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Structuring of management control systems by resident organizations in technological parks**Estructuración de sistemas de control de gestión por parte de organizaciones de residentes en parques tecnológicos****Estruturação de sistemas de controle gerencial por organizações residentes em parques tecnológicos****Authors****Márcia Athayde Moreira**

PhD in Controllershship and Accounting (USP). Professor at the Federal University of Pará - Faculty of Accounting Sciences. Address: Av. Augusto Correa no. 1 – District Guamá – Zip Code 66.075-110 - Belém - PA. Telephone: (91) 32018049. Identifiers (ID):

ORCID: <https://orcid.org/0000-0003-1859-6394>Lattes: <http://lattes.cnpq.br/0214030655326645>E-mail: mathayde@ufpa.br**Everaldo Marcelo Souza da Costa**

PhD in Business Administration. Professor at the University of Amazonia - Master's and Doctoral Program in Administration. Address: Av. Alcindo Cacela, 287 - District Umarizal – Zip Code 66060-902 - Belém - PA. Telephone: (91) 40093000. Identifiers (ID):

ORCID: <https://orcid.org/0000-0001-5134-4733>Lattes: <http://lattes.cnpq.br/2098914218110446>E-mail: prof.emsc@gmail.com**Carlos Augusto Santana de Freitas**

Scientific Initiation Fellow. Federal University of Pará - Faculty of Accounting Sciences. Address: Av. Augusto Correa no. 1 – District Guamá – Zip Code 66.075-110 - Belém - PA. Telephone: (91) 32018049. Identifiers (ID):

ORCID: <https://orcid.org/0000-0001-9441-6741>Lattes: <http://lattes.cnpq.br/0196619757813793>E-mail: carlossdfreitas@gmail.com**(Article presented at the XLVI ANPAD Meeting, EnANPAD - 2022)**

Abstract

Purpose: The present research emphasizes the models of management control system (MCS), with the objective of analyzing the structuring of Guamá Science and Technological Park companies MCSs, allowing to measure the level of structuring of their management processes.

Methodology: This is exploratory research developed with a quantitative approach, through a survey, applied in 15 enterprises at Guamá Science and Technological Park.

Results: The results indicated that resident entrepreneurs have structured management control systems, with greater emphasis on planning markers and results control and less structuring of cultural and behavioral controls, in line with the results obtained with the importance attributed by managers to the use of MCS. It was concluded that the companies participating in the research conduct a balanced management between planning and operational control, with the need to conduct actions to stimulate the use of management tools that help in dissemination of culture and behavioral controls.

Contributions of the Study: As a practical contribution, this study contributed to improvement of technological Parks management, from the mapping of the needs of their users. As an academic contribution, we believe that understanding management factors that are best developed and those that need to be developed to achieve satisfactory levels of management control systems is critical for definition of internal development policies of management processes, thus, moving forward for the social contribution of the research, the theoretical improvement favors entrepreneurs and their ventures, with profits for ecosystem of technological parks and for general society.

Keywords: Management Control Systems. Science Parks. Incubated Companies.

Resumen

Objetivo: La presente investigación hace énfasis en los modelos de sistema de control de gestión (MCS), con el objetivo de analizar la estructuración de los MCS de las empresas del Parque Científico y Tecnológico Guamá, permitiendo medir el nivel de estructuración de sus procesos de gestión.

Metodología: Se trata de una investigación exploratoria desarrollada con enfoque cuantitativo, a través de una encuesta, aplicada en 15 empresas del Parque Científico y Tecnológico Guamá.

Resultados: Los resultados indicaron que los empresarios residentes tienen sistemas de control de gestión estructurados, con mayor énfasis en los marcadores de planificación y control de resultados y menos estructuración de controles culturales y de comportamiento, en línea con los resultados obtenidos con la importancia atribuida por los gerentes al uso de MCS. Se concluyó que las empresas participantes de la investigación realizan una gestión equilibrada entre la planificación y el control operativo, con la necesidad de realizar acciones para estimular el uso de herramientas de gestión que ayuden en la difusión de la cultura y los controles de comportamiento.

Contribuciones del Estudio: Como contribuciones prácticas, este estudio contribuyó a la mejora de la gestión de los Parques Tecnológicos, a partir del mapeo de las necesidades de sus usuarios. Como contribuciones académicas, creemos que comprender los factores de gestión

que mejor se desarrollan y los que es necesario desarrollar para alcanzar niveles satisfactorios de los sistemas de control de gestión es fundamental para definir políticas internas de desarrollo de los procesos de gestión, avanzando así en la contribución social de investigación, la mejora teórica favorece a los emprendedores y sus emprendimientos, con beneficios para el ecosistema de parques tecnológicos y para la sociedad.

Palabras clave: Sistemas de Control de Gestión. Parques Tecnológicos. Empresas Incubadas.

Resumo

Objetivo: A presente pesquisa enfatiza os modelos de sistema de controle gerencial, com o objetivo de analisar a estruturação dos SCGs das empresas incubadas no Parque de Ciência e Tecnologia Guamá, permitindo mensurar o nível de estruturação de seus processos de gestão.

Metodologia: Trata-se de pesquisa exploratória desenvolvida com abordagem quantitativa, por meio da aplicação de questionários aplicados presencialmente em 15 empreendimentos do Parque de Ciência e Tecnologia Guamá.

