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APPLICATION OF IMPORTANCE AND PERFORMANCE MATRIX TO ASSESS THE QUALITY OF SERVICES PROVIDED BY BUSINESS INCUBATORS

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¹Diego Philipe de Oliveira Godeiro

²Marcel Lima Ribeiro Dantas

³Dmitryev Cyreneu da Silva

⁴Maxwell dos Santos Celestino

ABSTRACT

The purpose of this article is to demonstrate the use of importance and performance matrix in assessing the quality of services provided by incubators. It is a descriptive research and it uses a qualitative approach. The research design is a case study, based on interviews with four entrepreneurs from the same incubator. It also uses a documental analysis from the public notice selection of the incubates used by this incubator. The dimensions of the services provided by incubators (infrastructure, professional services and network) and the attributes of these dimensions were selected based on previous studies. These attributes were used in the construction of the interview script and results analysis, aided by qualitative data analysis software for researchers, called NVivo® from QSR International Pty Ltd. The coding was developed based on 146 citations from interviews. High importance was attached to the infrastructure, which was evaluated as excellent. The professional services have received less importance, but they need to be improved. Despite the importance attached to the network, no robust actions were reported by the incubator. The analysis of clusters (or groupings) resulted in a group with hardware companies and another with software companies, resulting in two importance and performance matrixes being built. These matrices suggest the improvement of incubator performance in promotional activities to internal and external network. For hardware developers, access to laboratories is added. The study contributes to investigate the quality of services offered by incubators, especially when using importance and performance matrix.

Keywords: Business Incubators. Quality of Services. Importance and Performance Matrix.

¹Doctorate Student in Administration from the University Federal Rio Grande do Norte - UFRN, Natal, (Brazil). E-mail: diegophilipe@hotmail.com ORCID ID: <http://orcid.org/0000-0002-1917-0590>

²Doctorate Student in Administration from the University Federal Rio Grande do Norte - UFRN, Natal, (Brazil). E-mail: marcellrdantas@yahoo.com.br ORCID ID: <http://orcid.org/0000-0002-1802-7426>

³Masters Administration from the Federal University of Rio Grande do Norte - UFRN, Natal, (Brazil). E-mail: dmitryev14@gmail.com ORCID ID: <http://orcid.org/0000-0001-7029-6482>

⁴Doctorate Student in Administration from the University Federal Rio Grande do Norte - UFRN, Natal, (Brazil). E-mail: maxwelsc@ufrnet.br ORCID ID: <http://orcid.org/0000-0003-3810-7586>



APLICAÇÃO DA MATRIZ IMPORTÂNCIA E DESEMPENHO PARA AVALIAR A QUALIDADE DOS SERVIÇOS FORNECIDOS POR INCUBADORAS DE EMPRESAS

RESUMO

O objetivo deste artigo foi demonstrar o uso da matriz importância e desempenho na avaliação da qualidade dos serviços fornecidos por incubadoras. Esta pesquisa é descritiva e usa abordagem qualitativa. O desenho de pesquisa é estudo de caso, baseado em entrevistas com quatro empreendedores de uma mesma incubadora. Utiliza-se ainda de análise documental do edital de seleção de empresas incubadas por essa incubadora. As dimensões dos serviços prestados por incubadoras (infraestrutura, serviços profissionais e *network*) e os atributos dessas dimensões foram selecionados partindo de estudos anteriores. Esses atributos foram usados na construção do roteiro das entrevistas e análise dos resultados, auxiliado pelo *software* de análise de dados qualitativos para investigadores, chamado NVivo® da QSR International Pty Ltd. A codificação foi desenvolvida baseada em 146 citações das entrevistas. Observou-se alta importância à infraestrutura, avaliada como excelente. Os serviços profissionais receberam importância menor, mas devem ser melhorados. Apesar da importância conferida ao *network*, não foram relatadas ações robustas pela incubadora. A análise de agrupamentos resultou em um grupo com empresas de *hardware* e outro com empresas de *software*, sendo construídas duas matrizes importância e desempenho. Essas matrizes sugerem a melhoria do desempenho da incubadora nas ações de promoção do *network* interno e externo. Para desenvolvedoras de *hardware*, acrescenta-se o acesso aos laboratórios. O estudo contribui ao investigar a qualidade dos serviços oferecidos por incubadoras, sobretudo pelo uso da matriz importância e desempenho.

Palavras-chave: Incubadoras. Qualidade dos Serviços. Matriz Importância e Desempenho.



1 INTRODUCTION

Business incubators have grown in Brazil supported by the government, companies and universities, leading to innovation in incubation models (Chandra, Chao, & Astolpho, 2014). These incubators have become important in attracting and supporting innovation (Gerlach, & Brem, 2015). The discussion that approaches the incubation process of the companies involves at least two aspects. The first refers to the mortality of this type of company. The second is the support that can be provided for innovation (Barbosa, & Hoffman, 2013).

Several authors (Bizzotto, 2003; Hackett, & Dilts, 2004) point out that, to evaluate the results of an incubator, it is necessary to implement a system that includes a series of performance indicators, as well as a methodology for their use. This is to aim at the constant measurement of performance of business incubators. Aranha (2002) explains that managerial information is essential for incubator managers to be able to establish more precise strategies to achieve organizational goals and objectives. However, in most incubators, there is a lack of a systematized management process (Motta, & Imoniana, 2005; Somsuk, & Laosrionghong, 2014; Scillitoe, & chakrabarti, 2010; Vanderstraeten, & Matthyssens, 2012; Somsuk, Wonglimpiyarat, & Laosirihongthong, 2012) with criteria that consider particularities, such as the evaluation of the quality of service offered to business incubators.

Incubation services are widely discussed in Brazilian studies (Tietz, Anholon, Cooper Ordonez, & Quelhas, 2015), suggesting high relevance of this theme. However, no study was found that ordered their priorities and, at the same time, investigated the performance of incubation services from the perspective of the entrepreneurs. To do so, it is necessary to use the Importance and Performance Matrix (IPM).

