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The performance of technology-based start ups: A comparative study in Brazil.

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The performance of technology-based start ups: A comparative study in Brazil.

Abstract

This study compared the performance of the product development process of new incubated technology-based firms across the geographic region of the incubator. We conducted a quantitative research in all technological incubators in Brazil in order to gather information on the 548 target firms. Our response rate was 59,1% and our results showed that there is a different distribution of the industry of the target firms across the regions, however, there is no statistically significant difference among the performance metrics of the respondent firms.

1 Introduction

This article is one of the studies to present the results of a comprehensive quantitative research on the process of product development of the new technology based firms (NTBFs) that have been incubated in Brazil. The successful launch of new products is essential for the survival of start ups, especially NTBFs according to Beckman and Sinha (2005) and Mallick and Schroeder (2005). Despite this argument, the success rate in launching new products is still low and according to Barczak *et al.* (2009) this rate is about 14%. Brazil has invested heavily in the creation of incubators to foster the creation and survival of new businesses. For instance, the National Association of Brazilian Incubators (ANPROTEC, 2006) informs that the number of incubators has grown from 27 in 1995 to 359 in 2006 and that there is a concentration of incubators in the South and Southeast region. Thus, our work was to analyze the differences in the creation of NTBFs types and their performance across the regions.

1.1 Relevance of the research

From the academic point of view, we contribute to the assessment of the regional differences related to the creation of NTBFs and their performance through a quantitative research. According to Tödtling and Wanzenböck (2003) there is still no comprehensive and consensually approach to analyze the regional differences among start ups. Moreover, Beckman and Sinha (2005) argue that the studies about the product development process are generally conducted in large, established firms, so this study aims at examining this process in start ups. Finally, according to Vedovello *et al.* (2001), the product development process represents 52% of the research and development activities of NTBFs, which showed the importance of analyzing this specific process.

From the economic point of view, NTBFS have an important impact on economic development. Kirchhoff (1991) reports that NTBFs contribute significantly to job creation in high-tech industries. Another information is that Brazil is an important country to research incubated start ups, since Brazil has the fourth largest incubator park, behind the United States, Germany and China, according to Fealey and Chandra (2009).

1.2 Delimitation of the study

The target firms were incubated NTBFs in Brazil that developed a technology-based tangible product, for example, a firm that developed a software, or a chemical product, or an electronic equipment. Service companies were not considered. Technology-based products are the result of a process of research and development where highly skilled labor is applied in an advanced field of science, for instance semiconductors. Ideally the target firms were still in the incubation phase and had already started product sales.

2 Theoretical Framework

This section is structured as two subsections, the development of regional firms and the performance metrics for NTBFs.

2.1 The development of regional firms

As already mentioned, Brazil has invested in the creation of incubators to foster the development of new businesses. Perez *et al.* (2008), in their exploratory study with incubated firms in the city of Itu, state of São Paulo, showed that the mortality rate in the first year of existence of incubated firms was about 20% compared to 80% of non-incubated ones. Allen and McCluskey (1990) in their study with 127 incubators in the United States found evidence that the age of the incubator and its number of incubated firms influenced the job creation and the number of graduated firms. However, this process of creating new businesses is not uniform within a geographic region. Tödtling and Wanzenböck (2003) argued that the creation of new start ups is a regionally differentiated process, and in their comparative study with Austrian firms between 1990 and 1997, they found evidence of the following assumptions:

a) According to the urban incubation hypothesis, large urban centers provide the best conditions for the creation of knowledge-based start ups because of the existence of entrepreneurs and highly qualified workers in those centers;

b) Based on the approach of industrial district, or clusters, a favorable business environment for the creation of firms is specialized in some industries, has low entry barriers, and foster cooperation among firms;
c) If the industries of a region are capital intensive and formed by large firms, then the business environment is unfavorable for the creation of start ups.

