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UNIVERSITY ENTREPRENEURSHIP: THE ROLE OF TECHNOLOGY TRANSFER OFFICE MANAGERS IN THE TRANSFORMATION TOWARDS AN ENTREPRENEURIAL CULTURE

Universidades que empreendem: O papel dos gestores dos núcleos de inovação tecnológica na transformação para uma cultura voltada ao empreendedorismo

Universidades que emprenden: El papel de los gerentes de Núcleos de Innovación Tecnológica en la transformación hacia una cultura emprendedora

Vivien Mariane Massaneiro Kaniak[*1] | vivikaniak@gmail.com | ORCID: 0000-0003-1410-8592

Elizandra Severgnini[2] | elisevergnini@gmail.com | ORCID: 0000-0002-5848-2511

Jéssica Cristina Ceni[3] | jessicaceni@unicentro.br | ORCID: 0000-0002-8686-2730

Rivanda Meira Teixeira[4] | rivandateixeira@gmail.com| ORCID:0000-0003-3056-6032

[*] Corresponding author

[1]Universidade Federal do Paraná, Programa de Pós-graduação em Administração, Curitiba, PR, Brazil

[2]Universidade Tecnológica Federal do Paraná, Departamento de Gestão e Economia, Curitiba, PR, Brazil

[3]Universidade Estadual do Centro-Oeste, Departamento de Administração, Guarapuava, PR, Brazil

[4]Universidade Federal do Paraná, Programa de Pós-graduação em Administração, Curitiba, PR, Brazil

ABSTRACT

Managers of University Technology Transfer Offices (TTOs) play a crucial role in disseminating entrepreneurial ecosystems and managing the innovation policies of higher education institutions (HEIs). This study aimed to examine the role of these managers in the transition from a traditional university model to a culture centered on entrepreneurship. This research employed a qualitative and descriptive approach, utilizing multiple case studies. Data collection was conducted with seven universities in Paraná, involving interviews with 36 managers associated with the institutions' innovation agencies. The findings reveal two key points: (1) the universities studied have either undergone or are currently undergoing a cultural shift toward an entrepreneurship-focused model, and (2) the role of innovation agency managers has been pivotal in challenging established paradigms and laying the groundwork for a culture of innovation.
Keywords: university managers, culture for entrepreneurship, leadership in the university, Technology Transfer Office, innovation ecosystem.

RESUMO

Os gestores dos núcleos de inovação tecnológica (NITs) e das agências de inovação universitárias têm um importante papel na disseminação dos ecossistemas empreendedores e na gestão da política de inovação das instituições de ensino superior (IES). Este estudo objetivou descortinar o papel dos gestores na transformação de um modelo tradicional universitário para um modelo de cultura voltada ao empreendedorismo. Os autores realizaram uma pesquisa de natureza qualitativa e descritiva, por meio de estudo de casos múltiplos. Sete universidades paranaenses e entrevistas com 36 profissionais ligados às agências de inovação das instituições foram analisadas. As evidências indicam: 1) que as universidades estudadas já passaram ou estão vivendo uma mudança na sua cultura para um modelo voltado ao empreendedorismo e 2) que o papel dos gestores das agências de inovação tem sido fundamental para quebrar paradigmas e estabelecer novas bases para a cultura da inovação.
Palavras-chave: *gestores universitários, cultura do empreendedorismo, liderança na universidade, Núcleos de Inovação Universitária, ecossistema de inovação.*

RESUMEN

Los gestores de las núcleos de innovación tecnológica (NITs) de las agencias de innovación universitaria tienen un papel importante en la difusión de los ecosistemas emprendedores y en la gestión de la política de innovación de las instituciones de educación superior. Este estudio tiene como objetivo descubrir el papel de los directivos de las Agencias de Innovación/NIT en la transformación de un modelo universitario tradicional en una cultura centrada en el emprendimiento. Se realizó una investigación cualitativa y descriptiva, de estudio de casos múltiples, se analizaron siete universidades de Paraná y se entrevistaron 36 profesionales vinculados a la agencia de innovación de las instituciones. La evidencia sugiere que todas las universidades estudiadas ya han experimentado o están experimentando un cambio en su cultura y que el papel de los gestores de las agencias de innovación ha sido fundamental para romper paradigmas y establecer nuevas bases para una cultura centrada en el emprendimiento y la innovación.
Palabras clave: *directivos universitarios, cultura para el emprendimiento, liderazgo en la universidad, Núcleos de Innovación Tecnológica, ecosistema de innovación.*