This matrix provides a global view of the various attributes of the services and suggests the treatment to be dispensed for each of them (Prajogo, & McDermott, 2011). It has been successfully used to assess quality of services in areas such as tourism, education and health (Sever, 2015). Its application in assessing the quality of services provided by incubators may indicate priority means to support small entrepreneurs starting from their perceptions of, for example, infrastructure, development of entrepreneurial skills and relationships with other entrepreneurs. The research on the previous studies was developed based on Science Direct, Scopus and Emerald using the combination of terms quality of services AND importance and performance matrix AND incubators.

In this line, the central question dealt here is how to use the performance matrix of importance in assessing the quality of incubation services. The objective of this article is to demonstrate the use of IPM in the evaluation of the quality of services provided by incubators. This research uses the case study research design and its implementation was carried out in



a technological incubator in Natal in Rio Grande do Norte (RN), Brazil. The option for a qualitative analysis is emphasized, since in the literature IPM is frequently used from a quantitative analysis.

The choice of the incubator is justified by its pioneering nature and importance in the technology sector in the state motivated through activities of research, extension, events and new proposals of continuous training developed in this Institute (Gomes, Maia, & Nunes, 2016). The billing of products and services negotiated by the companies linked to the incubator in 2014 was R\$ 11 million (Anprotec, 2015). In addition, the topic gains relevance due to the role played by incubators for the socioeconomic progress of Rio Grande do Norte state and region, through the creation of new companies, in which innovation and entrepreneurship stand as an important differential.

The remaining sections of this article include a literature review of business incubators, services provided by business incubators, service quality and importance and performance matrix. It also discusses the research method, presentation and data analysis, which includes the characterization of the Incubator and of the incubated companies, the perceptions of the entrepreneurs about the quality of the services, as well as the conclusion of this work.

2 LITERATURE REVIEW

In this section it's done a literature review, with some concepts evidenced in work already applied, as well as gaps that can be addressed to improve the knowledge on the subject. Initially it is approached the subject of business incubators with the description of their process and history. Later, concepts about quality of services as well as quality of services in incubators are exposed.

2.1 Business Incubators and Services Provided

A business incubator can be defined as a set of companies that share a physical environment with adequate facilities and administrative infrastructure, providing the conception, development and consolidation of new businesses, as well as the establishment and strengthening of partnerships (Vedovello, 2000). The business incubators appear as a mechanism that has the "objective of improving the competitive environment of companies" (Vedovello, & Figueiredo, 2005) and to guarantee greater survival for innovative companies, through managerial training of incubated entrepreneurs.

The incubators have been fundamental for the emergence and growth of small companies with advanced technology (Iacono, Almeida, & Negano, 2011). Business incubators play a crucial role in the start of new organizations during a very critical period: the introduction of the company in the market. Incubators have been identified as important actors for the development of companies and even regions (Serra, Serra, Ferreira, & Fiates, 2011).



The incubators offer consulting services to the projects in their initial phases, for a maximum of three years, providing physical arrangement, with basic infrastructure services (internet, rooms, telephone and work environment) and management assistance. This enables the adequate development of the business in its primary phase. This type of support may vary from incubator to incubator. Xavier, Martins and Lima (2008) conclude that the effectiveness of the service provided by the incubator to the entrepreneurs can be considered as decisive factor for the success of the enterprise.

The activities developed by incubators to assist companies are divided into physical and administrative infrastructure, specialized and customized services for specific demands (Medeiros, 1998). Among these specialized services and/or specific demands, are the foundations of knowledge of business processes, indicated by Studdard (2006). This assumes that the scope of an incubator goes beyond the physical structure, furniture and equipment (Medeiros, 1998). The factors that support business incubation are: building and maintaining effective support network, developing new business marketing team skills, monitoring and evaluating business progress, and access to adequate funding (Patton, Warren, & Bream, 2009).

The services offered may vary from incubator to incubator. Different authors present different groupings for services (Raupp, & Beuren, 2011; Barrow, 2001; Theodorakopoulos, Kakabadse, & McGowan, 2014; Abduh, D'souza, Quazi, & Burley, 2007). Raupp and Beuren (2011) separate the services that make up the support offered by the incubators into five categories: administrative support, financial support, structure support, support through programs developed by the incubators and support through programs of development agents next to the incubators. However, this classification is not unanimous among the different authors.

The services offered by incubators to the incubated and other aspects that relate to the company, the process of incubation and incubator are part of the scope of the Centro de Referência para Apoio a Novos Empreendimentos (CERNE) methodology (Reference Center methodology to Support for New Enterprises), developed through cooperation between the Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (SEBRAE) (Brazilian Support Service for Micro and Small Enterprises) and the Associação Nacional das Entidades Promotoras de Empreendimentos Inovadores (ANPROTEC) (National Association of Promoting Innovative Enterprises Institutions). Their purpose is to create a model of solutions to extend the incubator's capacity to support successful innovative ventures (De Almeida, Barche, & Segatto, 2014), taking in account their basic principles: process focus, accountability, transparent and participatory management, human development, sustainability, ethics, focus on entrepreneurship and continuous improvement (De Almeida, Barche, & Segatto, 2014).

2.2 Quality of Services

Grönroos (1982) points out that clients evaluate service quality by comparing their perceptions about the expected service (expectations) and service received (performance).



According to Gibson (1964), perceptions go through the basic senses and other factors of users, such as memory, personality and culture.

The cognitive structures implicit in the performance assessment process have been researched and results have revealed consistent structures related to assessment. This way, Parasuraman, Zeithaml and Berry (1988) consider the expectations in the evaluation of service quality and use the following formula: $Q = P - E$, where Q represents the quality of the service; P means perception about performance; and E refers to expectations.

Thus, three possibilities arise: a) performance equal to the expectation; b) performance exceeding the expectation; and c) performance below the expectation. A performance equal to or above expectations suggests good quality of services, while lower performance implies poor quality. However, Cronin and Taylor (1992) assert that the quality of service is more faithfully apprehended using only perception over performance rather than using the expectation and performance dyad. Therefore, the Importance and Performance Matrix (IPM), which will be detailed below, provides simultaneous understanding of expectation (importance) and performance.

