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The high rate of staff turnover has caused concern in the industrial sector, not only for the loss of labor, but also because it directly implies the capacity for innovation, which is essential for the development of companies in a globalized market. Therefore, the objective of this work was to study the relationship between human resource turnover, known as Turnover, and innovation in the Sergipe food industry. A documentary search was carried out in the RAIS, CAGED databases to verify the turnover rate of the industries and a mapping of the patent deposits in the databases of the National Institute of Industrial Property, European Patent Office and World Intellectual Property Organization. When analyzing the average remuneration of the workers, it is noticed that the mineral extractive sector has the highest average remuneration of the state, so it was made the comparison with the food sector, when calculating the turnover rate of both sectors, it was verified that the food industry has a higher than extractive turnover rate. In addition, the Mineral Extractive Industry has a greater number of patent deposits compared to the Food Industry. In this way, it is understood that there is a relation between the turnover rate and the innovation of the sectors, since the Mining Extractive Industry, since it is a sector with higher qualified personnel and with a lower turnover rate, presented a larger quantity of patent deposits in comparison with the Food Industry which presented a higher rate of turnover.

Keyword: Patent Deposits, Innovation, Measurement, Turnover.

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Abstract

The high rate of staff turnover has caused concern in the industrial sector, not only for the loss of labor, but also because it directly implies the capacity for innovation, which is essential for the development of companies in a globalized market. Therefore, the objective of this work was to study the relationship between human resource turnover, known as Turnover, and innovation in the Sergipe food industry. A documentary search was carried out in the RAIS, CAGED databases to verify the turnover rate of the industries and a mapping of the patent deposits in the databases of the National Institute of Industrial Property, European Patent Office and World Intellectual Property Organization. When analyzing the average remuneration of the workers, it is noticed that the mineral extractive sector has the highest average remuneration of the state, so it was made the comparison with the food sector, when calculating the turnover rate of both sectors, it was verified that the food industry has a higher than extractive turnover rate. In addition, the Mineral Extractive Industry has a greater number of patent deposits compared to the Food Industry. In this way, it is understood that there is a relation between the turnover rate and the innovation of the sectors, since the Mining Extractive Industry, since it is a sector with higher qualified personnel and with a lower turnover rate, presented a larger quantity of patent deposits in comparison with the Food Industry which presented a higher rate of turnover.

Keywords - Patent Deposits, Innovation, Measurement, Turnover.

1. Introduction

The secondary sector of the economy is formed by companies that are characterized by the intensive use of labor. In these institutions, there has been a growing concern with employee turnover or turnover, since relevant studies on the topic show that high turnover has had an impact on the innovative practices of organizations, directly affecting productivity, profitability and profitability (CHIAVENATO, 2004) .

Employee turnover or turnover, is the phenomenon characterized by the movement in and out of professionals employed in a given period (SILVA, 2006). In the definition of DIEESE (2011, p. 11), “conceptually, turnover represents the replacement of the occupant of a job position by another, that is, dismissal followed by admission, in a specific, individual position, or in several positions , involving several workers ”.

According to one of the main recent studies on the theme - Turnover in the Brazilian labor market - produced by the Inter-Union Department of Statistics and Socioeconomic Studies - DIEESE in partnership

with the Ministry of Labor and Social Security - MTPS, Brazil has high rates of job turnover .

The study points out that in 2014, the global turnover rate of the Brazilian formal labor market, which includes workers in the labor force and statutory workers, was 53.9%. However, if only the employees in the employment category are considered, which is the hiring regime practiced by the private sector, the global turnover rate reaches the rate of 62.8%. The survey also presents a history of the turnover rate in the celetist segment, referring to the years 2003 to 2014, which serves to show that the turnover rate of the Brazilian formal market has always presented high numbers, so that, in this period, an average global turnover found is 59.24% (DIEESE, 2016).

With regard specifically to the manufacturing industry, the area where the present research is located, the study revealed that the global turnover rate is 50.7% (DIEESE, 2016). In the food industry sector, according to data extracted from the Annual List of Social Information - RAIS and in the General Register of Employed and Unemployed - CAGED, the global turnover rate reached, in 2014, the rate of 50.84%, this it is higher than the average rate presented by the sectors that make up the transformation industry (RAIS - CAGED).