Resultados: Os resultados indicaram que os empreendedores residentes possuem sistemas de controle gerencial estruturados, com maior ênfase para marcadores de planejamento e controle de resultados e menor estruturação de controles culturais e comportamentais, coadunando com os resultados obtidos com a própria importância atribuída pelos gestores ao uso de SCG. Conclui-se que as empresas participantes da pesquisa realizam uma gestão equilibrada entre o planejamento e o controle operacional, com necessidade de realização de ações para estimular o uso de ferramentas gerenciais que auxiliem na divulgação da cultura e nos controles comportamentais.

Contribuições do Estudo: Como contribuição prática, este estudo coopera para o aprimoramento da gestão de Parques Tecnológicos, a partir do mapeamento das necessidades de seus usuários. Como contribuição acadêmica, acreditamos que compreender fatores de gestão que estão melhor desenvolvidos e os que precisam se desenvolver para o atingimento de níveis satisfatórios de sistemas de controle gerencial é crítico para a definição de políticas internas de desenvolvimento dos processos de gestão, dessa forma, caminhando para a contribuição social da pesquisa, na qual o aprimoramento teórico favorece empreendedores e seus empreendimentos, com ganhos para o ecossistema dos parques tecnológicos e para a sociedade como um todo.

Palavras-chave: Sistemas de Controle Gerencial; Parques Tecnológicos; Empresas Incubadas.

1 Introduction

Entrepreneurship has been gaining prominence and attention from researchers, notably because of the social dimension it represents, comprising aspects such as innovation and the introduction of new ways of satisfying the needs of people and society, highlighting behaviors that involve boldness, self-confidence, assertiveness, leadership, creativity, satisfaction and personal fulfillment, making up the learning process that involves research in organizations (Benedetti, Rebello & Reyes, 2006; Pardini & Paim, 2001).

This movement has aroused interest in entrepreneurship in the academic-scientific environment, stimulating university-entrepreneur cooperation. Steiner, Cassim and Robazzi

(2008) understand that innovation environments, as seen in universities, boost the economy and the generation of knowledge, in turn generating quality jobs, taxes, social welfare, and especially product and service innovation (Pereira, Oliveira & Oliveira, 2016), as occurs, for example, in the process of incubating entrepreneurial projects, one of the links that connects entrepreneurship to educational institutions, with a view to achieving networks of contacts, physical infrastructure and management support (Neck, Meyer, Cohen & Corbett, 2004).

Incubators, in general, aim to support the development of products and services based on the promotion of companies focused on technology and innovation, through actions and advice that contribute to the success of ventures and social development (Costa, França & Teixeira, 2010). In this context, the Guamá Science and Technology Park (PCT Guamá) was set up in the Amazon region of Brazil, the first technology park to start operating in the Amazon. Its aim is to stimulate applied research, innovative entrepreneurship, the provision of services and technology transfer for the development of value-added and competitive products and services (PCT Guamá, 2021).

In view of the entrepreneurial development and promotion carried out by the PCT Guamá, it is important for the companies housed there to have an adequate management system in order to grow in a structured and competitive manner. Companies need to pay attention to the development of their management systems in order to ensure that they remain in the market (Lenzi & Kiesel, 2009). Management systems, developed through management control, involve a series of activities, such as planning and defining strategies; coordinating operational activities; communicating and evaluating information and influencing people, with the aim of shaping their behavior to achieve the intended strategies (Anthony & Govindarajan, 2011), acting as a facilitator for the performance and growth of organizations (Thiesen & Theiss, 2020).

Thus, there is a research gap to be investigated in this study: the management control process in enterprises housed in technology parks, in a different vein to previous studies on strategies (planning) and the need to have adequate management control systems (MCS) (Beuren, Santos & Theiss, 2018; Borsatto Junior & Vesco, 2020; Campos & Gáudio, 2014; Santos, Beuren & Conte, 2017; Thiesen & Theiss, 2020; Veroneze & Kruger, 2021). In this study, the elements present in the main theoretical proposals for management control (Anthony & Govindarajan, 2011; Malmi & Brown, 2008; Simons, 1995) were used together to assess the level of structuring of management control systems.

In the previous research, other biases have been used, such as in the study by Beuren, Santos and Theiss (2018), who highlighted the use of planning and the presence of cultural control in the use of packaged MCS in startups; Borsatto Junior and Vesco (2020), who found that packaged MCS establish norms for the functioning of the field and how they produce and reproduce power hierarchies, Thiesen and Theiss (2020), who showed the direct and positive influence of the design of the MCS package on the performance of tasks in the analyzed enterprises.

On the other hand, Campos and Gáudio (2014) found an underuse of management control systems in the SMEs analyzed, in line with the perception of Santos, Beuren and Conte (2017) and Veroneze and Kruger (2021), who identified a variation between little use and heterogeneity in the use of management control systems among the incubated enterprises analyzed.

Therefore, the question that will guide the research is: **how well are their management controls structured?** In this way, the research aims to analyze the structuring of the MCSs of the companies incubated at the Guamá Science and Technology Park, allowing the level of structuring of their management processes to be measured. As complementary objectives, the research aims to identify whether the organizations have structured strategies and to capture the

entrepreneurs' perception of the importance of management control systems for the growth and sustainability of their ventures.

It is justified by the need to show the entrepreneurial influence that the academic community makes available to society, in order to highlight the social and economic benefits generated by the dissemination of knowledge and the academic-scientific relationship between Technology Parks, Educational Institutions and organizations that belong to society in general. Abbud and Tonelli (2018) emphasize that the implementation of technology parks benefits companies, due to the technical, logistical and administrative infrastructure, as well as bringing benefits to the surrounding society. The implementation of technology parks boosts entrepreneurship in Brazil and around the world (ANPROTEC, 2021).