2.3 The Importance and Performance Matrix

The Importance-Performance Analysis (IPA) was used by Martilla and James (1977) to provide managers with treatment information to be assigned to various attributes of the services. Originally, the IPA was presented using a two-dimensional or square matrix with the x-axis representing the performance and the y-axis describing the importance, as shown in Figure 1. The matrix contains four quadrants. Quadrant 1 reveals high levels of customer performance and importance and receives the words "Keep up the good work." Quadrant 2 is characterized by low levels of performance in attributes of high importance, called "Improvement area", requiring immediate managerial attention. Quadrant 3 represents low attributes in both performance and importance, and therefore receives a "low priority" label. Finally, Quadrant 4 represents attributes with high performance, but of low importance, being considered as belonging to the "Possible exaggeration". This is because the latter term implies that the resources committed to these attributes could be used elsewhere (Prajogo, & Mcdermott, 2011).

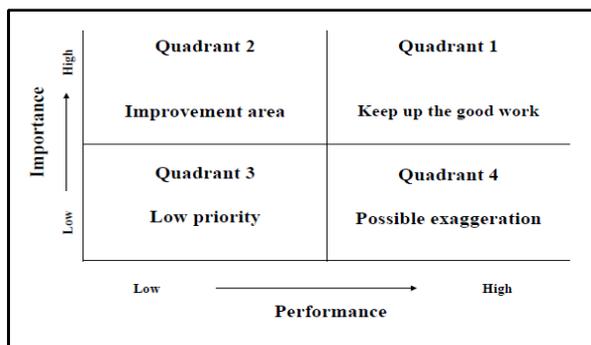


Figure 1: Importance and performance matrix.
Source: Adapted from Martilla and James (1977).



The bibliography presents several papers that used IPM. For example, Joseph, Sekhon, Stone and Tinson (2005) conducted an exploratory study to understand customer satisfaction with banking services in the United Kingdom. The IPM showed that two factors and their underlying attributes were in the "keep up the good work" quadrant and the other two, at "low priority." From the managerial point of view, it provided an overview of resource allocation. One outstanding contribution of this paper was to show that financial institutions can use similar procedures to evaluate their clients' satisfaction.

In the meanwhile, Azzopardi and Nash (2013) developed a methodological evaluation of studies that used the IPM to analyze the competitiveness of tourist destinations. The study distinguished this tool as useful and versatile. Spalenza, Ronchi, and Pelissari (2017) used IPM to study doctors' perceptions of health plans. For all the questions the performance was below the expected, being the IPM used for the decision of prioritization of these questions. Thus, to exemplify, the question "authorization process for customers" was in the critical area. Finally, Ramirez-Hurtado (2017) used a variant of the original model of Martilla and James (1977) to show the attributes that travel agent franchisees feel most dissatisfied with their franchisors: advertising chain, continuous support and support training.

Researchers such as Bacon (2003) and Slack (1994) have modified the use of this matrix. They have developed a variation of importance and performance matrix. It is like the one mentioned above and is divided into four zones: urgent action, improvement, appropriation and excess. In this version of the matrix the x-axis represents the importance and the y, the performance. Each of these is divided into three regions, that are subdivided into three points. The performance axis represents the performance of the company analyzed in relation to the performance of competitors. Abduh et al. (2007) used IPA to assess satisfaction with services provided by incubators. Compared with the matrix proposed by Martilla and James (1977), two points of divergence are noted. The original axes, importance and performance were maintained. However, Abdu et al. (2007) highlights the importance in the x-axis and the performance in the y.

This does not change the logic of the seminal matrix. In addition, there are discrepancies in the location of the quadrants and in the words of the suggested treatment for each of these. Although, the main idea for each quadrant was not significantly modified. Considering that the focus of the research is to identify the perception of the quality of the service that the Brazilian incubators offer to incubated companies, the methodological procedures used to carry out the study are presented next.

3 METHODOLOGY

The present study is a descriptive research and it makes use of the qualitative approach. This one considers the subjectivity of the subjects involved in the research (Flick, 2009), in the specific case, the perceptions about the quality of the service.



In a qualitative investigation there are many methods, however, when one intends to investigate a contemporary phenomenon within its real-life context, there being no clear distinction between the phenomenon and the context, it is faced an empirical investigation process of the type "case study ". In this design, the research questions focus on the "how" or the "why" and the research strategy is comprehensive, using various sources of evidence to triangulate data (Yin, 2005).

The methodological procedures developed in the present study are shown in Figure 2. The study began with a literature review. This step allowed the identification of the dimensions and attributes of the incubation services.

Given the discrepancies in the literature regarding the dimensions and attributes of incubation services, the authors of this article were based on the dimensions outlined by Barrow (2001): infrastructure, professional services and network. In addition, they selected in national and international empirical articles the attributes to compose such dimensions. In this way, Figure 3 shows the dimensions and attributes selected for the present research.