To get an idea of the high turnover rate that the numbers of the Brazilian labor market present, a global study carried out by MERCER in 2016, one of the largest and most important Human Resources consulting companies on the planet, pointed out that Europe has an average turnover rate of 7%, the United States 8.1%, Japan 13.23%, India 18.07% and China 19.24% (GUTMANN, 2016).

In the global crisis scenario, between 2011 and 2014, in companies around the world, employee turnover grew significantly or moderately by 38%. In Brazil, in the same period, this phenomenon was observed in 82% of companies, that is, a number almost three times higher than the world average (MELO, 2014).

In this context, Bastos (1993) argues that technological innovations are frustrated or lose their strength if the organization does not have a human capital committed to work and that it finds conditions for self-realization and growth.

Regarding human capital, Bateman and Snell (2009) define it as the knowledge, skills and capacity of employees, which have economic value for the organization. Thus the term human capital, or more broadly intellectual capital, is used to describe the value of the skills and knowledge of employees used for the good of an organization.

Bringing these considerations to the field of innovation, we have, initially, that the Oslo Manual defines innovation as the action of developing new products (goods or services), marketing or organizational processes or methods, as well as promoting significant improvements in products, existing processes or methods, through scientific, technological, organizational, economic-financial and commercial activities (OECD, 2005).

In Brazil, it is important to note that the new regulatory framework for science, technology and innovation (Law 13.243 / 16), enacted on January 11, 2016, conceptualizes innovation as: "introduction of novelty or improvement in the productive and social environment that results in new products , services, processes or that includes the addition of new features or characteristics to an existing product, service or process that can result in improvements and an effective gain in quality or performance ”.

The main database that involves innovation in the country is the Innovation Research (PINTEC), which is carried out by the Brazilian Institute of Geography and Statistics (IBGE), with the support of the Financier

of Studies and Projects - FINEP and the Ministry of Science, Technology, Innovation and Communication. This research, which follows the OECD-predicted innovation references, structures sectoral, national and regional indicators, of innovation activities in companies in the Industry sector, and national indicators of innovation activities in companies in the Electricity and gas and Services, compatible with international recommendations in conceptual and methodological terms (IBGE, 2016).

Within this context, considering that the figures presented by the Ministry of Labor and Employment - MTE indicate that the turnover of employees in the Sergipe food industry reaches high rates. Given this, the present study aims to study the relationship between the turnover of human resources, known as Turnover, and innovation in the food industry in Sergipe.

The high rates of turnover observed in the Sergipe industry and the fact that in Brazil the topic is studied and researched with a greater emphasis on the search for causes and less on the attention dedicated to the knowledge of the repercussions of the phenomenon, justify a thorough study of its consequences. Within the possible consequences, the reflexes provoked in the innovation capacity of organizations, a characteristic considered vital for the survival of companies in an increasingly globalized and competitive world, will be studied.

The increasing numbers of staff turnover have caused concern in organizations, as the loss of qualified labor, in addition to producing high financial costs, considering the dismissal and hiring of a new substitute, has a direct impact on the capacity for innovation (CHIAVENATO, 2004).

Studies on the subject have increasingly shown that innovation is linked to the formation of a common human heritage effectively committed to work, where individuals find conditions for self-realization and growth (BASTOS, 1993). For this reason, good human resources management, which manages to maintain motivation and commitment of employees in organizations, ensures the differentiation and innovation necessary for survival in the competitive world.

Therefore, the relevance of this study is based on the possibility of relating employee turnover to innovative activities developed by companies, in an extremely competitive environment, generating numerous losses, compromising the results of these institutions.

2. Staff Turnover

Initially, it is important to clarify that in the field of human resources science, the word Turnover, has an etymological origin in the combination of the English words "Turn", which means rotation or spin and "over" which means new or beginning. Therefore, in the context of this dissertation, it refers to staff turnover, which will be conceptualized and classified below (MOWDAY; PORTER; STEERS, 2013).