Another argument that the creation of firms is a local process rather than a national and homogeneous process within a country is provided by Chandra and Chao (2011) in their qualitative research with 12 Chinese incubators. Chandra and Chao (2011) identified that China has greatly increased the number of incubators, from 77 incubators in 1998 to 534 in 2006, and that the incubation process has evolved over time from a generic model to a diversified and local model. Chandra and Chao (2011) also argued that the diffusion process of incubators as a mechanism for promoting the creation of start ups is different in emerging countries like China, India and Brazil. In China the process is centralized by the government, in Brazil the process is driven by public-private partnership with universities working as a catalyst. Since incubators work regionally, the support provided by incubators to incubated firms should probably influence firms' business performance. In fact, Cooper and Park (2008) and Aerts *et al.* (2007) found empirical evidence on this relationship.

According to Raupp and Beuren (2006), the incubator support can be classified into three categories: management support, financial and infrastructure. Based on their sample of 37 incubators spread over Brazil's territory, Raupp e Beuren (2006) identified the types of service the Brazilian incubators provided to their tenants. It was found that the most frequent management supports provided by incubators are legal counseling, marketing assistance and secretarial services. The most frequent financial services are fund raising support and shared costs during the incubation process. The most frequent infrastructure services are telecommunication services, meeting rooms and catering.

In relation to Brazil, we showed in Table 1 an empirical evidence that the effort to create start ups is not homogeneous across the geographic regions. The data in Table 1 are the R&D investment and the number of incubators across the geographic regions of Brazil and it is clear the concentration of investment and incubators in the more economically developed regions, which naturally requires more financial resources. The point is whether this investment influences the final result of the start ups, that is, the business performance. Without a minimum level of business performance, the firms do not survive neither generate more jobs.

Table 1: Distribution of the R&D expenditure and the nº of incubators across geographic regions of Brazil

Region of Brazil	Percentage of R&D expenditure *1 *2	Percentage of incubators *3
Southeast	81,9%	35,4%
South	10,2%	35,4%
Northeast	4,8%	17,5%
Middle West	2,0%	7,8%
North	1,1%	3,9%
Total (thousand Reais)	6.999.700	384 *4

Source:
*1 MCT (2010)
*2 Only expenditure in R&D is considered
*3 ANPROTEC (2006)
*4 ANPROTEC and MCT (2011)

Based on the previous arguments, we present our hypotheses to be checked in our study:

H1: The type of NTBFs created is different in function of the regions, or clusters, where the firms were incubated.

H2: The performance of NTBFs is different in function of the regions, or clusters, where the firms were incubated.

2.2 The performance metrics for NTBFs

Combs *et al*. (2005) present their model for measuring organizational performance that consists of two dimensions, operational and organizational. Operational performance is a mediating factor between the firms' activities and its organizational performance. The operational performance is related to the results of the activities of the value chain of the organization. The organizational performance has three inter-related categories, the financial return, growth and market value. From a practical point of view, the organizational performance has to be defined according to the characteristics of target firms. Specifically, in our study the target firms are NTBFs for which we do not find a database of financial results and these firms do not like to make their financial results public in order to avoid calling the attention of new competitors.

According to Mendelson and Pillai (1999), considering the high clockspeed of the industries of NTBFs, the number of products launched onto the market and the cycle of product development are important indicators for these firms to monitor their adaptation to the industry's changes. Another important performance metric is sales growth because it is an evidence of the success of a firm was used in studies of technology-based firms, for example, García-Muiña and Navas-Lopez (2007) and Mallick and Schroeder (2005). Thus, the performance metrics of NTBFs used in our study were the product

development time and the sales growth. These metrics are consistent with the dimensions of organizational and operational of Combs *et al.* (2005) and were selected because NTBFs try to survive and to seek sales growth for the return on investment in their product development.

3 METHODOLOGY

We conducted a survey according to the guidelines of Forza (2002) and Dillman (2007), which involved four steps: planning, questionnaire design, pre-test and contact procedure.

3.1 Planning

The population consisted of all firms in Brazil that fitted the conditions of the section 1.2, delimitation of the study. Given that there was no database of such firms, we have built a database selecting first the technological incubators at web site of the National Association of Brazilian Incubators (www.anprotec.org.br). Then we looked at the web site of each incubator in order to identify target firms. The unit of analysis was the development process of the main product that was the one representing the highest share of a firm's sales. This procedure has tried to reduce the problem of analyzing different processes of product development, as mentioned by Atuahene-Gima (1995). Regarding the sample size, Verma and Goodale (1995) recommend for an effect size of 0.2, error type I of 0.05 and power analysis of 0.8 a sample size of 271. The respondent was the entrepreneur responsible for commercial or technical activities, which is in accordance with the recommendations of Dess and Robinson Jr. (1984) and Kumar et al. (1993).