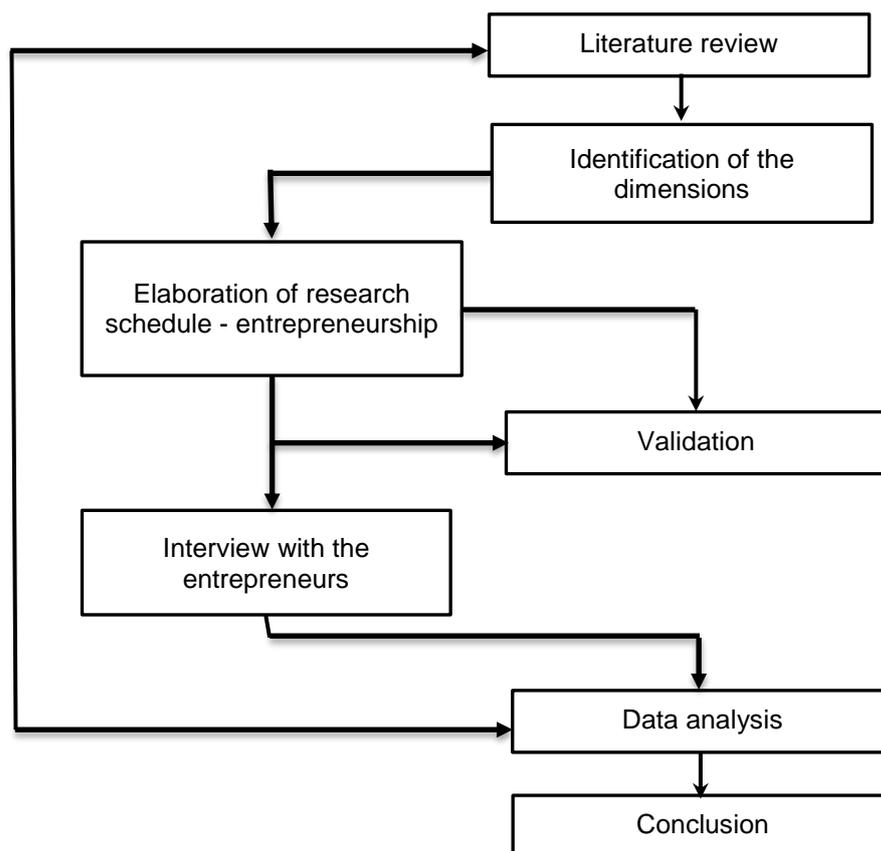


Figure 2 – Research Design
Source: The authors (2017)



Dimensions	Attributes	Authors
Physical infrastructure: Constituted by individual and shared physical space. This includes, for example, reception, conference rooms and parking. More specialized facilities, such as laboratories and research equipment, can also be placed under shared resources	Individualized physical space	Sousa, Sousa and Predebon (2006); Ratinho, Harms and Groen; Barbosa and Hoffmann (2013); Marimuthu and Lakha (2015)
	Shared physical space	Sousa, Sousa and Predebon (2006); Ratinho, Harms and Groen; Barbosa and Hoffmann (2013); Marimuthu and Lakha (2015)
	Libraries	Raupp and Beuren (2011); Barbosa and Hoffmann (2013); Wang et al. (2008); Sousa, Sousa and Predebon (2006)
	University labs	Raupp and Beuren (2011); Barbosa and Hoffmann (2013); Wang et al. (2008); Sousa, Sousa and Predebon (2006)
Professional services: These include, among others, mentoring, coaching and counseling, support for the development of a business plan and the training of entrepreneurs	Consulting	Sousa, Sousa e Predebon (2006); Abduh et al. (2007); Raupp and Beuren (2011); Barbosa and Hoffmann (2013); Marimuthu and Lakha (2015); Wang et al. (2008)
	Training	Sousa, Sousa and Predebon (2006); Abduh et al. (2007); Vieira (2012); Xavier et al., Wang et al. (2008)
	Coaching	Ratinho, Harms and Groen; Barbosa and Hoffmann (2013); Theodorakpoulos, Kakabadse and Mcgowan, (2014); Engelman, Fracasso and Brasil (2011)
	Mentoring	Ratinho, Harms and Groen (2013); Barbosa and Hoffmann (2013); Theodorakpoulos, Kakabadse and Mcgowan, (2014); Engelman, Fracasso and Brasil (2011)
Network: Access to a network of professional contacts involving incubates, graduates, customers and suppliers	Network between incubated in the same incubator	Ratinho, Harms and Groen (2013); Wang et al. (2008); Somsuk; Wonglimpiyarat and Laosrihongthong (2012); Serra et al. (2011).
	Network with external networks	Ratinho, Harms and Groen (2013); Wang et al. (2008); Somsuk; Wonglimpiyarat and Laosrihongthong (2012); Serra et al. (2011).

Figure 3: Dimensions and attributes
 Source: The authors (2017)

The subsequent stage was the elaboration of the interview script, shown in Figure 4. To compare perceptions of expectations (importance) and performance of attributes of incubation services, each attribute gave rise to a question of importance and another question of performance.



Application of Importance and Performance Matrix to Assess the Quality of Services Provided by Business Incubators

Questions		Attributes of incubation facilities surveyed
Before the start of the incubation process, what was your expectation about...	... the individualized physical space used by each incubated?	Individualized infrastructure
	... the shared physical space used by the incubated company?	Shared infrastructure
	... the use of libraries?	Libraries
	... the use of university laboratories?	University Laboratories
	... the consultancies offered by incubators?	Consultancy
	... the training offered by incubators?	Training
	... the coaching offered by the incubators?	Coaching
	... the mentoring offered by incubators?	Mentoring
	... the actions of the incubator to promote the network among the incubated?	Network among incubators
	... the actions of the incubator to promote the network with networks of contacts external to the incubator?	Network with external networks
How do you rate...	... the individualized physical infrastructure offered by your incubator?	Individualized infrastructure
	... the shared infrastructure offered by your incubator?	Shared infrastructure
	... the libraries offered by your incubator?	Libraries
	... the university labs offered by your incubator?	University Laboratories
	... the consultancies offered by your incubator?	Consultancy
	... the training offered by your incubator?	Training
	... the coaching offered by your incubator?	<i>Coaching</i>
	... the mentoring offered by your incubator?	Mentoring
	... the actions of your incubator aimed at promoting the network among the incubated?	<i>Network among incubators</i>



	... the actions of your incubator aimed at promoting the network with networks of contacts outside the incubator?	Network with external networks
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Figure 4: Interview script
Source: The authors (2017)

To test the suitability of the selected dimensions and attributes as well as the survey instrument, interviews took place with the participation of entrepreneurs of a mixed based incubator of a private university located in Natal, Rio Grande do Norte, Brazil. The dimensions and attributes were adequate. Some adjustments were made in some terms used and in the way of exposing the questions to the entrepreneurs.

The next step was to conduct the interviews in the incubator focused in the present research. This incubator houses a total of 13 incubated companies, four of which were selected for the interviews, being sampling by access. Semi-structured interviews (Fontana & Frey, 1994) were carried out with incubators entrepreneurs during the second semester of 2016 and had an average duration of 25 minutes.