Studies like this contribute to improving the management of Technology Parks by mapping the needs of their users. Understanding the management factors that are best developed and those that need to be developed in order to achieve satisfactory levels of management control systems is critical to defining internal policies for developing management processes that favor entrepreneurs and their ventures, with gains for the technology park ecosystem and society in general.

2. Literature review

2.1 Anthony: Management Control between Strategies and Task Control

In the view of Anthony and Govindarajan (2011), management control occupies a space between defining strategies and controlling tasks. The management control system defined by Anthony and Govindarajan (2011) is understood as a process that involves planning and control, guiding a set of variables to achieve a preconceived goal or general objectives. Thus, the management control system described by these authors comprises three main elements: strategy formulation, management control and task control.

The management control function is a process that involves a series of activities that include planning, coordinating, communicating, evaluating, deciding and influencing people. Strategies are plans defined by senior management that determine the path the company should follow, and task control is important in this context, as it is responsible for ensuring that tasks are carried out as planned in the management control process (Anthony & Govindarajan, 2011).

In the startups evaluated in Santa Catarina (Brazil), planning was a positive point highlighted in the management control process; however, aspects linked to control, management and evaluation, which are fundamental to achieving strategies, were not evident. Despite the importance of adopting formal management controls in the early stages of incubation for growth and minimizing the uncertainties of the ecosystem, the use of management control instruments was found to be only partial and circumstantial (Veroneze & Kruger, 2021).

The definition of MCS has evolved over the years from a vision centered on the provision of information by organizations, such as external information related to the market, such as customers and competitors; non-financial information related to production processes; predictive information and a wide range of decision support mechanisms (Chenhall, 2003). In this sense, seeking to portray the reality of organizations, authors such as Simons (1995) and Malmi and Brown (2008), presented methodologies for structuring management control systems, characterized by elements of control, planning and decision-making.

2.2 Simons: SCG Delimited by Control Levers

Simons (1995) defined management control through four tools which he called control levers: the diagnostic control system, the belief system, the limits system and the interactive control system. The main objective of these systems is to provide control actions that help managers achieve their plans and guarantee that targets are met. The ability of the levers to achieve the strategies outlined by the company is due to the fact that they are forces that act mutually, providing greater control of present actions, aligning them with future objectives (Widener, 2007). Thus, the business strategies are presented as the central axis and guide the structuring of each lever, which, by maintaining joint forces, cooperate to achieve the goals. According to Simons (1995), diagnostic control systems allow managers to ensure that important objectives are achieved efficiently and effectively by helping to track the progress of individuals and organizations towards strategically important objectives.

In turn, belief systems are essential values incorporated by the organization to engage individuals. The third lever is represented by limit or boundary systems, which establish rules and delimit operational actions that employees must avoid. Finally, the fourth lever represents interactive control systems, which are formal information systems that managers use to personally involve and regulate subordinates' decisions, allowing managers to focus on strategic uncertainties, learn about threats and opportunities as competitive conditions change, with the capacity to respond proactively.

Brazilian studies have assessed the level of structuring of MCS in organizations and the results have shown the use of some of the elements of management control, with an emphasis on the use of diagnostic controls, the absence of the four levers used together and the lack of structuring of an MCS integrated with business strategies, aimed at permanent monitoring and the implementation of new strategies (Moreira, Borges & Santiago, 2017; Pletsch & Lavarda, 2016; Ribeiro, Sotello & Damke, 2017).

It is important to emphasize that the scope of the method is linked to the simultaneous action of the levers coordinated with the business strategy, whether from the perspective of achieving the central objects, obtaining better results or providing joint efficiency (Moreira et al., 2017). The role of diagnostic control in internal control, monitoring activities and the results achieved stands out (Ribeiro et al., 2017), as does the interactive control system, which allows the interaction of those involved, organizational learning and the emergence of new ideas (Pletsch & Lavarda, 2016).

2.3 Malmi and Brown: Packaged Management Control Systems

The SCG package typology is understood as a collection of controls and/or control systems designed to support organizational objectives, control activities and the evaluation of organizational performance. It is based on the distinction between decision-making and control, making up a structure delimited into five groups: planning controls, cybernetic controls, reward and compensation controls, administrative controls and cultural controls (Malmi & Brown, 2008).

Planning controls are elements that establish the functional objectives of an organization, cybernetic control comprises the *feedback* loop and is represented by the use of performance standards, measurement and comparison of pre-established standards, rewards and compensation are systems that aim to motivate and increase the performance of those involved, aligning them with organizational objectives, administrative controls are used to guide and

monitor the behavior of employees within the organization, and finally, cultural controls correspond to the set of values, beliefs and social norms shared in the organization (Malmi & Brown, 2008).

Seeking to identify the use of packaged MCSs in startups, Beuren, Santos and Theiss (2018) highlighted the use of planning and the presence of cultural control, Thiesen and Theiss (2020) showed the direct and positive influence of the design of the MCS package on task performance, strengthening evidence that a MCS can act as a facilitator for the performance and growth of startups. In an analysis involving power relations, Borsatto Junior and Vesco (2020) found that packaged MCSs establish norms for the functioning of the field and produce and reproduce power hierarchies. Packaged MCSs provide managers with instruments that can be used to boost company growth and influence task performance, with an emphasis on the influence that cultural control exerts within organizations (Beuren et al., 2018; Borsatto Junior & Vesco, 2020; Thiesen & Theiss, 2020).