3.2 Questionnaire design

The complete questionnaire of our research was created according to Dillman (2007) and we used pre-tested scales selected in Roth *et al.* (2008) and the database EBSCO. Regarding the performance metric product development time, we used the definition of Ali *et al.* (1995). Regarding the performance metric sales growth, we used the scale of Christensen *et al.* (2005). The questions asked were:

From the decision to develop the main product until the beginning of its commercialization, how many months did it take?

What was the annual growth rate of sales of the main product in the last 12 months?

3.3 Pre-test

According to Dillman (2007) and Forza (2002), first, the questionnaire was reviewed by three experts. Then it was applied to two target firms with the presence of a researcher. Finally, the questionnaire was applied to a pilot sample of 49 target firms. We carried out the pre-test from February to May 2010.

3.4 Contact procedure

Considering that the target firms were located in an incubator, first, we contacted the incubator's manager to present the research and get his/her acceptance. Then we contacted the firms. The maximum number of contacts with the entrepreneur was 6 (4 e-mails, then 1 phone call and an e-mail). The time between contacts was two weeks. We carried out the data collection from May and October 2010.

4. RESULTS

This section is structured as two subsections, descriptive and comparative analysis.

4.1 Descriptive Analysis

In relation to the contact procedure, 103 technological incubators were identified, 93 had target firms and 82 participated in the survey, which resulted in a response rate of 88.2%. With respect to target firms, 601 participants were identified. After the validation of the target firms by the incubator's manager, 548 firms left, and 324 participated in the survey, which resulted in a response rate of 59.1%. Out the 324 respondents, 26.9% answered in the first contact, 41.6% in the second, 13.3% in the third, 12.0% in the fourth, 3.1% in the fifth and 3.1% in the sixth.

With respect to non-respondents, we estimated the possible bias according to Armstrong and Overton (1977), specifically the extrapolation method applied to successive waves of questionnaires. This method estimates the bias effect of non-respondents by means of comparing the responses of early respondents to late ones. The early respondents were the first quartile, that is, the firms that responded at the first contact (26.9%). The late respondents were the last quartile, that is, the firms that responded at the fourth, fifth and sixth contacts (18.2%). We conducted the test of the difference of means with unknown standard deviation of population between early and late respondents for each performance metric, product development time and sales growth. The results of the tests showed that, at the 5% significance level, there was no statistical

evidence to reject the hypothesis that the difference between the mean of the performance metrics of the early and late respondents is zero.

Regarding missing data, firms that did not provide information on the performance metrics were excluded from the analysis. Regarding outliers, we analyzed the box plot of the variables product development time and sales growth rate and eliminated all atypical observations. This procedure was carried on in the comparative analysis because we eliminated outliers among firms of the same industry. The product development process is probably different for each industry because the technology and clients' requirements, thus, it would not be appropriate to compare performance metrics among firms of different industries. In fact, Pavitt (1984) showed in his study that the pattern of generation and the pattern of application of technology vary according to the industry. After eliminating the outliers, we checked the assumption of the normal distribution of the two performance metrics according to Hancock and Mueller (2006), who recommend that the skewness and kurtosis should not be higher than 2 and 7, respectively. None of the performance metrics exceeded the limits.

The distribution of the number of participating incubators and the number of identified target firms according to the geographic states of Brazil are on Table 2.

Table 2: Distribution of the nº of participating incubators and the nº of target firms per Brazilian state

States[*1]	SP	MG	RS	PR	RJ	SC	CE	RN	BA	DF	GO	SE	PB	TOTAL
Nº of Incubators	21	10	11	13	7	9	2	1	3	1	1	2	1	82
Nº of target NTBFs	211	78	58	50	45	44	14	11	10	8	7	6	6	548

*1 SP=São Paulo; MG=Minas Gerais; RS=Rio Grande do Sul; PR=Paraná; RJ=Rio de Janeiro; SC=Santa Catarina; CE=Ceará; RN=Rio Grande do Norte; BA=Bahia; DF=Distrito Federal; GO=Goiás; SE=Sergipe; PB=Paraíba.