To obtain access to the companies, a meeting was held with the manager of the incubator, who in turn provided the data of the incubated companies. With this information, a first contact was made by e-mail and, from there, the companies that were most available were selected. The respondents were informed of the research objectives and adherence was voluntary, which is recommended by Yin (2005), regarding research ethics. However, it was decided to ensure the anonymity of the companies and of the interviewees, to preserve them and not to spoil the analysis and understanding of the data collected (Cone, & Foster, 2006).

Researchers followed the ethical procedures outlined by Flick (2009). Two terms were delivered: a) Confidentiality Term; and b) Free and Informed Consent Term, authorizing the recording of interviews for strictly academic purposes. For each interview, identification sheets were used as suggested by Flick (2009), containing date, place, length of interview, particularities occurred and interviewee information such as sex, age, training and profession. The interviews were transcribed and totaled 28 pages. Later they were interpreted according to the content analysis (Bauer, & Gaskell, 2000; Bardin, 2011).

In all the interviews were present the four Authors of this article, who took notes of their impressions which were discussed and compared among themselves. This type of triangulation, by researchers, means the application and engagement of different observers to reveal and minimize biases from the individual researcher (Gibbs, 2009). In addition to the interviews, the selection announcements of the incubated companies were analyzed, thus configuring the process of triangulation of the sources.

The analyzes were carried out with the aid of NVIVO 11 software. The categories were inspired by the dimensions of the services provided by incubators according to Barrow (2001).



Subcategories have been defined based on attributes that represent such dimensions. Each attribute taken from the literature gave rise to a subcategory of expectation and another of performance. For example, the library attribute gave rise to the subcategories "library importance" and "library performance".

Content analysis was performed according to the proposal of Bardin (2011). In the coding process, the cycles suggested by Saldaña (2015) were used. In the first one, 146 extracts or citations were selected that refer to the subcategories of the services provided by incubators. These extracts gave rise to 67 codes. In the second cycle, the labels of the codes have been refined and defined more precisely. Some codes were suppressed as they were contained in more comprehensive codes. Thus, 51 codes remained. These were allocated in the subcategories

The next step was the elaboration of matrices displaying, for each subcategory, their respective codes and sources. These matrices provided subsidies for the discussion of the results allowing inter and intra-case comparisons. Clusters of companies were also developed based on the codification of the statements of their entrepreneurs, with the purpose of facilitating the characterization and interpretation for each group.

Finally, it was built performance importance matrices inspired by Martilla and James (1977). One for enterprise software developers and another for hardware companies. According to the interviews conducted with the entrepreneurs, the authors of this article constructed a ranking of importance for the attributes, as well as a ranking of performance for these same attributes in the view of the entrepreneurs. Then, the correlation between the attributes in the two axes (importance and performance) and the region where it was located were verified.

4 ANALYSIS OF THE RESULTS

The results obtained from the interviews with entrepreneurs representing incubators at Inova Metropolis are presented below. Initially, the characterization of the Incubator is performed. Subsequently, it's done a characterization of the incubated companies participating in this study and present the perceptions of their managers regarding the services provided by the incubator, dividing the third subsection into three topics to analyze the effects in each identified category. Finally, the importance and performance matrices are presented.

4.1 Characterization of the Incubator

Started in 2009, the Metr pole Digital Project was consolidated as Digital Metropolis Institute (MDI), Supplementary Unit of the Federal University of Rio Grande do Norte (UFRN). In 2016, the incubator had eighteen incubated companies, a graduate company and twenty-



five pre-incubated companies. Investment was still low in the incubator structure. In 2014, R\$120 thousand were invested through a SEBRAE (Brazilian Micro and Small Business Support Services) announcement and approximately R\$ 90 thousand from the incubator companies. Federal support is part of the university structure.

To enter the Inova Metr pole incubator, proposals are required for the development of products, processes or services using innovative technologies. The public selection notice indicates the services offered: basic package for use of the Data Center; technology orientation for product development; guidance on intellectual property, patent registration and technology transfer; psychological follow-up; business orientation through consultancies and specialized advisory services; training for entrepreneurs; dissemination of the projects in the various media used by the incubator; support for participation in events and access to the virtual services of the UFRN Library.

The same public notice also foresees the infrastructure offered by the incubator: meeting rooms and living spaces with shared use by the incubator, its partners and the participants of its incubation system; room for individual use, for each of the companies selected for incubation, with basic facilities of electric energy and data communication, besides being equipped with a basic office kit, access to IMD laboratories and other UFRN laboratories.

4.2 Characterization of Incubates

The segmentation of the incubations studied was summarized in Figure 5. The names of incubated companies were presented in a generic way to preserve their identity. Two are software developers, while equal numbers are engaged in developing hardware.

Company	Occupation area	Incubation phase	Sex of the entrepreneur
Incubated L1	Information and Communication Technology Solutions	Initial	Male
Incubated L2	Digital Marketing	Final	Male
Incubated N1	Trade, assistance and development of projects with embedded systems	Initial	Male
Incubated N2	Development, manufacturing and marketing of electronic systems	Final	Male

Figure 5: Characterization of interviewees
Source: The Authors (2017)



4.3 Entrepreneurs' Perceptions about the Quality of Services

The presentation and discussion of the results is done from the categories, using the frequency of the codes in each subcategory. Excerpts from the interviews with the entrepreneurs are highlighted and the results found are compared with previous studies have been made.

4.3.1 Infrastructure

The infrastructure category has eight subcategories and 18 codes, according to the matrix shown in Figure 6, which also details the sources of the citations.

The entrepreneurs of L1 and L2, software development companies, pointed out the infrastructure offered by the incubator as the main reason that led them to look for the incubation process, which reveals high importance given to this aspect. The manager of the L1 said: "we came in with the intention of taking a space". These results are in line with those found in Xavier et al. (2008), Sousa, Sousa and Predebon (2006), Barbosa and Hoffman (2013), Marimuthu and Lakha (2015) and Engelman, Fracasso and Brazil (2011), who highlight the infrastructure offered as the most attractive factor to bring entrepreneurs to incubate their business. However, in the present study, the entrepreneurs who developed hardware did not take the same position.

All entrepreneurs claimed to like the infrastructure provided by the incubator. The individualized infrastructure of the incubator was one of the most praised items. The L1 entrepreneur stated that the rooms are good. The L2 classified the structure as perfect. This same enterprise showed high satisfaction with the furniture, energy and dimensions of the individual rooms.