3 Markers of Management Control Systems

In an analytical exercise presented in Table 1, it is possible to highlight the three approaches to MCSs in a summarized way, recognizing the relationships established in MCSs from the point of view of each author.

Table 1

Management control markers by aspect of management intervention

Aspects		
Strategic planning, control and decision-making	Carrying out/monitoring tasks and achieving objectives	Cultural and behavioral control
Definition of business strategies, based on planning, objectives, goals and standards that the company intends to achieve, contributing to the continuity of business activity, company growth and decision-making at a strategic level; interactive control, in order to be aware of information within the company and personally regulate the decisions of subordinates, attention and focus on the main organizational and strategic issues.	It is the process responsible for carrying out, monitoring and diagnosing tasks in order to achieve the objectives proposed by the company in the planning stage. This includes <i>feedback</i> processes, adopting performance standards for measuring, comparing, feeding back information, correcting and modifying systems.	They seek to align the values, customs and behaviors of individuals with the aims and objectives of organizations, aiming to establish rules, standards of ethical behavior and codes of conduct that delimit individual and collective operational actions, assigning responsibilities to those involved or motivating them to the point where they carry out tasks with greater performance, through a system of rewards and compensation.

Source: Research data (2022)

There is a consensus in the literature on the role and importance of MCSs, and it is possible to evaluate them based on control markers that are similar in terms of their proposed management intervention, through three basic aspects: 1) strategic planning, control and decision-making; 2) carrying out/monitoring tasks to achieve operational objectives; 3) cultural and behavioral control.

It can be seen that there is a prevalence of certain control elements in some theoretical models when compared to others, this can be attributed to the fact that management control systems have been improved over time in the perception of each author, this is visible when

comparing the structure of elements of Anthony and Govindarajan (2011) older model (original publication from the 1980s), Simons (1995) and Malmi and Brown (2008) more recent model.

Being able to recognize, implement or improve elements of management control in organizations makes it possible to improve the efficiency, efficacy and effectiveness of business activities and it is in this context that MCS theories seek to intervene in order to add value to the business philosophy, improve performance, competitiveness and promote long-term sustainability.

3. Technology parks

A science and technology park can be defined as a business support and technology transfer initiative that encourages and supports the start-up and incubation of innovative knowledge-based businesses, providing an environment where companies, in their various sizes and businesses, can develop specific and close relationships with a knowledge promotion center (universities) for the mutual benefit of the parties and increase the generation of income and wealth in the community (UKSPA, 2021; IASP, 2020). It is an enterprise that promotes a culture of innovation, competitiveness and increased business capacity, based on the transfer of knowledge and technology, with the aim of increasing the production of wealth in a region (ANPROTEC, 2021).

Steiner et al. (2008) understand that innovation environments, above all, serve to boost the economy and the generation of knowledge, in return generating quality jobs, taxes, social welfare, and in particular, according to Pereira, Oliveira and Oliveira (2016) product and service innovation. In Brazil, measures to encourage innovation and scientific and technological research in the productive environment were introduced into legislation in 2004 (Brazil, 2004). Among the measures adopted by the government, technology parks and incubators were created, defined as complexes designed for business and technological development, promoting innovation, competitiveness, training and scientific research (Audy & Piqué, 2016).

It is worth highlighting the role of universities *in* this process of setting up technology parks. Universities have become important players in the production of technologies, supported by the academic context. Universities have come to have social objectives, producing science and generating development, and they are also led to practice the mission of contributing more effectively and directly to the pursuit of economic development (Oliveira & Velho, 2009; Tonelli, 2012, 2015). Thus, taking into account the actual disbursements of public and private resources made for the implementation of technology parks, it is highly pertinent to evaluate their effectiveness as a relevant public policy instrument, with regard to national science, technology and industrial innovation and economic development policies (Vedovello, Judice & Maculan, 2006).

4. Methodology

4.1 General aspects of the research

This is a quantitative, exploratory study, carried out by means of a *survey*, using structured questionnaires as a data collection tool, applied to the managers of enterprises housed by the Guamá TCP.

The survey questionnaire, structured in two blocks, was designed to collect socio-demographic data in the first block and, in the second block (containing 20 questions), specific data on the use of management control systems, defined within the framework of the management control markers identified in the literature: strategic planning, control and decision-making (4 statements); carrying out/monitoring tasks and achieving operational

objectives (3 statements); cultural and behavioral control (5 statements). In addition, five statements were defined to measure the importance attributed to management control systems; and finally, three statements were defined to identify whether the company has structured strategies.

The instrument is based on a Likert-type scale and the collection of information began on July 15, 2021, and the questionnaires, structured in Google Forms, were applied in person by the researchers in 15 organizations.

Based on a survey carried out on the Guamá Foundation's website (PCT Guamá, 2021) in April 2021, a total of 65 related entities were identified, including 13 R&D laboratories, 20 associates, 5 supporting institutions and 27 resident companies. In this sense, the initial population of this research consisted of the 27 resident *startups*, and data was interviewed and collected from 15 companies, a sample equivalent to 55% of the initial population. The field research ended on October 31, 2021.

4.2 Data analysis methodology

The data from the questionnaires was tabulated and processed using *Microsoft Excel software*. The Analyse strategy consists of two stages:

- 1) Calculation of the IUSCG: Management Control System Usage Index;
- 2) Analysis of the coherence between the perception of importance and the use of management control systems in the startups surveyed.

