INNOVATION MEASUREMENT IN CLUSTERS OF INFORMATION TECHNOLOGY COMPANIES: MULTI-CASE STUDY IN A BRAZILIAN IT LPA (LOCAL PRODUCTION ARRANGEMENT)


Abstract

This article aims to analyze the innovation scores of IT companies and their respective clusters, resulting in a tool for constructing knowledge about these companies and gaining useful information for comparison purposes, since few studies are focused on innovation in Brazilian IT companies, especially microenterprises. A case study methodology was used in this research, and to measure innovation, the model proposed by Edison, Ali and Tonkar (2013) was used. The target audience was the LPA of information technology companies in southwest Paraná, being composed of 50 companies divided into 3 clusters. The data collection was based on a survey with 43 questions built according to the Likert Scale. As a result of the application of the Kruskall-Wallis test, with 5% significance, it was observed that there is a difference between the innovation scores of each cluster, with Clusters 1 and 3 having higher scores. As for the relationship between innovation and turnover, the Spearman Correlation test, with 5% significance, showed that there is a moderate relationship between innovation scores and company turnover. Measuring innovation, both individually and in clusters, is important in the information technology sector because it allows management to see weaknesses and strengths, and implement improvements and changes that ensure increased competitiveness and permanence in the market.

Keywords:

Innovation, cluster, Information Technology.

1 INTRODUCTION

The information technology market has three unique characteristics: low cost for entry of new players in business; constant evolution of information technology products through the release of new product versions that accumulate resources from previous versions; and low appropriability, as during the development process of the product or service, the analysis step consumes many resources and has great importance in the process. Thus the software itself, which has its importance, is only a by-product of these companies, and if copied in isolation, it will not bring a competitive advantage to the one who copied it. [1] These characteristics, coupled with the high competitiveness of the sector, make innovation an essential survival factor for information technology companies.

The scenario presented in the information technology sector in the state of Paraná, Brazil does not escape these characteristics because, according to [2], in 2013, 79% of national companies in the IT sector grew, with companies having headquarters in Paraná reaching an 82% rate of growth.

It is a consensus that for a company to remain in a highly competitive and technological market, it is necessary to develop innovation strategies [3]. However, a company characterized as innovative does not only invest in technology. An innovative organization has the ability to create superior value to the customer and as a consequence, the skills it presents are compared to those of its competitors, placing it as the best in the market segment and encouraging it to an obsessive pursuit of increasing value to customers [4]. To that end, the innovation process (and its management) goes beyond investment in technology, since it is linked to the development and implementation of a novelty, including new processes or the development of new ideas, such as new technology, products or new arrangements [5], [6].

Despite this, there are very few studies applied in Brazil that focus on this segment of the market, especially with regard to innovation, which is consistent with the reading of Marques [7] when he states that it is imperative to carry out studies that provide information technology companies with a kind of data on innovation, as this can help the entrepreneurs in their management, in addition to being relevant to the national economy.

Thus, the general objective of this article is to analyze the innovation scores of the IT companies that compose the cluster in the Southwest Paraná sector, and their respective clusters. With this, the intended result to be presented is a knowledge-building tool that allows companies and clusters to have a view of their innovation performance, as well as the possibility of establishing comparisons with other national and international clusters from the application of the same tool, which is specific for the sector in question.

2 METHODOLOGY

The research was developed in a descriptive way [8], and from a qualitative approach, where the case studies were used [9; 10] due to the need to maintain focus on the innovation measurements of the clusters. Furthermore, [11; 12] states that when case studies are conducted jointly with various individuals, institutions or events, they are called multi-case studies. The strategy of this research was a survey [13], having a structured questionnaire as a data collection instrument, with closed questions [14], from a pre-established model.