The entrepreneur of L2 came to affirm that the incubator under discussion is a reference in the state among the incubators regarding the shared infrastructure. In turn, the entrepreneur of N2, when analyzing the facilities of the building used the adjective exceptional to classify his perception of the infrastructure of the incubator.

Although Marimuthu and Lakha (2015) consider physical infrastructure as one of the main influencing factors in the companies that are candidates for the incubation process, the authors emphasize that this can vary from one incubator to another, as well as the context in which are inserted.



Subcategories	Codes	Frequency of codes			
		L1	L2	N1	N2
Importance of individualized infrastructure	Expected infrastructure similar to what is offered	0	3	0	0
	Expected minimum infrastructure	1	1	0	0
	Main reason to look for the incubation process	1	3	0	0
Individualized infrastructure Performance	Criticism of individualized infrastructure	0	1	0	0
	Likes the individualized physical infrastructure	4	4	1	2
	Reasons for other entrepreneurs to incubate their business	0	1	0	0
Importance of shared infrastructure	Expected minimum structure	1	0	0	0
	Low-cost structures for entrepreneurs	1	0	0	0
	Reasons for searching the incubation process	0	3	0	0
Shared of the infrastructure performance	Criticism of shared infrastructure	2	2	2	1
	Likes shared physical structures	4	2	1	2
	Reasons for other entrepreneurs to incubate their business	0	1	0	0
Importance of the library	Interested in using the library	1	1	2	1
	Internet as the library substitute	0	0	1	0
Importance of university laboratories	Disinterest in using university laboratories	0	1	0	0
	Interest in university laboratories	0	0	1	1
Performances of Universities Laboratories	Criticism of access to university laboratories	0	0	3	2
	Demand from hardware companies	0	0	1	0

Figure 6: Subcategories, codes and frequency of infrastructure codes
Source: The authors (2017)

Despite the satisfaction with the infrastructure, criticism was made by all entrepreneurs. The entrepreneur of L2 reported: "an environment of entrepreneurship, an environment where people talk about incubation, creativity, could be less hospital than what is here. Those white walls, for God's sake, that's it [...] the guy goes to think he's in a hospital, it's depressing". The N2 entrepreneur complained that the parking lot is often full. The N1 entrepreneur said: "there are some difficulties in the development part in the part of our software that is online because of jurisdiction issues [...] you cannot update the site here".

Entrepreneurs interviewed did not value access to libraries. The L1 entrepreneur said he had no interest in libraries. The entrepreneur of N1 said: "this technology area always comes new thing and is always on the internet has no book on a board that launched these



days that we have here is updating". As the entrepreneurs revealed a lack of interest in using the library and stated that they never did, the performance of the library was not evaluated. Taking up the discussions of Sousa, Sousa and Predebon (2006) and Barbosa and Hoffman (2013), these authors affirm that libraries have been little used by incubated companies, especially those related to technology and innovation.

4.3.2 Professional services

The professional services category contains eight subcategories and 19 codes, according to the matrix shown in Figure 7, which also details the origin of the citations.

All the interviewees evaluated the consultancies as very important, which agree with Raupp and Beuren (2011) and dos Santos, Beuren and Conte (2017), when affirming that the consulting service and its monitoring support the incubation process. The entrepreneur of L1 stressed the value of consulting firms because the partners of the company do not have management training. A similar result was found by Xavier et al. (2008) when presenting the report of a businessman stating that the consultancies are very important because the partners did not have knowledge about business management

The incubator performs the companies monitoring through the OKR methodology (Objectives and Key Results), which is done every three months in the areas of management, marketing, financial and organizational psychology. The internal consultants are hired by an internal foundation called Fundação Norte-Rio-Grandense de Pesquisa e Cultura (FUNPEC) and they are instructed through those goals established in this schedule, monitoring and training at least one hour per month with each company depending on the demand and goals set in that tool. These goals change every three months. There are also consultancies from outside that are brought and prospected by the direction of the incubator and leave at zero cost to companies. In these cases, the incubator has used resources received by the CERNE Certification and completely facultative.

The entrepreneurs of L1, N1 and N2 liked the consultancies provided. However, all the entrepreneurs interviewed criticized. The manager of N2 said: "should be a little less academic and more market-oriented". It is possible that some consultancies offered by the incubator are closely related to the university and are not considered relevant to the entrepreneurs, which is in keeping with the premise proposed by Wang et al. (2008) and may mean a possible inadequacy of the services offered. Despite a possible inadequacy of the services offered, the managers of L1 and L2 described the evolution of the consultancies. They said: "when we started it was bad and today is much better, because the maturity has reached the staff of the incubator and they already use methodologies of [...] even the most mature incubation process".



Only the entrepreneur of N2 emphasized the importance of training. On the other hand, when evaluating the performance of these trainings, the managers of L1 and N2 made criticisms, some of them due to possible divergences between what was given and the needs of the entrepreneurs. The manager of L1 said: "the guy would get there, start I'll say some things talk out of the reality here, quite out of the reality", while the N2 said: "some that were given and that are a little unfocused because you expect something else". Despite criticism, the L1 entrepreneur reported improvement in training.

The improvement of training is indicated by the study carried out by Xavier et. al (2008) as the main attribute to be improved among incubation services.

