies and departments existing in Federal Government, which has made this one an impracticable method.

#### 4. Results

Results we found are presented in following tables. Table 1 and Table 2 provide information about the amount of PE in Federal Direct Administration and in Federal Indirect Administration respectively. Table 3 presents public bodies with some possibility of having production engineers in its staff. Data on this table refers to those public bodies or public companies that have presented a tender to hire production engineers, but there was no available information obtained from AIL about the amount of PE in their staff.

Table 1 – Production Eng. in Brazilian Federal public sector (Direct Administration)

<b>Bodies / Companies</b>	<b>Amount</b>	<b>Comments</b>
CVM	3	
MDIC	2	
CGU	2	
FIOCRUZ	2	



MPOG	2	
MAPA	4	
MF	1	
MCTI	1	
INMETRO	23	Data is not divided in graduate, master and doctoral. We have opted to work with the given amount.
UNIVERSITIES	15	We have noted that there is a possibility of the field “Description of Professional Ability” is filled with “University professor”, instead of “Production Engineer”. Considering both registers are possible, it is reasonable to suppose that this value is very underestimated.
CNEN	2	
INT	5	
ANAC	17	
BRAZILIAN NAVY	53	
<b>TOTAL</b>	<b>132</b>	

Source: original compilation

Table 2 – Production Engineering in Brazilian Federal public sector (Indirect Administration)

<b>Bodies / Companies</b>	<b>Amount</b>	<b>Comments</b>
BNDES	0	There are 353 engineers without any division in specialties.
CEPEL	0	

CHESF	5	
FURNAS	25	There are also 8 PE professionals (besides 25) that do not work as superior level employees
PETROBRAS	936	
CDRJ	2	
CMB	17	
CODESP	1	
ECT	79	
EMGEPRON	10	
HEMOBRÁS	1	
CEITEC	1	
EMBRAPA	64	Data is not divided in undergraduate, master and doctoral. We have opted to work with the given amount.
EPE	7	
INB	23	
<b>TOTAL</b>	<b>1171</b>	

Source: original compilation

Table 3 – Public bodies which might have production engineers in their staff

<b>Public bodies / public companies</b>
CAERD
CAERN
CELESC
CESAN

CET/SP
COMLURB
COMPESA
CPTM
DECEA
DIO/ES
EMATER/PA
EMBASA
IFRJ
IFS
IFTO
IFB
IQUEGO
PETROBRAS BIOCOMBUSTÍVEL
PETROBRAS DISTRIBUIDORA
SEDECT/PA
SEMA/PA
UEPA

Source: original compilation

## 5. Discussion and Conclusion

Through the used methodology, it has been possible to estimate that there are 1303 PE in Brazilian Federal public sector, being 132 in Direct Administration, and 1171 in public companies, as it can be seen in Table 1 and Table 2. Despite the trying of enlarging the scope, this universe only refers to the production engineers who work in federal level.

Two results are especially remarkable in those Tables. First of them is the preponderancy of Petrobras. More than 70% of production engineers of all federal public sector (direct and indirect administration) are into this company. It is due to the fact that this is the biggest public company in Brazil, and with a consistent policy on public tenders for production engineers, generally with tenders every year, sometimes twice a year. (Peiconcursos, 2013) Second remarkable result is the rate between the amount of PE in Table 1 and Table 2. Considering the totality of PE in public sector, we can note that only 10% is in Direct Administration. Yet we cannot consider Petrobras, which is an outlier as we referred before, rate would still not be equal: only 35% would be in Direct Administration. It evidences that public entities which have more intersection with private sector are more susceptible to hire production engineers to its staff, and that the competences of Production Engineers should be more disseminated among more internal areas of government.

Table 3 presents public bodies and public companies of three governmental spheres of power (federal, state and municipalities) which have already done public tenders to PE, except those which have already been mentioned in Table 1 and Table 2. It is interesting to remark that PE professional, yet it has a lot to develop inside the public sector, it appears in public bodies and public companies of varied kinds, as EMBRAPA (Brazilian Agricultural Research Company), COMLURB (Urban Cleaning Company of Rio de Janeiro State), CPTM (Metropolitan Train Company of São Paulo State), and EMATER/PA (Company of Technical Assistance and Rural Extension of Pará State). This diversity is a positive aspect that helps the promotion of PE career in public sector.

We consider that this paper presents a great contribution to the field of production engineering, since it enables greater and future discussions about the relations production engineering and the public sector. We also consider that this research plays an important role on the matter since it provides quantitative data about distribution of PE in the Federal Brazilian public sector that were not available until this moment.

We suggest that future work in this subject conduct quantitative analysis of data this research provides as well as explore the qualitative aspects of the work of production engineers into the public sector.

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