To calculate the IUSCG: Management Control System Use Index, the measurement item coefficient of variation (CVIM) was initially used to identify the levels of homogeneity (agreement) of each item. In this way, the lower the CVIM value, the greater the agreement around the average of the answers. Thus, CVIM values <0.3 demonstrate sample homogeneity, between $0.3 < CVIM < 0.7$ are moderate and $CVIM > 0.7$ are considered heterogeneous (Fávero & Belfiore, 2017).

$$CVIM_i = \frac{S_i}{\bar{X}_i} \quad (1)$$

where:

CVIM: Coefficient of variation of the measurement item;

S_i : Item standard deviation;

\bar{X}_i : Item average;

i : Measurement item, where $i \geq 1$.

The CVIM for each item reflects the sample's homogeneity rate for the item, so the lower its value, the higher the respondents' level of agreement with the item measured, and therefore the greater the reflection it should have on the dimension that forms the MCS. As a result, the second expression calculated shows the item agreement index (ICI), the mathematical premise of which is to identify the respondents' degree of agreement with the dimension's measurement item.

$$ICI_i = 1 - CVIM_i \quad (2)$$

Therefore, low CVIM values generate high ICI values, and the opposite is true, thus guaranteeing the proportionality of the influence of each item measured. On the other hand, each dimension has its own agreement index (CI), which can be calculated as the simple arithmetic mean of the items involved, as shown in the third mathematical expression.

$$IIMD_K = \frac{\sum_{i=1}^n ICI_i}{i} \quad (3),$$

where IIMD: Average structuring index and/or the importance of the dimension.

The IIMD reflects the level of structuring of the management control system (MCS) dimension in the managers' view. Since the MCS is made up of k dimensions, where $k \geq 1$ the average of the dimensions gives the average degree of structuring of the MCS, in the view of the managers (see expression 4).

$$IUSCG = \frac{\sum_{k=1}^n GIMD_k}{k} \quad (4),$$

where IUSCG: Management Control System Usage Index.

The IUSCG values vary between 0 and 1 and determine the level attributed to the use and importance of the MCS. As the values are derived from the CVIM, it can be concluded that the closer to 1 the greater the use and importance of the MCS in the managers' view. Thus, IUSCG was calculated by adding up the scores of the three defined blocks: strategic planning, control and decision-making; carrying out/monitoring tasks and achieving operational objectives; and cultural and behavioral control. In order to analyze the coherence between the perceived importance and the use of management control systems in the *startups* surveyed, the same IUSCG technique was used to calculate the importance attributed to management control systems and to check whether the company has structured strategies. Then, with the results in hand, the answers were planned into four quadrants, as shown in Figure 1.

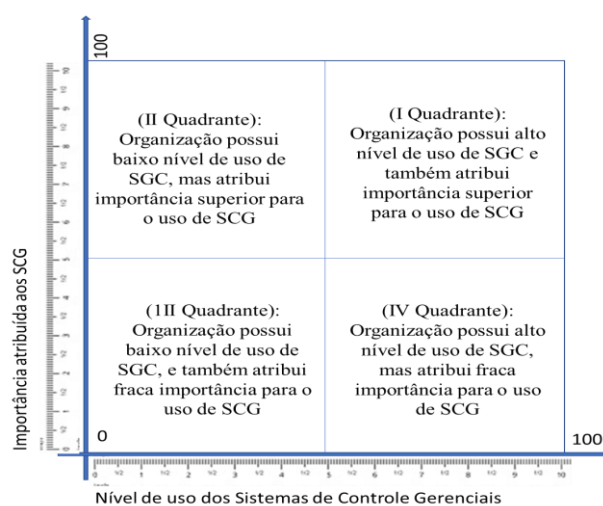


Figure 1 Matrix of use x importance attributed to MCSs

Source: Research data (2022)

5. Presentation and analysis of results

5.1 About the residents

The residents interviewed in this survey have a profile of companies that are mostly managed by men with an average age of 41, with a prevalence of owners involved in the management of the business and with postgraduate degrees. The most representative business segment is information and communication technology, with four companies with a total of 54 employees, the average number of employees per business being 10.53. The average length of time these companies have been in existence is eight years (the oldest has been operating in the market for 32 years), and the average time they have been residents of PCT Guamá is two years.

As already mentioned, the most representative segment identified was information and communication technology (4 companies), followed by education (2 companies). The other participating companies belong to segments linked to food production, engineering and

construction, business consultancy, trade in laboratory products, technical-scientific and laboratory services, geology, animal health and services for organizing technical and scientific events. All the managers of the companies interviewed are classified as residents of PCT Guamá.

5.2 Calculation of the SCG structuring index

The SCG structuring index was calculated on the basis of the raw data collected from the 15 companies taking part in the survey, using it to calculate the standard deviation and average, which were used to determine the indices, according to the *CVIM*, *ICI* and *IIMD* equations already presented in the methodology of this research. Initially, the results of the calculations are presented for each group of questions, with the first group referring to the "strategic planning, control and decision-making" marker. Table 2 shows the statements used in the survey and the indicators found.