The histogram of the participating incubators according to the number of identified target firms is on Table 3. In addition, 15 incubators represented 40.7% of the identified target firms, 8 of these incubators are in São Paulo (SP), 2 in Minas Gerais (MG), 2 in Rio de Janeiro (RJ), 1 in Rio Grande do Sul (RS), 1 in Ceará (CE) and 1 in Rio Grande do Norte (RN).

Table 3: Histogram of the incubators according to the nº of identified target firms

Nº of identified target firms	Nº of Incubators	Frequence %
=< 2	15	18,3%
2< Nº =<4	17	20,7%
4< Nº =<6	17	20,7%
6< Nº =<8	13	15,9%
8< Nº =<10	8	9,8%
10< Nº =<15	9	11,0%
15 < Nº	3	3,7%
Total	82	100%

Since Allen and McCluskey (1990) found evidence that the age of the incubator and its number of incubated firms influenced the job creation and the number of graduated firms, we decided to plot the data of Table 2 on the Figure 1 in order to analyze the possible clusters of geographic states as a function of the number of incubators and number of incubated firms.

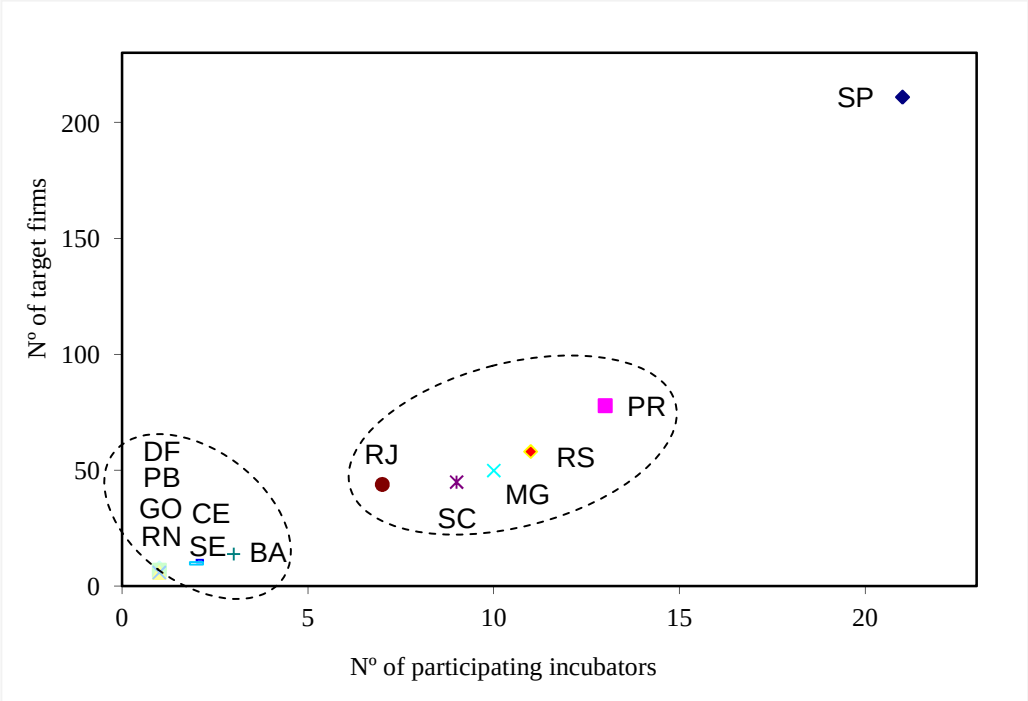

Figure 1: Clusters of geographic states based on the number of incubators and incubated firms

Based on Figure 1, we can see that there are probably three clusters of states: One only with São Paulo, another cluster with the states in the Southeast and South region of Brazil, and the third cluster with the states in the Northeast and Middle West regions. The comparative analysis was carried on according to the above clusters in order to identify differences in the

performance metrics among the target firms. The classification of the identified target firms by industry is on Table 4 and it was done according to the National Classification of Economic Activities (Classificação Nacional de Atividades Econômicas - CNAE) of the Brazilian Institute of Geography and Statistics (IBGE) and the U.S. Standard Industrial Classification (SIC).