Subcategories	Codes	Frequency of codes			
		L1	L2	N1	N2
Importance of consultancies	Training of entrepreneurs in non-management courses	1	0	0	0
	Valuation of consultancies	1	3	1	1
Consulting performance	Consulting Criticism	6	1	2	1
	Development of consultancies	1	3	0	0
	Like the consultancies	4	0	1	1
	Suggestions for improvements to the consultancies	1	0	0	0
Importance of Training	Values trainings	0	0	0	1
Training Performance	Training reviews	1	0	0	0
	Evolution of trainings	1	2	0	0
	Divergent training of incubator needs	1	0	0	1
Importance of mentoring	High valuing of mentoring	0	2	0	0
	Doubt about the importance of mentoring	1	0	0	0
Mentoring Performance	Criticisms of mentoring	0	0	0	1
	Evolution of mentoring	0	2	0	0
	Likes mentoring	0	2	0	0
Importance of coaching	High valuing of coaching	0	2	0	0
	Difficulty in finding professionals for the area	0	0	1	0
	Doubt about the importance of coaching	1	0	0	0
	Important for large companies	3	0	0	0

Figure 7: Subcategories, codes and frequency of codes of professional services
 Source: The authors (2017)



Only the L2 entrepreneur valued coaching and mentoring. He said, "mentoring and coaching cut paths". The L1 manager has doubted the importance of these services. Although the importance of coaching and mentoring are not appreciated by most of the entrepreneurs interviewed. Sousa, Sousa and Predebon (2006) assert that incubators must overcome the barrier of traditional services and offer services that generate added value. The L2 entrepreneur stressed that the mentors helped a lot and revealed the evolution of the same by saying "In that last year now they have greatly evolved this issue of mentoring".

In this line, criticism has shown that some mentoring is repetitive and deals with few relevant topics.

4.3.3 Network

The network category has four subcategories and 14 codes, according to the matrix shown in Figure 8, which also details the sources of the citations. Chandra, Chao and Ryans (2011) stated that incubators that can provide excellent network provide services with high added value.

In the study by Xavier et al. (2008), the exchange with similar companies was one of the less valued aspects, cited by only 13% of the entrepreneurs as a reason that led them to search for the incubation process. In Sousa, Sousa and Predebon (2006), interaction with other incubated companies ranked fifth among nine reasons that led entrepreneurs to seek incubation. However, in the present study, the entrepreneurs ahead of L1 and L2 pointed to the network as the highest value provided by the incubator.

The manager of L1 said: "the biggest value I see in the incubator is neither the physical structure, it's the networking environment". Along the same lines, the L2 entrepreneur said: "the network for me is the most important thing it has". But the hardware entrepreneurs did not point to the network as the main attraction of the incubators. It is possible that the divergence attached to the importance of the network between software and hardware developers in the incubator under study may be linked to the large number of software companies present in the incubator, while the hardware ones are rare.

The four entrepreneurs interviewed emphasized that the incubated network happens spontaneously. The N2 entrepreneur said: "I think it's more spontaneous, it's that corridor and affinity conversation that's going on between companies". It is possible that there are actions by the incubator aimed at increasing the network between incubated but are little known by the entrepreneurs. The entrepreneurs of L1 and N1 found that the incubator promoted such practices. The N1 entrepreneur stated that there are initiatives by the incubator. However, no entrepreneur reported any concrete action.



Subcategories	Codes	Frequency of codes			
		L1	L2	N1	N2
Importance of Network among incubated	High value of the network with other incubated	0	1	1	0
	Learning with other incubates	1	2	0	0
	Higher value provided by the incubator	1	2	0	0
	Reason to continue in the incubator and attract new incubators	0	2	0	0
Performance of the Network with other incubated	It happens spontaneously	1	1	1	1
	It happens through the incubator	2	0	1	1
	Increased incubation network	0	1	0	0
	Criticism of the incubated network	3	0	0	1
	Few hardware incubations for network	0	0	1	1
	Suggestions to improve the incubation network	1	2	0	0
Importance of external network	Higher value provided by the incubator	1	1	0	0
	Reason to attract new incubators	0	1	0	0
	Role of the incubator in the external network	2	2	0	0
Performance of the Network with entities outside the incubator	Incubator promotes the external network	1	1	0	0

Figure 8: Subcategories, codes and frequency of network codes
 Source: The authors (2017)

The network with external networks is also highly valued by software companies. The L2 entrepreneur asserted:

This is a hub, it looks like the hub, right? People from outside also come here and we also share the knowledge with those who come from outside. Usually people that so in the ecosystem of entrepreneurship and who know that this incubator exists and that there are many people here, that's it. It's important too.

Regarding the incubator's performance in promoting the external network, the L1 entrepreneur said: "people in the industry are making it easier for you to talk to people from



other companies". According to Zhou (2008), who defined the relationship between university and enterprise, companies use the favorable image promoted by the university to obtain partnerships among others.

4.4 Importance and Performance Matrix

To verify possible groupings among the entrepreneurs interviewed, based on the content of their interviews, cluster analysis was used. Based on the similarity of the coding of the four sources (interviews), using the Jaccard correlation coefficient and revealed that the software companies (L1 and L2) were in the same grouping, while those of hardware (N1 and N2) are in another, as represented in Figure 9.

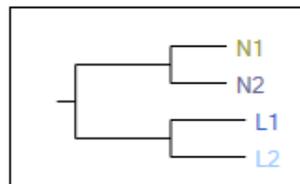


Figure 9: Cluster analysis
Source: The authors (2017)

Due to the divergences found in the evaluations of importance and performance conferred by the entrepreneurs of each grouping, two matrices were elaborated according to Martilla and James (1977), shown in Figures 10 and 11. The interpretation of the matrices revealed the most critical attributes to be worked by the managers of incubator, that is, they are highly valued by the entrepreneurs, but the incubator did not present an excellent performance. These attributes are in the "Improve" quadrant (red) and have been given the caption "ME". They are: the network between the incubated ones and the network with external contacts. In the case of hardware developers, access to university laboratories was added. This attribute was strongly influenced by the difficulties of the entrepreneurs in accessing the laboratories.

In the "Keep" (green) quadrant, with attributes highly valued by the entrepreneurs and excellent performance of the incubator, the attributes were given the caption "MA". In this region are the individualized and shared infrastructure. As Marimuthu and Lakha (2015) and Engelman, Fracasso and Brazil (2011) point out, the structure is more valued by entrepreneurs. At the same time, the perceptions of those surveyed in this study on these attributes indicated high performance. For the software companies, the consultants also stayed in this quadrant.

In the region with attributes less valued by the entrepreneurs and poor performance by the incubator, quadrant labeled "low priority" (BP), in yellow color is coaching. The low importance of this attribute may be linked to the perceptions of entrepreneurs that coaching is



needed for larger, more mature companies. In turn, it is possible that the low performance of the incubator in this attribute is linked to the difficulty of finding professionals to perform such role. For software companies, we also noticed the presence of access to university laboratories.