For Anselmi, Anserami and Gomes (1997), turnover of personnel or Turnover is the phenomenon that refers to the entry and exit of personnel in a certain company or sector, that is, the movement that takes place in the labor market, characterized by the entries and exits of individuals from the institution or company that makes up this market.

At this juncture, Chiavenato (2008), when defining and rotating people, adds that this flow refers to the inflows to compensate for the exits of people in the organizations, because, as Silva (2006, apud BEZERRA, 1997) teaches, the rotation is found if closely related to the idea of replacement, replacement

or rotation.

As Ribeiro (2010) prelects, worker turnover only includes movements to replace workers in existing jobs. Thus, analyzing the concepts outlined above, we find in Sarsur; Fleury (2004) the most precise definition on the subject, considering the characteristics of replacement, replacement, rotation and time, the turnover of people is the movement of entry and exit, spontaneous or caused by the company, of its employees, employees, in a certain period .

Chiavenato (1999) draws attention to the fact that staff turnover occurs in two ways: when the decision-making agent is the company, a situation in which its manager makes the decision to dismiss the employee; when the employee leaves the company, he decides to leave the company.

That is why Lucena (1999) classifies staff turnover into two types: the one controlled by the organization and the one controlled by the market.

In the first case, the author explains that the organization is able to retain and motivate the best performing, most qualified professionals with the potential to grow and contribute more effectively to the development of the company. It identifies these employees, monitors their development, gives them career opportunities, with a view to keeping them satisfied, rewarded, recognized, and therefore does not wish to leave the organization. The exits that happen are employees who do not have those characteristics of performance and potential.

Continuing, Lucena (1999) states that the turnover controlled by the market is exactly the opposite: the company loses its best professionals to its competitors and to the market in general, because it does not have policies and criteria to motivate and retain them. Those who do not have the competence to compete in the market remain in the organization.

Morrell, Loan-Clarke and Wilkinson (2001) proposes a classification from the point of view of the object of the study. For him, when the object is the labor market, the research takes place in general in the field of Economic Theory and the causes of Personnel Turnover will be associated with economic and cyclical phenomena.

If the object of study is the individual, this is the field of interest of Psychology, Sociology, Medicine and the causes will be associated with phenomena specifically related to individuals. If the object of study is the organization, it is of particular interest to the Theory of Organizations and the causes will be related to the implementation of policies and administrative models (MORRELL; LOAN-CLARKE; WILKINSON, 2001).

3. Methodology

The highlighted study has a quantitative descriptive research characteristic, since it produced quantitative descriptions about the sectors of the food and beverage and mineral extraction industries in the state of Sergipe.

This research is classified as descriptive, according to Gil (2002), the descriptive research has the objective of describing the characteristics of a given population or phenomenon or establishing relationships between variables.

As far as the research approach is concerned, it is classified as quantitative and Diehl (2004) states that

quantitative research is characterized by the use of quantification, both in the collection and treatment of information, using statistical techniques.

The method of this research was the documentary analysis. The documentary research was carried out on the databases of RAIS, CAGED, National Institute of Industrial Property (INPI) of Brazil, European Patent Office (EPO) and World Intellectual Property Organization (WIPO).

Consultations were carried out in the RAIS database, in order to obtain figures relating to the average remuneration of all economic sectors in the State of Sergipe, relating to the year 2015 and 2016. This search occurred because, the main cause of turnover identified in the market Brazilian workforce is low pay.

From these results, the research was funnelled to the information on the employment stock, average employment stock, education level and average remuneration of employees who perform their activities in the food and beverage sector, which is the main object of analysis of the study, and the mining and quarrying sector, for having presented the highest remuneration average of the economic segments of the State of Sergipe.

To search for job stock data, average remuneration and education level, the RAIS database was used and to consult the average stock the CAGED database was used.