Table 2

Strategic planning, control and decision-making markers

Assertions	DVP	Méd.	CVIM	ICI	IIMD
"My business strategies are designed based on strategic planning"	1,15	4,20	0,27	0,73	0,77
"We use planning because we believe it is a tool that contributes to the continuity of business activity, the growth of the organization and decision-making at a strategic level."	0,41	4,80	0,09	0,91	
"We make decisions based on <i>felling</i> (business perception), which is often more important than planning and setting prior objectives and goals for the success of an enterprise."	1,10	4,07	0,27	0,73	
"We hold regular meetings because they allow managers to be aware of the information within the organization and to personally regulate the decisions of their subordinates."	1,13	4,13	0,27	0,73	

Source: Research data (2022)

The result of the calculated Standard Deviation (SVD), the Average score obtained, considering the Likert scale used, followed by the result of the calculation of the Measured Item Variation Coefficient (CVIM), the calculation of the Item Concordance Index (ICI) and, finally, the calculation of the Average Structuring Index of the Dimension evaluated (IIMD), the latter being the partial component that competes for the calculation of the final Structuring Index of the SCG of the resident companies of the Guamá PCT.

The analysis carried out for the Coefficient of Variation of the Measurement Item (CVIM) for the strategic planning, control and decision-making marker showed a CVIM between 0.09 and 0.27, which demonstrates homogeneity in the entrepreneurs' understanding of the questions asked, which aims to identify the degree of agreement of those surveyed with the dimension's measurement item, in which a high ICI value of between 0.73 and 0.91 was obtained for the assertions, corroborating the premise that low CVIM values generate high ICI values, guaranteeing the proportionality of influence of each item measured.

Thus, the calculation of the Average Dimension Structuring Index (*ASDI*) resulted in a value of 0.77, reflecting the level of structuring of the dimension, in the managers' view, in terms of the management control system (MCS). Considering that this index ranges from 0 to 1, the result can be considered satisfactory, thus corroborating the ideas of Anthony and Govindarajan (2011) who understand planning as a process capable of guiding a set of variables to achieve the preconceived goal or the general objectives of the organization and the findings of Veroneze & Kruger (2021), who also perceived the importance attributed to planning by startups in Santa Catarina, Brazil.

Next, Table 3 shows the data relating to the second marker "Accomplishment/monitoring of tasks and achievement of objectives".

Table 3

Achievement markers/monitoring of tasks and achievement of objectives

Assertions	DVP	Méd.	CVIM	ICI	IIMD
"Here in the organization, we constantly monitor the tasks assigned in order to achieve the objectives proposed by the organization at the planning stage."	0,96	3,93	0,24	0,76	0,71
"We use feedback processes to measure, compare, feedback information, correct and modify tasks in the organization."	1,18	3,60	0,33	0,67	
"Due to the size/activities of the organization, we consider it necessary to use tools to monitor the accomplishment of tasks and the organization's results."	1,29	4,33	0,30	0,70	

Source: Research data (2022)

The analysis of the Coefficient of Variation of the Measurement Item (*CVIM*) for the marker of accomplishment/monitoring of tasks and achievement of operational objectives showed a *CVIM* between 0.24 and 0.33, also demonstrating sample homogeneity for the statements formulated, the item concordance index (*ICI*) was between 0.67 and 0.76, and the average dimension structuring index (*IIMD*) was 0.71, reflecting the importance of the dimension in the managers' view of the management control system, and the result can be considered satisfactory. The results found in this research corroborate the proposal by Simons (1995), which states that control systems ensure that objectives are achieved, and monitoring associated with business strategy ensures better results and efficiency, in this case the results found here corroborate the studies by Moreira et al., 2017 and Ribeiro et al., 2017, allowing for better interaction of those involved, organizational learning and the emergence of new ideas (Pletsch & Lavarda, 2016).

Finally, Table 4 shows the data for the markers relating to the "Cultural and Behavioral Aspect".

Table 4
Markers Cultural and Behavioral Aspects

Assertions	DVP	Méd.	CVIM	ICI	IIMD
"We're looking for employees who have values, habits and behaviour that are aligned with the values, purposes and objectives of our organization."	0,77	4,20	0,18	0,82	0,57
"The organization seeks to assign responsibilities to those involved or motivate them to the point where they carry out tasks with greater performance, through a system of rewards and compensation."	1,49	3,27	0,46	0,54	
"Employees know the mission, vision and values of the organization."	1,60	3,47	0,46	0,54	
"The organization has rules and standards of ethical behavior, formalized in codes of conduct that delimit individual and collective operational actions, limiting unwanted actions."	1,37	2,80	0,49	0,51	
"In this organization stimuli are given through financial rewards and the employee is free to act in pursuit of individual results that guarantee satisfactory financial performance."	1,60	3,00	0,53	0,47	

Source: Research data (2022)

The analysis of the Cultural and Behavioral Aspect markers showed a more moderate CVIM in most of the statements, with values of 0.18 and 0.53. This shows that in this topic there is already a reduction in the average coefficient of the item, with average agreement on the part of the companies in most of the statements. The Item Concordance Index (ICI) obtained showed values between 0.47 and 0.82 for the statements. The Mean Dimension Structuring Index (MDSI) obtained a value of 0.57, reflecting the importance of the dimension in the managers' view of the management control system, and the result can be considered satisfactory (regular). Malmi & Brown (2008) point out that cultural controls correspond to the set of values, beliefs and social norms shared in the organization, elements that were observed in the research by Beuren et al. (2018), who highlighted the use of planning and the presence of cultural control in the sample surveyed, with emphasis on the influence that cultural control exerts within organizations.