Table 4: Classification of target firms by industry

CNAE Code	Industry description	SIC code	Nº of target firms	Nº of Respondents	% of population coverage
62	Computer and Data Processing Services	737	170	105	61,8%
26,5	Measuring and Controlling Devices	382	63	34	54,0%
1,4	Biotechnology	873	44	27	61,4%
63,1	Internet Products	489	41	20	48,8%
26,6	Medical Instruments & Supplies	384	39	24	61,5%
28	Industrial Machinery and Equipment	35	33	21	63,6%
20	Chemical Products	28*	32	17	53,1%
21	Pharmaceutical Products	283	22	10	45,5%
27	Electrical Equipment	36**	18	14	77,8%
26,3	Telecommunications Equipment	366	18	11	61,1%
38,3	Recycled Material	399	16	9	56,3%
26,2	Computer and Office Equipment	357	12	6	50,0%
25	Metal Products	34	6	4	66,7%
35	Energy Generation Equipment	49	6	3	50,0%
	Others		6	4	66,7%
26,4	Household Audio & Video Equipment	365	4	4	100,0%
26,1	Semiconductors	367	3	2	66,7%
26,7	Optical Equipment	382	3	3	100,0%
19,3	Biofuel Production Equipment	286	3	2	66,7%
22	Rubber and Plastics Products	30	3	0	0,0%
23,4	Clay and Ceramic Products	145	3	2	66,7%
30,4	Aircraft Production	372	3	2	66,7%
	TOTAL		548	324	59,1%

* Except the codes 283 e 286

** Except the codes 365, 366 e 367

The distribution of target firms according to the geographic state of Brazil and industry is on Table 5.

Table 5: Distribution of target firms according to geographic state and industry

Industry CNAE code	SP	MG	RS	PR	RJ	SC	CE	RN	BA	DF	GO	SE	PB	TOTAL Number
62	58	14	16	18	19	21		7	4	4	3	3	3	170
26,5	22	10	11	4	4	8			1			1	2	63
1,4	22	11	6	2	1		1			1				44
63,1	10	6	6	5	2	6		3	1	1	1			41
26,6	16	15	1	4		1			1				1	39
28	21	2	3		1	2	4							33
20	22	2	1		2	3			1		1			32
21	7	3		3	9									22
27	2	4	1	7		1	2				1			18
26,3	6	4	1	2	1	2					1	1		18
38,3	7		3	1			3		1	1				16
26,2	1	4	3	1	1			1		1				12
25	3		1	2										6
35	3	1			1		1							6
			1	1	1		1		1			1		6
26,4	1	2	1											4
26,1	3													3
26,7	2		1											3
19,3	1		1		1									3
22	1						2							3
23,4			1		2									3
30,4	3													3
TOTAL number	211	78	58	50	45	44	14	11	10	8	7	6	6	548

4.2 Comparative Analysis

We analyzed the difference among the geographic states of Brazil related to the industry profile of target firms, then we analyzed the difference among clusters related to the product development time and sales growth.

4.2.1 Comparison of the industry profile of target firms across states

Based on the data in Table 5, a statistical test was carried on in order to analyze the difference in the industry profiles of the target firms across the geographic states, in other words, if a geographic state has a concentration of target firms in certain industries different from that of other state. The statistical test was based on the mean difference between paired observations as it is described in Anderson et al. (2007). A condition for the application of the test is that the paired differences follow a normal distribution, or that the sample size is higher than 30. Given that the number of industries is 22, we did the Kolmogorov-Smirnov normality test for the distribution of the mean difference between two geographic states.

Regarding the Southeast region, that is, São Paulo(SP), Rio de Janeiro (RJ) and Minas Gerais (MG), the pairs of states in the Southeast region that passed the Kolmogorov-Smirnov normality test, at 5% significance level, were SP-RJ and MG-RJ. At 5% significance level, there was statistical evidence to reject the hypothesis that the mean difference between the number of target firms per industry between São Paulo and Rio de Janeiro is zero. In other words, there was statistical evidence of a different industry concentration of target firms in the states of São Paulo and Rio de Janeiro.