The universe surveyed encompasses the companies participating in the Clusters of Information Technology Companies in the cities Francisco Beltrão, Dois Vizinhos and Pato Branco, PR. There is a total of 50 companies that constitute the cluster, where the subjects of the research will be the managers of these companies (IT Managers, IT Directors or CEOs), since these actors are the ones who have the necessary information to measure innovation.
The questionnaire was applied through in-house data collection; that is, the questionnaire was answered in an interview conducted by the researchers in the companies' environment, was manually documented and occurred between June and July of 2016. The questionnaire was constructed from the model from [15], which in its study, after extensive literature review and interviews with specialists in the area of innovation and information technology, developed a model (Figure 1) to measure innovation specifically for information technology companies.

Figure 1. Model for the measurement of innovation [11].

Regarding the responses, the use of the 5-point Likert scale was chosen due to its wide acceptance, popularity and reliability for behavior measurement from a ranking of response options, which in this case were variables regarding the degree of agreement of the respondents to the affirmative questions set out [17]. The response rate was 84% (42 participating companies) among the three clusters. The innovation rate, from both the companies and the clusters, was obtained from the calculation of the median.

Subsequently, the questionnaire was validated with the use of Cronbach's Alpha [18]. The Crobanch's Alpha coefficient of the instrument drawn from the innovation measurement model was 0.94, which demonstrates internal consistency [19].

In addition to the descriptive statistics, the Kruskall-Wallis test was used to analyze the data, with 5% significance, to verify if there is a significant difference between the rates of the cluster and the companies that compose it. For this, the Kruskall-Wallis test presented an H statistic of 5.208, with 2 degrees of freedom and asymptotic significance of 0.074, thus finding that there is a significant statistical difference between the innovation scores of the cluster and those of the companies that compose it; that is, the null hypothesis is accepted for the test of equality of the medians, as the medians do not differ among the groups with different innovation scores. In addition, see Figure 2.

![Figure 2. Box-Plot Chart of Innovation Scores by Cluster.](image)

3 RESULTS

3.1 Characterization of the cluster and the companies

The cluster of companies participating in this study is located in Southwest Paraná, with 50 participating companies, and covers the clusters of three municipalities: Pato Branco, Francisco Beltrão and Dois Vizinhos. The companies participating in this study are information technology companies whose characteristics noted in the questionnaires show that all of them are microenterprises according to the size classification of the company proposed by [20] which is based on the annual turnover of the company. Three of these companies have more than 15 employees and a turnover between R $ 500,001 and R $ 1,200,000.

3.2 Rate of innovation

The questionnaire developed from the model from [15] allows the measuring of innovation in which the organization is found and in the case of the companies participating in this study, the results are shown in Table 1.

Table 1. Mean, Median and Standard Deviation of Innovation Measurements by Cluster.

<table>
<thead>
<tr>
<th>Cluster</th>
<th>No of Companies</th>
<th>Mean</th>
<th>Median</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1</td>
<td>16</td>
<td>4.16</td>
<td>4.31</td>
<td>0.56</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>16</td>
<td>4.15</td>
<td>4.21</td>
<td>0.59</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>11</td>
<td>3.71</td>
<td>3.79</td>
<td>0.58</td>
</tr>
</tbody>
</table>

It is observed that there are measurements ranging from 7.59 (Company 34) to 14.93 (Company 21). These measurements are found both inside the companies of a cluster and in different clusters, so it is important to verify if there is a significant difference between the rates of the cluster and the companies that compose it. For this, the Kruskall-Wallis test presented an H statistic of 5.208, with 2 degrees of freedom and asymptotic significance of 0.074, thus finding that there is a significant statistical difference between the innovation scores of the cluster and those of the companies that compose it; that is, the null hypothesis is accepted for the test of equality of the medians, as the medians do not differ among the groups with different innovation scores. In addition, see Figure 2.

A decisive factor for the increase or maintenance of innovation rates in this category of companies is the financing for innovation, as companies end up needing to invest their own funds to continue their innovation projects and still face difficulties to obtain external financing. These factors corroborate with the study [23] that poses the difficulties encountered by SMEs in innovative activities in order of importance: lack of resources for investments; access to financing; information on entities supporting technological innovation; trained human resources; machines and equipment; information on technological changes; trust in partnerships and alliances for technological innovation and market information.