Once the *IIMD* for each dimension had been calculated, the Index of Use of the Management Control System (*IUSCG*) could finally be calculated, thus achieving the main objective of this research. With regard to calculating the *IUSCG*, it was obtained by averaging the *IIMD* of each dimension (markers), so the *IUSCG* is shown in Table 5.

Table 5
Index of Use and Importance of the Management Control System

Topics / Bookmarks	IIMD	IUSCG
Strategic planning, control and decision-making	0,73	0,64
Carrying out/monitoring tasks and achieving operational objectives	0,71	
Cultural and behavioral aspects	0,57	

Source: Research data (2022)

With regard to the Use of Management Control System Index (*IUSCG*), a value of 0.64 was obtained, giving a concept that is considered good for the PCT Guamá companies participating in the research, and that to a greater or lesser degree have and make use of MCSs in the conceptual models discussed by Anthony and Govindarajan (2011), Simons (1995) and Malmi and Brown (2008).

The indices show that the PCT Guamá companies taking part in the survey make more frequent use of planning tools, an important tool for running the enterprise and defining business strategies. It was also observed that the companies carry out controls through periodic meetings, allowing managers to become aware of elements inside and outside the organization that can contribute to changing course and making decisions. However, despite the use of planning, an important point that drew attention was the adoption of non-formal tools such as *felling by* the interviewees.

The managers of the companies interviewed said that they use tools to control and monitor tasks, as well as *feedback* processes to ensure that activities are carried out. It is important to emphasize that even though they are small, many companies consider it important to have tools to monitor the accomplishment of tasks and the organization's results. Among the three markers of the management control system defined, the one that obtained the lowest score was cultural and behavioral controls, whose score of 0.57 on a scale of 0 to 1 indicates that this item is only moderately on the agenda of the entrepreneurs interviewed, with the greatest focus being on the use of controls that seek to align the values, customs and behaviors of individuals with the purposes and objectives of the organizations.

Considering that this topic was the one with the highest number of statements with moderate CVIM, it is likely that the MCSs that seek to interact with cultural and behavioral aspects are not yet fully established in companies, as partial agreement is noted in the statements that establish responsibilities and rewards, understanding of the organization's mission, vision and values, as well as rules, standards of ethical behavior and codes of conduct.

5.3 Analysis of the importance attributed by entrepreneurs to MCSs

Table 6 shows the statements used in the survey on the "Importance of Management Control Systems", the result of the calculated Standard Deviation (SVD), the Average score obtained, considering the Likert scale, followed by the result of the calculation of the Coefficient of Variation of the Measured Item (CVIM), the calculation of the Index of Agreement with the Item (ICI) and, finally, the calculation of the Average Importance Index of the Dimension evaluated (IIMD).

Table 6
The importance of management control systems

Assertions	DVP	Méd.	CVIM	ICI	IIMD
"We consider planning to be fundamental for the organization, because it is through planning that the direction of the business and its main objectives are established."	0,74	4,60	0,16	0,84	0,72
"We monitor the tasks within the organization because it's an effective method for monitoring whether the process is taking place satisfactorily and within the established parameters."	1,08	3,8	0,28	0,72	
"We consider it important for long-term performance to establish and foster among employees the values, purposes and objectives of the organization."	0,94	4,2	0,22	0,78	
"Codes of ethical conduct and pre-established rules are mechanisms capable of imposing limits on behavior and actions that should be avoided in the organization."	1,35	3,6	0,38	0,62	
"Motivating employees through rewards and compensation is an important way of stimulating productivity and efficiency in the execution of tasks."	1,3	3,87	0,34	0,66	

Source: Research data (2022)

The analysis carried out for the Coefficient of Variation of the Measurement Item (*CVIM*) for the Importance of Management Control Systems showed a *CVIM* between 0.16 and 0.38, which demonstrates homogeneity in the entrepreneurs' understanding of the questions, also reflecting a good result for the Item Concordance Index (*ICI*), with a high *ICI* value of between 0.62 and 0.84 for the statements. Finally, the calculation of the Average Importance of the Dimension Index (*IIMD*) resulted in a value of 0.72, reflecting the importance attributed to the MCS in the managers' view. Considering that this index ranges from 0 to 1, the result can be considered satisfactory.

At this point, the analysis of importance (table 6) reinforces that the companies surveyed in the Guamá PCT attach greater importance to MCSs that are related to the planning and definition of objectives, to the control and execution of tasks, and to a lesser extent to cultural controls that are more closely linked to the purposes and objectives of the organization, thus corroborating the results described above regarding the use of these elements of the MCS.

5.4 Analysis of the coherence between the importance attributed and the structuring of the MCSs

Next, with the results in hand, the answers of each entrepreneur and the average of the 15 organizations were divided into four quadrants, as shown in Figure 2. Plotting in quadrants made it possible to analyze the degree of coherence between the perception of importance and the use of management control systems in the organizations surveyed, denoted by each organization's Management Control System Use Index (MCSUI).

In Figure 2, each circle represents a company. The red circles are those that are close to other Quadrants and do not follow the pattern of the average of the other companies, in this case the green circles. In yellow is the average for all the companies, as described above: 0.64 for the SCG use index and 0.72 for the importance attributed to the use of SCG.

When analyzed individually, there is consistency in most of the organizations, which fall into Quadrant I, where both the perception of importance and the use of management control systems are higher. However, it can be seen that four residents affirmed the importance of using MCSs, but in practice have not yet managed to consolidate the use of the tools, positioning themselves very close to Quadrant II, while a single company did not attribute importance to the use of MCSs, but in practice indicated the use of its tools, positioning itself close to Quadrant IV.