INTRODUCTION

Entrepreneurial universities are designed to foster economic development and drive social transformation (Guerrero et al., 2020; Hayter & Cahoy, 2016; Leih & Teece, 2016). To achieve these objectives, numerous Brazilian universities have established dedicated structures for managing innovation and entrepreneurship which are locally nominated as innovation agencies or NIT's (Costa et al., 2021; Machado & Sartori, 2015; Pabis et al., 2023) and internationally known as Technology Transfer Offices (TTOs).

International research has promptly addressed the influence of leadership and management on the entrepreneurial capabilities of universities (Audretsch, 2014; Etzkowitz, 2003; Leih & Teece, 2016; Siegel et al., 2004; Teece, 2018). Within this context, the role of TTOs' managers has emerged as critical. These managers are tasked with formulating innovation policies for educational and research institutions while facilitating technology transfer among universities, research institutes, and the private sector (Costa et al., 2021; Katz et al., 2018).

Despite the growing body of literature on TTO's management in Brazil, research focusing specifically on the leadership within these agencies remains limited (Moraes et al., 2020). While developed countries have seen an increase in studies examining this phenomenon in recent years (Etzkowitz & Leydesdorff, 2000; Siegel et al., 2003), Brazil still lacks empirical evidence regarding how managers act as catalysts for institutional and cultural change (Adriano et al., 2018; Freitas & Lagos, 2019).

To address this gap, the present research examines the role of managers in Brazilians TTOs and the implications of transitioning from traditional university models to those focused on entrepreneurship. To achieve this, the authors conducted a qualitative study, investigating offices in seven universities within the state of Paraná and interviewed professionals and managers.

The findings reveal two key points: (1) the universities analyzed have either completed or are in the process of shifting their institutional culture toward an entrepreneurial model; and (2) the role of TTOs managers has been pivotal in challenging existing paradigms and establishing a foundation for a culture of innovation.

The structure of the article is as follows: following the introduction, the first section presents the theoretical background, discussing the distinctions between traditional and entrepreneurial universities and the role of university TTOs and their leaders. The second section details the chosen methodology, the third offers an analysis and discussion of the research findings, and the final section concludes with observations drawn from the study.

THEORETICAL BACKGROUND

Universities: the traditional model versus the entrepreneurial model

The rise in competitiveness among companies, and consequently among nations, is driven by advancements in education and technology (Etzkowitz et al., 2005). Universities play a crucial

role in this process by generating new knowledge and technologies that contribute value to society through their innovation agencies or TTOs. Moreover, following the enactment of the Innovation Act of 2004, institutions of Science, Technology, and Innovation in Brazil are mandated to develop innovation policies to support the establishment and growth of their TTOs.

Elmuti et al. (2005) highlight that the earliest universities were primarily dedicated to teaching. However, by the late seventeenth century, the University of Berlin pioneered a new model by integrating research with teaching. This shift laid the foundation for the implementation of extension activities, which included cultural and scientific engagements within the community. This approach, recognized as the first academic revolution, is characterized by a traditional view of the university (Almeida & Cruz, 2010; Garnica & Torkomian, 2009).

The second academic revolution emerged after World War II when North American universities such as Stanford, the Massachusetts Institute of Technology (MIT), and Harvard introduced a new operational model aimed at transferring knowledge to society. In adopting this entrepreneurial stance, these institutions redefined their societal roles (Arbix & Consoni, 2011; Etzkowitz & Leydesdorff, 2000). Subsequently, the universities in Silicon Valley developed strong cooperative relationships with companies and other universities through research exchanges and collaborative projects, exemplifying a dynamic model of academic and industry synergy (Saxenian, 1994).