However, innovative activities in SMEs may be informal or non-explicit, which ultimately lowers the rates of the innovation measurements of these firms [24]; [25]. Yet, [26] reports that many of the innovations in SMEs' processes
are related to the incorporation of physical capital rather than tangible investments in research and development. Thus, because the companies in this study are characterized as SMEs, it is necessary to evaluate their innovative capacity based on different indicators that can express their degree of innovation, as well as to perform an analysis of how innovation and turnover can be related. This is because in order for an idea to be converted into innovation, the product, process or service must be available in the market and used by consumers, generating or increasing the company's revenues and profitability. In addition, if a company makes investments in the form of research and development fostering the innovative process, there is consequently a greater profitability coming from these activities.

The association between turnover and the innovation score of IT companies under study was then evaluated from Spearman's correlation coefficient indicating a moderate correlation, \( r = 0.348 \), with significance level \( p \) value = 0.048. This result shows that corporate turnover influences innovation in a way that innovation contributes significantly to a company's financial performance, productivity, and growth [27].

In addition, companies investing in research and development have higher growth rates than companies that do not have such investments, moreover investment in innovation is more efficient than capital investment in relation to the company's capital growth [28]; [29] [30] [31]; [32]. Innovation is a differential factor in the growth and profitability of companies, especially when associated with product quality, because when the company includes daily practices such as the search, flexibility, and openness to the new, experimentation, discovery, and radical changes, all of which are associated with the notion of innovation (exploration) and discipline, control, standardization, rigidity, efficiency, incremental change, execution and continuous improvement (exploitation), there is a positive growth in the profitability of the company [33]; [34].

4 CONCLUSION

The IT industry stands out as one of the most important industries in the techno-economic scenario, and its participation in the creation of wealth manifests itself as a promoter of efficiency and productivity, permeating the different productive chains that, with its incorporation, have the functionalities of their activities changed.

Furthermore, the information and communication technology sector is in full growth and stands out for competitiveness and for being an important economic axis, having peculiar characteristics which make it a rich environment for academic research, even more so when it comes to innovation. Thus, the approach developed in this study was focused on measuring innovation in companies in three municipalities in Southwest Paraná, in addition to comparing the individual innovation measurements of the companies with that of the clusters to which they belong and to verify if there was a relationship between Innovation and company turnover.

Based on the hypothesis that individual IT innovation measurements do not interfere in the measurements of the clusters they belong to and that there is no correlation between innovation and turnover, the use of statistical procedures was sought after to identify and analyze the IT companies that made up the company clusters.

Thus, the first analysis was carried out, which demonstrated the existence of a significant difference between the innovation scores of the clusters. Cluster 1 and 3 showed close innovation scores and a more even distribution of their company data, as can be seen in Figure 2, since it has box-plots with almost equally distributed quartiles. Cluster 2 has a wider distribution of the first two quartiles, showing that the companies that compose it have lower innovation scores.

The following analysis refers to the relationship between innovation and turnover in IT companies whose results, obtained from the application of the Spearman correlation, showed a moderate correlation, with a significance level of 5% in a bilateral test. This confirms that for this sample, there is a relationship between turnover and innovation, which is in agreement with the literature, since the ideas for innovation need to be available for the use of the clients from their commercialization, which directly impacts the company's turnover.

Regarding limitations of this study, because it is a multi-case study, it is impossible to make inferences to the IT sector as a whole, limiting it only to the universe of this study. Therefore, there is a need to carry out the application of this innovation measurement methodology in future studies so that it is possible to make inferences to the information technology sector as a whole.

In this way, the importance of the measurement of innovation is verified for its continuity and development, and for improvements in performance and competitiveness in companies of the information technology sector, because it allows to evaluate the performance and verify the current situation of the companies, their strengths and weaknesses, benefits and challenges are really needed for the development, growth and increased competitiveness of small and medium-sized enterprises. Thus, in this context, one can see the importance of the application of innovation evaluation methodologies, especially in a sector of the economy that is in rapid growth and that has to be competitive and innovative in an increasingly aggressive market.

5 REFERÊNCIAS