With these numbers in place, the turnover calculation for these sectors for the year 2016 was carried out, using information obtained from the RAIS and CAGED databases, which relate the number of employees admitted and dismissed in 2016 and the employment stock of the employees. years 2015 and 2016, applying the following equation:

$$\text{Equation 02: } \text{TRA} = \text{AD} / \text{MET}$$

Where:

TRA = Annual turnover rate

AD = Minimum number between admitted and dismissed

MET = Average stock of workers up to 12/31 in the current year and the year prior to the reference year

With information on the level of education of employees and the global turnover rate of the sectors of the food and beverage industry, we sought to relate them to innovation, through the criterion of human resources training and the number of patents requested and granted by companies in these sectors.

At this point, a technological mapping of patent deposits was carried out in the databases of the National Institute of Industrial Property (INPI) of Brazil, European Patent Office (EPO) and World Intellectual Property Organization (WIPO) using as search criteria the names of companies in the depositor field. English terms were used in the international databases and Portuguese terms were used in the National database. The research took place from August to January 2018.

Table 1 highlights the mineral extraction industries that have a branch in Sergipe, these were used as a keyword in the depositor field to identify the deposits made by these companies.

Table 1. Search Criteria on the INPI, ESPACENET and WIPO bases for Mineral Extractive Industries.

Keywords	Bases Used		
	INPI	ESPACENET	WIPO
Companhia Vale do Rio Doce	370	519	539
Petrobras	1541	2987	1628
Votorantim	28	19	32
Halliburton	2675	10.000	37.727
Schlumberger	592	10.000	35.811
Fafen e Fabrica and Fertilizantes and Nitrogenados	0	0	0
Nassau e Itaguassu and Agro and Industrial	0	0	0
Indústria Misu	0	0	0

Source: Own authorship (2017)

Table 2 highlights the food and beverage industries that have a branch in Sergipe, these were also used as a keyword in the depositor field to identify the deposits made by these companies.

Table 2. Search criteria in the INPI, ESPACENET and WIPO databases for Industries and Food and Beverage

Keywords	Bases Used		
	INPI	ESPACENET	WIPO
Ambev	8	18	24
Cipa and Industrial	4	4	2
Marata e Jav and Industria and Alimentos	0	0	0
Tropfruit	0	0	0
Laticinio and Santa and Maria	0	0	0
Kapricho and Industria and Alimentos	0	0	0
Sabe and Alimentos	0	0	0
Fabise	0	0	0
Sumo and Industrial	0	0	0

Source: Own authorship (2017)

To interpret the information of interest, an analysis was carried out highlighting the amount of deposits per base analyzed, as well as the temporal evolution of the data found.

4. Results

A survey was carried out in the database of the Ministry of Labor, through the Annual List of Social Information - RAIS, where the stock of jobs, education level and remuneration of the sector of the food and beverage industry and the mineral extraction sector in Sergipe were analyzed. .

The research uses as a starting point the extraction of data that indicate the average remuneration of workers by sector of economic activity in the state of Sergipe, since, for Baltar (1994), studies indicate that the distribution of wages is one of the main causes the turnover of the Brazilian labor market.

In a consultation carried out in the Ministry of Labor's database, through RAIS, the following results were found:

Table 3. Average December Remuneration, in Reais - Sergipe (2015-2016)

Economic Activity Subsector	2015	2016
Mineral Extraction	9.867,64	9.322,89
Non Metallic Mineral Products Industry	1.634,17	1.516,15
Metallurgical Industry	1.687,46	1.814,42
Mechanical Industry	1.822,33	1.423,90
Electrical Equipment And Communications Industry	1.173,00	1.304,89
Transport Material Industry	1.407,05	1.477,41
Wood And Furniture Industry	1.469,88	1.392,09
Paper, Cardboard, Editorial And Graphics Industry	1.670,73	1.598,86
Rubber Industry, Smoke, Leather, Leather, Similar, Various Industries	1.518,50	1.617,08
Pharmaceutical Chemicals, Veterinary Industry	4.212,25	3.643,12
Textile Garment Industry And Fabric Artifacts	1.402,74	1.420,63
Footwear Industry	1.180,08	1.235,27
Food, Beverage And Ethanol Industry	1.541,45	1.556,08
Industrial Public Utility Services	3.574,27	4.495,30
Construction	1.653,14	1.777,67
Retail Business	1.408,26	1.374,38
Wholesale	1.621,74	1.869,95
Credit Institutions, Insurance And Capitalization	5.589,40	5.353,99
Com. And Property Management, Securities	1.626,26	1.654,54
Transport And Communications	1.932,22	1.995,17
Serv. Housing, Food, Repair, Maintenance	1.508,17	1.566,14
Medical, Dental And Veterinary Services	2.132,08	2.559,94
Teaching	3.454,19	3.566,31
Direct And Local Public Administration	3.381,79	3.609,71
Agriculture, Forestry, Livestock	1.132,87	1.111,38
Total	2.361,83	2.458,15