In relation to the South region, that is, Rio Grande do Sul (RS), Santa Catarina (SC) and Paraná (PR), all pairs of states in the South region passed the Kolmogorov-Smirnov normality test, at 5% significance level. At 5% significance level, there was no statistical evidence to reject the hypothesis that the mean difference between the number of target firms per industry among the states is zero. In other words, there was no statistical evidence of a different industry concentration of target firms in the states of the South.

We also tested the mean difference between the states SP-RS, MG-RS and RS-RJ. The state of Rio Grande do Sul (RS) was selected because it has the highest number of target firms in the South region, and consequently, has a closer profile to the states of the Southeast region. All pairs passed the Kolmogorov-Smirnov normality test, at 5% significance level. Only for the case between São Paulo and Rio Grande do Sul (SP-RS), we rejected the hypothesis that the mean difference between

the number of target firms per industry among the states is zero. Therefore, at 5% significance level, we do not reject the hypothesis H1, in the section 2.1, that The type of NTBFs created is different in function of the regions, or clusters, where the firms were incubated.

4.2.2 Comparison of the product development time

In order to analyze the differences of the means of product development time we selected the Computer and Data Processing Services industry (CNAE code 62) and the Measuring and Controlling Devices industry (CNAE code 26.5) because these industries have the highest number of respondents, 105 and 34 respectively. We compared the means of product development time among the clusters through Anova analysis with the method of Tukey. The method of Tukey is suitable when the variances of the groups being compared are similar and the groups have different sample sizes.

4.2.2.1 Analysis of Computer and Data Processing Services industry (CNAE code 62)

All 105 respondents provided information on the product development time. Before the analysis we removed 13 outliers out the 105 firms, which were firms that had taken 48 months or more to develop their products. With the 92 firms left, the variable product development time met the recommendations of Hancock and Mueller (2006) about the skewness and kurtosis. In Figure 2 we show the Anova analysis of the mean of product development time of the clusters for the Computer and Data Processing Services industry. The column "N" informs the number of firms the cluster has. According to the Figure 1, we have three clusters: SP (formed only by the São Paulo state); second (formed by the Southeast states RJ and MG and by the South states RS, SC and PR); third (formed by the Northeast states CE, RN, BA, SE and PB and by the Middle West states DF and GO).

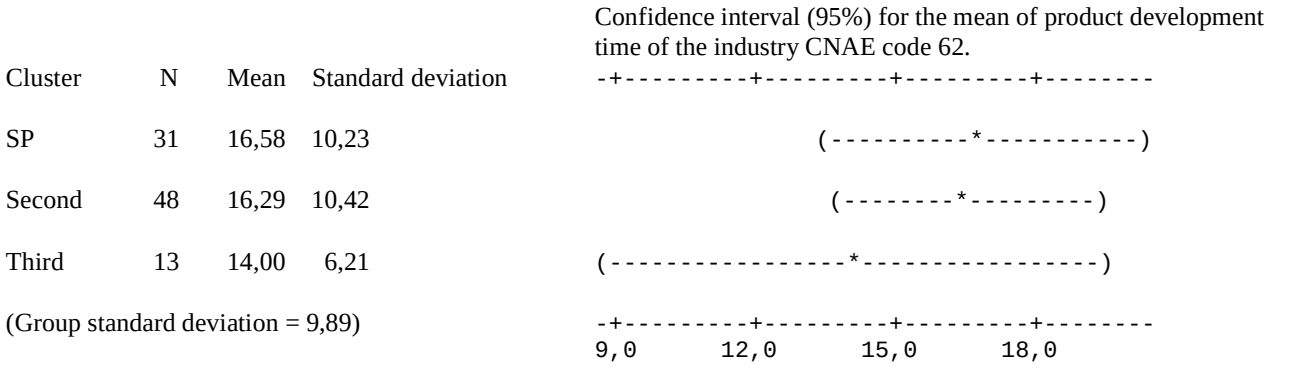

Figure 2: Anova Analysis of the mean of product development time for the Computer and Data Processing Services industry.

Based on the Anova result (p-value of F test= 0,71) and the confidence intervals of the Figure 2, there is no difference, at 5% significance level, among the mean of product development time of the clusters' firms of the Computer and Data Processing Services industry.