Finally, in the field of attributes that are not valued and the incubator performs optimally. The attributes training and mentoring received "PE", a cell named "possible exaggeration". For the hardware companies, it was added the consultancies.

RANKING OF IMPORTANCE	1	Network with incubators				GB						
	2	Network with external contacts			GB							
	3	Individualized Infrastructure								NI		
	4	Shared infrastructure									NI	
	5	Consulting							NI			
	6	Training						PE				
	7	Mentoring						PE				
	8	Coaching					LP					
	9	University laboratories		LP								
	10	Libraries										
			N.R.	9	2	1	8	7	6	5	3	4
RANKING OF PERFORMANCE												
Reading: GB = Get Better NI = Needs Improvement LP = Low Priority PE = Possible Exaggeration NR = Not Rated												

Figure 10: Importance-performance matrix and the perception of software developer entrepreneurs
Source: The authors (2017)

RANKING OF IMPORTANCE	1	Network with incubators					GB					
	2	Network with external contacts				GB						
	3	Individualized Infrastructure								NI		
	4	Shared infrastructure									NI	
	5	University laboratories		GB								
	6	Consulting								PE		
	7	Training							PE			
	8	Mentoring						PE				
	9	Coaching			LP							
	10	Libraries										
			N.R.	5	9	2	1	8	7	6	3	4
RANKING OF PERFORMANCE												
Reading: GB = Get Better NI = Needs Improvement LP = Low Priority PE = Possible Exaggeration NR = Not Rated												

Figure 11: Importance-performance matrix and the perception of hardware developer entrepreneurs
Source: The authors (2017)

It was possible, from a qualitative approach, to build the importance and performance matrices for incubation services from the perspective of software and hardware developers. Originally designed for use in marketing, the IPM is effective to be used to evaluate the services provided to the incubated. The construction of logic kept the essence of the matrix initially used by Martilla and James (1977), when using importance on the vertical axis and performance on the horizontal axis. In the present study, the matrices were developed based on the ordering of attributes regarding importance and performance, both based on the interviewees'



discourses, which tends to distance themselves from the criticisms inherent in the quantitative approach.

In the quantitative approach, part of the discussion revolves around how to measure importance, since it is a multidimensional construct. Thus, researchers recommend the use of multiple methods to measure importance within the same study. The divergences on how to measure importance extend to the type of scale to be used to measure importance and whether this measure should be carried out directly or indirectly. Scales can be, for example, Likert or metrics. On the other hand, direct measurement uses one of these scales without any further treatment for the data obtained, while indirect measurement relies on the performance of procedures such as multivariate regression or multicriteria methods (Abalo, & Manzano, 2007; Azzopardi, & Nash, 2013).

Discrepancies such as these imply in studies using IPM in combination with other methods. Tontini and Silveira (2007) joined the IPM and the Kano's method to propose a new method to identify improvement opportunities. These authors pointed out that the new method correctly identified improvement decisions in an empirical case. Azzopardi and Nash (2013) have associated the IPM with the Analytic Hierarchy Process (AHP) method. However, they considered that techniques like this are inadequate, since they require a broad process of data collection, which ends up making research arduous.

5 CONCLUSIONS

This work aimed to demonstrate the use of the importance-performance matrix the evaluation of the quality of services provided by business incubators. To do so, it used a case study applied in a technology-based incubator of the RN. The systematic review of the literature allowed the identification of the attributes that best fulfill the dimensions related to the services offered by incubators to their incubations. In the analysis, the dimensions originated the categories and the attributes, the subcategories. 146 quotes from entrepreneurs' interviews were coded and classified into subcategories. Matrices containing codes, quotations and their sources were the basis for the discussions. From this, the perceptions of expectations and performance of the service by the entrepreneurs were compared. Additionally, importance and performance matrices were elaborated.

On the infrastructure, an aspect highly valued by entrepreneurs according to literature, was not different in the present study. All the interviewees showed a great appreciation for this dimension. Moreover, they thought the infrastructure of the incubator to be excellent. One of the interviewees reported that the incubator is a reference among the incubators of the state in this regard. The professional services received less importance than the infrastructure, mainly as attractive for the entrance in the incubator. In addition, the entrepreneurs pointed out



that services need to adapt to the demands of the clients. For example, coaching was described by companies in the early stages of the incubation as appropriate for more companies towards the end of incubation. Entrepreneurs recognized the difficulty of finding themselves in the professional market appropriate to this type of service. In general, the interviewees evaluated the performance of services as good, however, with points to be improved, especially in coaching and mentoring. Entrepreneurs interviewed acknowledged the incubator's effort to provide an incremental performance of this aspect of the service.

The network was the most valued dimension by incubators. Despite the great importance conferred by the entrepreneurs of the present study, no robust actions were reported to increase it. The interpretation of the matrices allowed to indicate means for the managers to improve the supply of the services provided by the incubator in question. The critical points are the network with incubated and external networks. For companies that develop hardware, access to university labs is also a key point.

The use of the IPM principles conceived by Martilla and James (1977) in the evaluation of incubation services using a qualitative approach proved feasible. It was possible to point out critical areas and low priority regions, which may contribute to the development of a method to be used in the management of services provided by incubators. To do so, the interviewees' discourses were used, which avoided the use of scales and techniques of the quantitative approach, which in previous studies were divergent among the researchers.

Regarding the limitations of this study, only four incubated companies out of 13 companies in the incubator were interviewed and theoretical saturation was not reached. In addition, the results reflect the reality of an incubator. Thus, a suggestion for future studies may be to complement these results by investigating other entrepreneurs.

To broaden the discussion about these results and reflect a regional and/or even national reality, it will be necessary for such research to be carried out in other incubators. This will lead to consistent decision making by the management of the incubators, in one hand, and a better understanding of the aspects that have the greatest importance in attracting and/or consolidating an entity with an incubator. Another suggestion would be to deepen the perception of entrepreneurs about the contributions of the incubators in the prospection of investments.

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