Source: Prepared by the Ministry of Labor database (2017).

In table 3, it can be seen that the average salary of the industrial sector of food products and beverages was,

in the month of December of the years 2015 and 2016, respectively, R\$ 1,541.45 and R\$ 1,556.08, that is, a lowest of all economic sectors in the State of Sergipe. It is important to note that even though it did not show the worst result, its average remuneration was very close to the lowest index presented.

On the other hand, it appears that the highest average remuneration is that of the mining industry, presenting in the month of December of the years 2015 and 2016, respectively, values of R\$ 9,867.64 and R\$ 9,322.89. In view of the initial results presented, the research sought to investigate possible reasons for the discrepancy in the average remuneration of the industrial food sector and the sector that had the best average salary in the State's economic activity, which was that of the mining industry. Afterwards, it was verified whether, in fact, remuneration can influence the rate of labor turnover in these sectors and the repercussion on the level of innovation of these companies.

In Figure 1, the largest number of highly qualified workers are performing work activities in the mineral extraction sector. It is possible to extract from the comparison that, while in the extractive sector there are 1.4% of workers with a Master's degree and 0.2% with a Doctorate, in the food and beverages sector only 0.007% have a Master's degree and there are no employees with the qualification PhD. At the other extreme, it is also found that 1.7% of the total workers in the food sector are illiterate, almost four times the number of illiterates who work in the Mineral Extractive sector, which is 0.5% of the total.

The analysis of the graph shows that the food sector is composed of workers with a low level of education, a finding that is more visible when compared to the analyzed data from the mineral extraction sector, in which professionals with higher qualifications were found, with a low percentage of workers with incomplete elementary school and illiterate.

These data demonstrate the need for companies that make up the food and beverage sector to invest in the qualification of their workers, as the low percentage of qualified people reduces the effective application of investments in R&D and development of new technologies in the sectors.

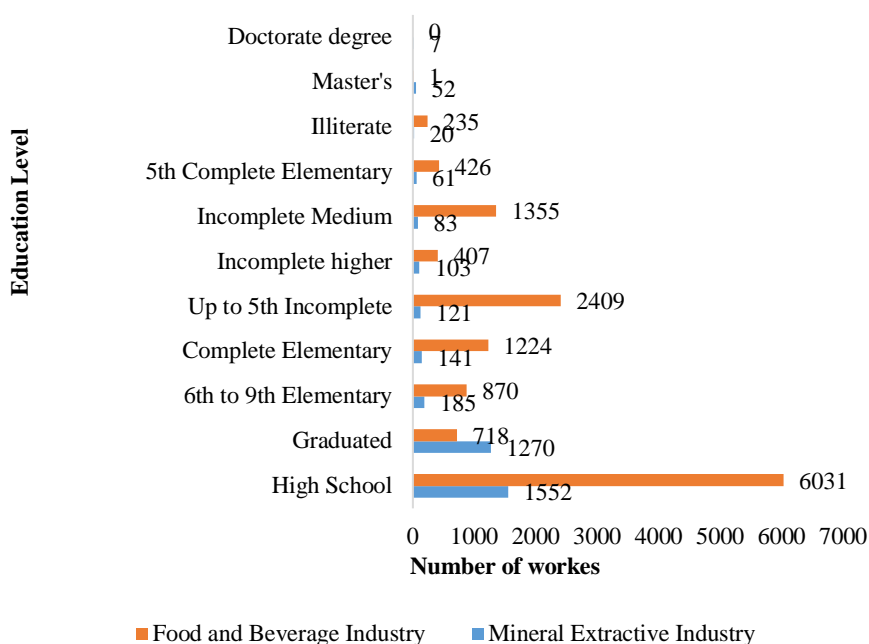


Figure 3. Number of Brazilian technology parks by region.