4.2.2.2 Analysis of Measuring and Controlling Devices industry (CNAE code 26.5)

All 34 respondents provided information on the product development time. Before the analysis we removed 3 out the 34 companies, which were firms that had taken 60 months or more to develop their products. With the 31 companies left, the variable product development time met the recommendations of Hancock and Mueller (2006) about the skewness and kurtosis. The third cluster was excluded because it had only two respondents. In Figure 3 we show the Anova analysis of the mean of product development time of the clusters for the Measuring and Controlling Devices industry.

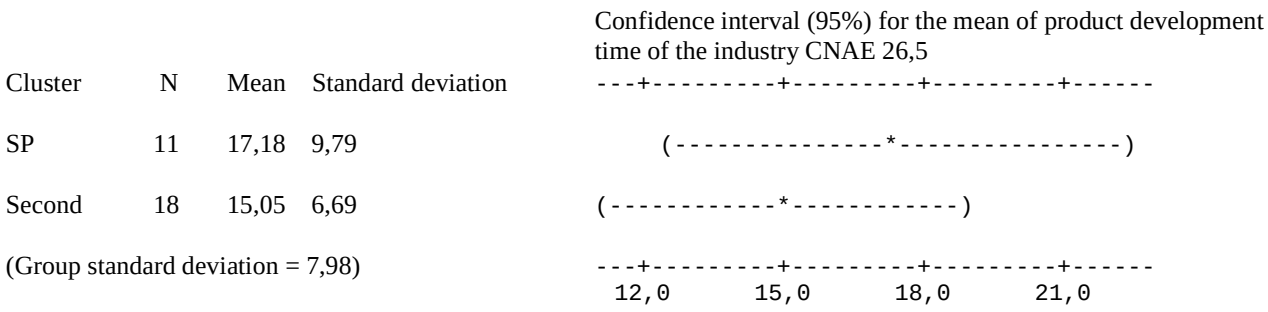

Figure 3: Anova Analysis of the mean of product development time for the Measuring and Controlling Devices industry.

Based on the Anova result (p-value of F test = 0,49) and the confidence intervals of the Figure 3, there is no difference, at 5% significance level, among the mean of product development time of the clusters' firms of the Measuring and Controlling Devices industry.

4.2.3 Comparison of the sales growth

We did the same procedure described in the section 4.2.2 for the performance metric sales growth, that is, we compared the mean of the sales growth among the clusters through Anova analysis with the method of Tukey for the Computer and Data Processing Services industry (CNAE code 62) and the Measuring and Controlling Devices industry (CNAE code 26.5).

4.2.3.1 Analysis of Computer and Data Processing Services industry (CNAE code 62)

Not all firms had already started the sales of the product. Firms that had started the sales of the product, but did not provide the sales growth rate were excluded. We removed the outliers, which were firms that had annual sales growth equal to or above 150%. The third cluster had only 4 firms and it was excluded. With the 62 firms left, the variable sales growth met the recommendations of Hancock and Mueller (2006) about the skewness and kurtosis. In Figure 4 we show the Anova analysis of the mean of sales growth of the clusters for the industry Computer and Data Processing Services.

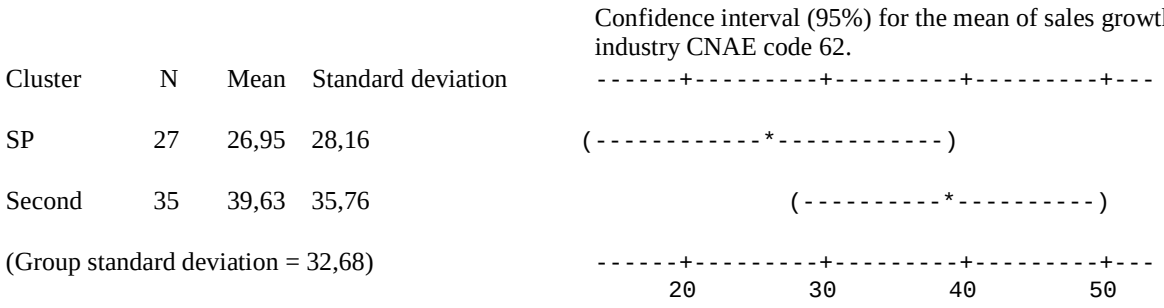

Figure 4: Anova Analysis of the mean of sales growth for the Computer and Data Processing Services industry.