No company was positioned in Quadrant III.

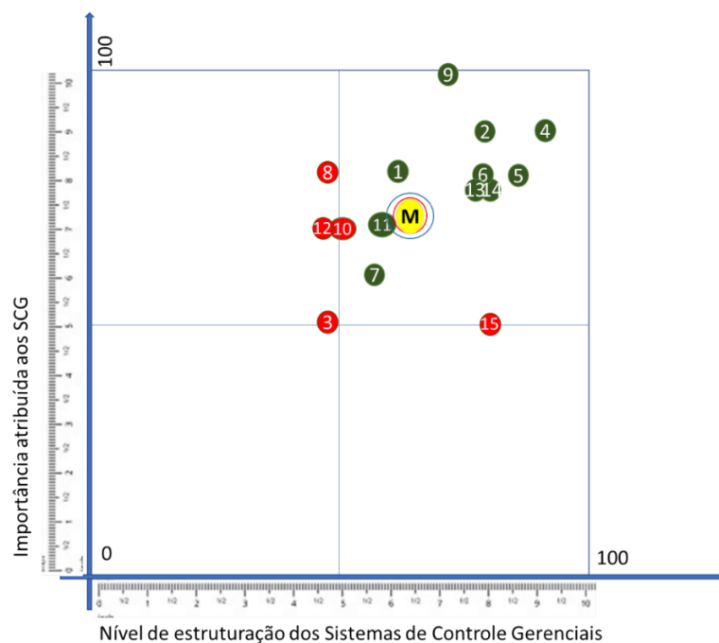


Figure 2 Matrix of use x importance attributed to MCSs, individualized by organization
Source: Survey results (2022)

This analysis provided reassurance for the average results found, but at the same time reinforced the need to maintain the Guamá STP's entrepreneurial development policies, since a significant percentage of ventures still need some support, either to raise awareness of their importance, to develop tools or both.

5.5 Identifying structured strategies

This topic presents the data relating to the "Identification of Structured Strategies" from the managers' perspective, shown in Table 7. In the analysis of the Coefficient of Variation of the Measurement Item (*CVIM*) for the Identification of Structured Strategies, the *CVIM* was between 0.27 and 0.46, showing that the maintenance of strategies presents sample homogeneity for two assertions, which are related to the organization's objectives and methods and actions oriented towards the medium and long term, while as for the perception of market movement, moderate homogeneity was obtained.

Table 7
Maintaining Strategies

Assertions	DVP	Méd.	CVIM	ICI	IIMD
"In the organization under my direction, we define what objectives the organization wants to achieve and what methods will be used to achieve these objectives."	0,98	3,67	0,27	0,73	0,67
"Based on the perception of market movements, our actions are oriented towards the short term."	1,54	3,33	0,46	0,54	
"Regardless of the importance (or not) of the short-term vision, our actions are (also) guided by medium- and long-term strategies."	1,13	4,13	0,27	0,73	

Source: Research data (2022)

Thus, the Item Concordance Index (*ICI*) obtained was between 0.54 and 0.73. The calculation of the Average Importance of the Dimension Index (*IIMD*) resulted in a value of 0.67, reflecting that yes, the managers believe they have structured strategies, the result can be considered satisfactory, and consistent with the results previously presented.

6. Final considerations

The aim of this research was to analyze the structuring of the MCSs of the companies incubated at PCT Guamá, in order to measure the level of structuring of their management processes. Initially, to make the field research feasible, theoretical markers were structured based on the main authors who have defended MCS models. These markers guided both the preparation of the research instrument and the analysis of the results, and were defined as: strategic planning, control and decision-making; carrying out/monitoring tasks and achieving objectives; and cultural and behavioral control.

Thus, based on the interpretation of the data obtained, the research problem can be answered, in such a way that the results show that the companies participating in the research have a satisfactory level of SCG structuring, with a greater focus on aspects related to strategic planning, control and decision making, as well as carrying out/monitoring tasks and achieving operational objectives, and less focus on cultural and behavioral control. This can be attributed to the incubation process itself, which provides entrepreneurs with networks of contacts, physical infrastructure and management support. Even so, there is a need to improve cultural and behavioural control processes in organizations.

In addition, two more analyses were carried out, the first of which aimed to cross-check information on the use of MCSs and the importance attributed by managers to the use of MCSs. This analysis showed consistency between the results found and the vision of the entrepreneurs, with a few exceptions, which could be reported from the individual analyses carried out by company. Finally, it was ascertained whether, in the managers' view, the ventures have structured strategies. Once again, the average results were satisfactory, leading to the conclusion that the companies taking part in the survey manage in a balanced way between planning and operational control, with the need to take action to encourage the use of management tools to help disseminate the culture and behavioral controls.

As a practical contribution, this study helps to improve the management of Technology Parks by mapping the needs of their users. As an academic contribution, we believe that understanding management factors that are better developed and those that need to be developed in order to achieve satisfactory levels of management control systems is critical for

defining internal policies for developing management processes, thus moving towards the social contribution of research, in which theoretical improvement favors entrepreneurs and their ventures, with gains for the ecosystem of technology parks and for society as a whole.

As a limitation of this research, the analysis of average results shows the possibility of interpretations that do not represent all the organizations studied. This limitation gives rise to recommendations for future qualitative research, given the importance of deepening the investigation, since among the organizations there was some incongruity between the importance attributed and the actual use of MCSs.

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