Source: Adapted from the Ministry of Labor (2017).

Regarding the remuneration of the sectors, it should be noted that the mineral extraction sector presents 15% of the total of its workers with a maximum remuneration range, that is, above 20 minimum wages, whereas in the food sector only 0.1% of its employees receive remuneration at this level. This comparison shows that the mineral extraction sector has a high rate of well-paid professionals, a reality that is very different in the food sector, which has a low percentage of high-paid professionals. This wage inequality indicates repercussions on the qualification of the professionals who work in these sectors, affecting the development of R&D and the production of new technologies in these industries.

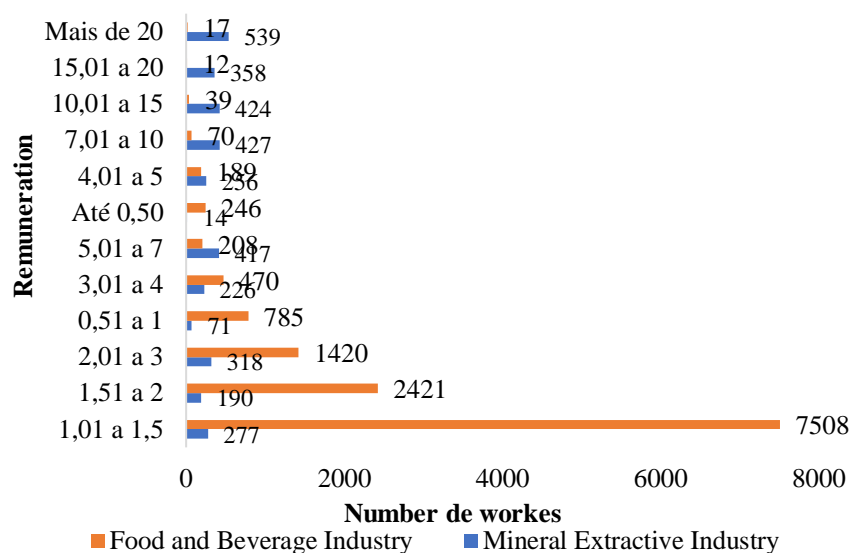


Figure 4. Remuneration of Sectors.

Source: Adapted from the Ministry of Labor (2017).

Thus, the indication that the higher the level of education of workers in the sector, the higher the remuneration average is extracted. These comparative data are important because in future analysis and in conjunction with the global turnover rate, they can indicate the repercussions that are sought in the level of innovation in these sectors.

- Sector Turnover Rate

Being in possession of data that explain the low average remuneration of the sector, it was necessary to verify the repercussion in the labor market turnover rate linked to these sectors.

Thus, from the data collected in RAIS, for calculating the turnover of the year 2016, the number of people admitted to the industrial food sector in 2016 was 6,460 and the number of dismissed workers was 6,908, which can be seen in Table 4.

Table 4. Sector Employment Table - 2016

Sectors	Total admitted	Total Disconnected
Food and Beverage Industry	6.460	6.906
Mineral Extractive Industry	190	312

Source: Own elaboration, based on CAGED data (2017).

For the average stock of the said period, we have that the stock of jobs in 2015 was R \$ 14,054 and in 2016 R \$ 13,676, which can be seen in Table 3.

According to RAIS, in order to calculate the turnover of the mineral extraction sector in 2016, the number of hires in 2016 was 190 and the number of dismissed workers was 312. In order to know the average stock of the said period, we have to the stock of jobs in 2015 was R \$ 4,296 and in 2016, R \$ 3,595.