Based on the Anova result (p-value of F test = 0,14) and the confidence intervals of the Figure 4, there is no difference, at 5% significance level, among the mean of the annual sales growth of the clusters' firms of the Computer and Data Processing Services industry.

4.2.3.2 Analysis of Measuring and Controlling Devices industry (CNAE code 26.5)

Out the 34 respondents, 26 firms had already started the sales of the product, but 2 firms did not provide information on the annual sales growth, then they were excluded. We removed 4 outliers, which were firms that had annual sales growth equal to or above 120%. With the 20 firms left, the variable sales growth met the recommendations of Hancock and Mueller (2006) about the skewness and kurtosis. In Figure 5 we show the Anova analysis of the mean of sales growth of the clusters for the Measuring and Controlling Devices industry.

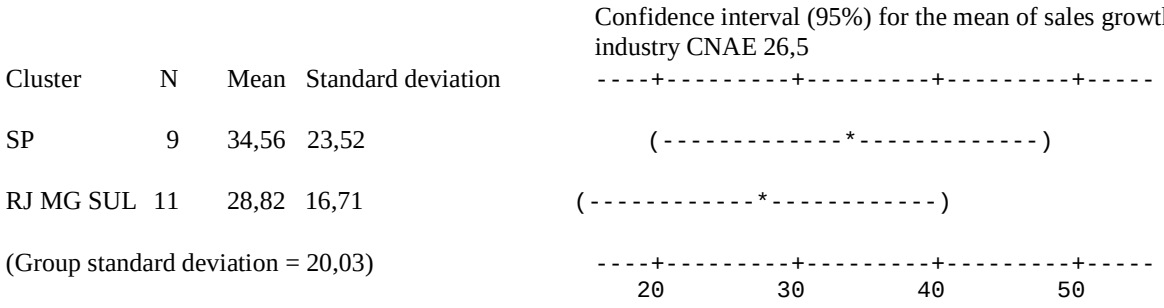

Figure 5: Anova Analysis of the mean of sales growth for the Measuring and Controlling Devices industry

Based on the Anova result (p-value of F test = 0,53) and the confidence intervals of the Figure 5, there is no difference, at 5% significance level, among the mean of the annual sales growth of the clusters' firms of the Measuring and Controlling Devices industry.

Therefore, based on the results of the sections 4.2.2 and 4.2.3 , and at 5% significance level, we rejected the hypothesis H2, in the section 2.1, that the performance of NTBFs is different in function of the regions, or clusters, where the firms were incubated.

5. CONCLUSIONS

Our objective was to analyze whether there were differences in the creation of NTBFs and their product performance across the regions, or clusters. Based on previous studies, we developed two hypotheses. The first hypothesis was not rejected, that is, we did not find evidence to reject the hypothesis that the creation of incubated NTBFs is different in function of the geographic clusters, where the firms were incubated. However, we found evidence to reject the second hypothesis that the performance of these firms is different by geographic clusters. Thus, there is evidence of one of the arguments of Tödtling and Wanzenböck (2003) who argued that large urban centers provide the best conditions for the creation of knowledge-based start ups. The sates with the highest number of incubated NTBFs are in the Southeast and South regions of Brazil, the most economically developed regions and where the main universities are located, for example, the University of São Paulo (USP) and the University of Campinas (Unicamp). In relation to the business performance of NTBFs, there are several critical success factors that influence the performance of these firms as showed by, for example, Atuahene-Gima (1995), Hult, Ketchen and Arrfelt (2007) and Calantone, Chan and Cui (2006). These critical success factors are related to, for example, the turbulence of the environment, entrepreneurial orientation, marketing and technical synergy. However, our

findings indicate that the geographic cluster of the incubator influences the number and the industry type of incubated NTBFs, but not firms' performance.

This study has limitations. We only analyzed the two main industries in our sample, we did not analyze other industries. Another limitation is that we analyzed two performance metrics, but we did not analyze other metrics to assess the economic contribution of these firms, for example, the number of jobs created by these firms. As a suggestion for a future study, it would be interesting to compare the performance between the firms belonging to university incubators and the firms belonging to incubators without formal link with any university. Another suggestion would be to use other performance metrics, such as job creation.

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