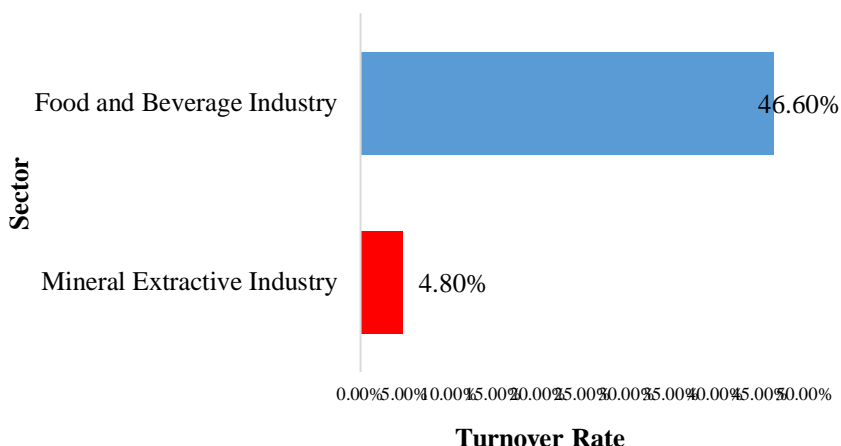
Table 5. Sectors' Employment Stock (2015-2016)

Sectors	2015	2016
Food and Beverage Industry	14.054	13.676
Mineral Extractive Industry	4.296	3.595

Source: Own elaboration, based on CAGED data (2017).

When the data is grouped, the following global turnover figures for these sectors are arrived at, which can be viewed through Figure 3.

Figure 3. Turnover rate by sector - Sergipe (2016)



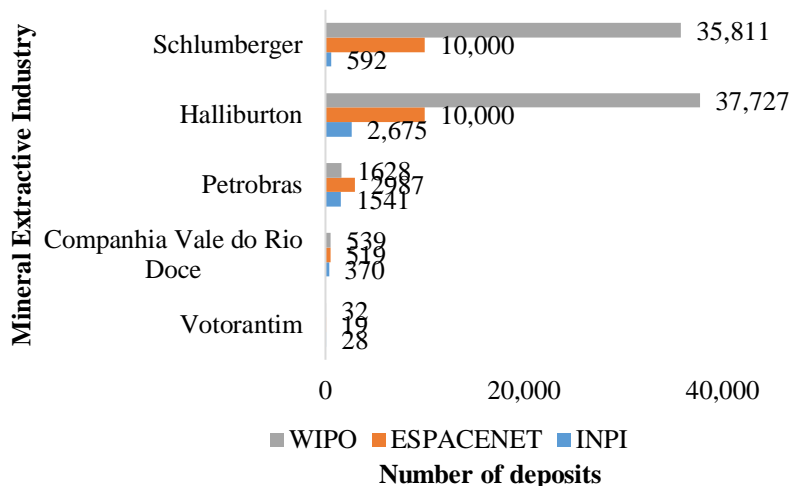
Source: Own elaboration (2017).

It is observed that the global turnover rate presented by the food industry was 46.60%, much higher than the index found in the mining industry, at 4.80%. These figures, when compared to those of countries considered developed or developing, such as Europeans, whose average turnover rate was 7%, the United States 8.1%, Japan 13.23%, India 18.07% and China 19.24%, show that the turnover rate of the food industry under study is very high (GUTMANN, 2016).

- Analysis of data related to INPI, EPO and WIPO databases

After analyzing the data referring to the rate of staff turnover, it was necessary to survey the INPI, EPO and WIPO databases for the number of patent deposits made by the Mining and Food Industries of Sergipe.

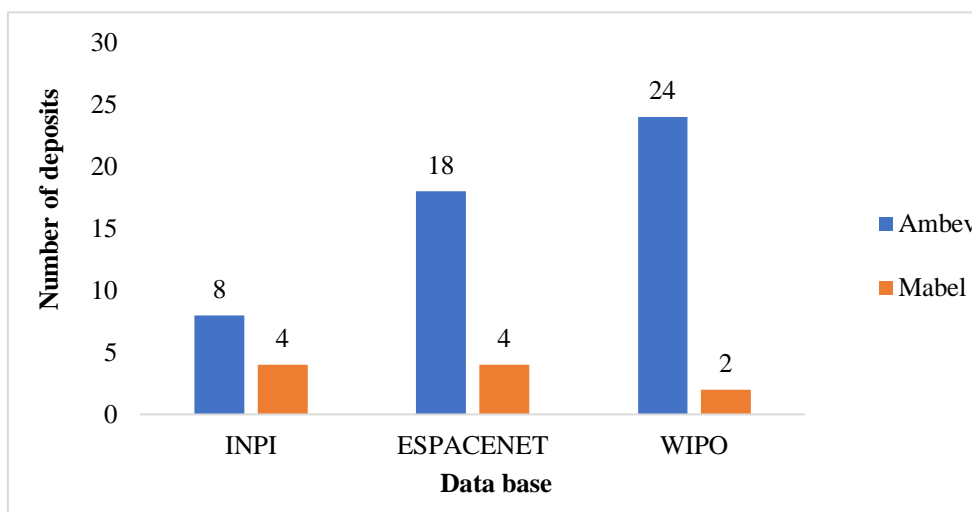
Figure 4. Patent deposits made by Mineral Extractive Industries of Sergipe at INPI, ESPACENET and WIPO bases



Source: Own elaboration (2017).

Figure 4 highlights that Schlumberger and Halliburton had the largest amount of deposits in the analyzed bases, with Halliburton representing 51% of deposits at INPI, 42% at EPO and 50% at WIPO; and Schlumberger represents 30% at INPI, 43% at EPO and 47% at WIPO. The company Votorantim presented the lowest number of patent filings; and the companies Fafen, Itaguassu Agro Industrial and Indústria Misu are not highlighted in this figure since they have not filed any patents, showing that these organizations are not yet seeking the protection of their technologies.

Figure 5. Patent deposits made by Sergipe's Food and Beverage Industries at INPI, ESPACENET and WIPO bases



Source: Own elaboration (2017).

Regarding the deposits made by Food and Beverage Industries, it is observed that Ambev has the largest number of deposits, representing 67% at INPI, 82% at EPO and 92% at WIPO. Mabel represents 33% at INPI, 18% at EPO and 8% at WIPO. However, the companies Marata, Tropfruit, Laticinio Santa Maria,

Kapricho, Sabe Alimentos, Fabise and Sumo Industrial do not appear in Graph 5, as they do not have deposits in the analyzed bases.

5. Conclusion

High staff turnover is a phenomenon that has caused concern in industrial organizations, as, in addition to the loss of qualified labor, it has had a direct impact on the innovation capacity of companies, an essential requirement for the development and survival of these institutions in an increasingly integrated world.

For the present study, it was not enough to just analyze the rate of staff turnover in Sergipe's food industries, it is also necessary to estimate the innovation of these organizations through the analysis of patent filings, as this is one of the most used methods for measuring innovation .

Regarding the average remuneration of workers, a comparison was made between the food and beverage sector, the object of this study, with the mineral extraction sector, as it presented a higher average remuneration in the state of Sergipe. When comparing the data, it was noticed that the mineral extraction sector, in addition to having highly qualified personnel, also has a high number of employees with high salaries, very different from the food sector, which has a large number of people with low qualifications and low wages.

Still, when calculating the turnover rate, it was observed that the Sergipe food sector has a turnover rate approximately ten times higher than the index presented by the mining industry, much higher than the indexes presented by countries considered developed or developing.

In relation to the patent filings made by Indústrias Extrativa Mineral de Sergipe at the bases of INPI, ESPACENET and WIPO, it was noticed that the companies Schlumberger and Halliburton present the highest number of deposits at the bases analyzed, but some companies in Sergipe that operate in the Mineral Extraction sector do not present patent filings. However, it was observed that comparing with the Food and Beverage Industry there are few companies that made deposits, being only Ambev and Mabel, this shows that more investment by these organizations in research and development is still necessary.

Still, it is understood that this differentiation of values in the production of patents is linked to the turnover rate, since when calculating the rate it was realized that the Mineral Extractive Industry has a lower turnover rate and more qualified personnel, consequently implying in the production and patenting of technologies.

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