Yusof and Jain (2010) point out that the successful experiences of universities in developed countries have spurred increased research on this subject. The term "entrepreneurial university," introduced by Clark (1998), describes institutions that actively pursue innovation, identify opportunities, and demonstrate entrepreneurial leadership as part of their culture. Such universities are characterized by their ability to innovate, adapt, transform, and create opportunities (Guerrero et al., 2016; Kirby et al., 2011).

Entrepreneurial leadership is understood as the capacity of leaders to enable stakeholders to achieve goals, enhance productivity, and foster satisfaction in relation to knowledge transfer and innovation ecosystems. Consequently, the concept of entrepreneurship within TTOs has evolved to encompass partnerships with external entities, such as private companies and public institutions, and the development of governance, leadership, and strategic planning frameworks (Etzkowitz, 2016; Kliewe et al., 2019).

Furthermore, entrepreneurial universities provide a supportive environment that encourages the university community to experiment with new ideas, develop innovative products and services, and undertake entrepreneurial initiatives (Ferreira et al., 2018; Guerrero et al., 2014; Leih & Teece, 2016). In Brazil, TTOs play a pivotal role in facilitating and mediating the entrepreneurial activities of universities.

NITs: Concept and function

A version of Technology Transfer Offices (TTOs) knows in the country as NITs were largely implemented in Brazil following the enactment of Law No. 10.973 in 2004. This legislation institutionalized these agencies within scientific regulation, standardizing the term "NIT" to

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replace previously used terminologies with other academic institutions (Costa et al., 2021; Pabis et al., 2023). The introduction of this legal framework marked a significant step in fostering innovation management. Subsequently, the approval of the Legal Framework for Science, Technology, and Innovation Law, in 2016, further enhanced the autonomy of them, granting them independent legal status. This change aimed to facilitate the development of strategies for innovation creation and transfer, as well as to streamline negotiation and management processes (Desidério & Zilber, 2014; Katz et al., 2018).

The primary responsibilities of NITs in Brazil include identifying potential corporate partners for the commercialization of new technologies, managing patenting processes, drafting licensing agreements, and overseeing the legal aspects of technology transfer (Arbix & Consoni, 2011; Singh et al., 2020; Torkomian, 2009). According to Machado and Sartori (2015), these agencies serve as a critical pillar within the National System of Science, Technology, and Innovation, supporting the translation of academic research into societal and economic benefits.

Furthermore, the role of university managers is pivotal in developing and implementing policies that align with the entrepreneurial ecosystem within universities. Effective leaders must possess the ability to assess both internal and external environments, enabling the formation of a strategic vision. Additionally, they are responsible for fostering and defending an entrepreneurial and innovative culture within their institutions (Freitas & Lagos, 2019).

Leader-Member Exchange Theory for fostering an entrepreneurial culture

The Leader-Member Exchange (LMX) Theory identifies two types of leadership: transformational and transactional. Transformational leaders are central to fostering an entrepreneurial culture driven by innovation, as they encourage new ways of thinking and acting (Bercovitz & Feldman, 2008), problem-solving (Begeç & Akyuz, 2023), and taking controlled risks (Ling et al., 2008). They work with teams to identify necessary changes through instruction and inspiration and implement those changes collaboratively (Zacher & Rosing, 2015). Transactional leaders, on the other hand, demonstrate clear expectations, provide structured incentives, and focus intensely on results, being perceived as developers (Schweitzer, 2014).

Transformational leadership differs from transactional leadership as it influences and inspires followers to perform beyond their perceived capabilities (Schweitzer, 2014; Zacher & Rosing, 2015). Transactional leadership, however, centers on task execution and step-by-step processes, prioritizing the means over the ends. This study emphasizes transformational leadership in driving organizational changes as it fosters autonomy and empowerment in decision-making (Chang et al., 2017). Therefore, transformational leaders are pivotal in promoting entrepreneurial culture, encouraging innovative thinking (Bercovitz & Feldman, 2008) and problem-solving (Begeç & Akyuz, 2023).

Ling et al. (2008) argue that transformational leaders often adopt behaviors and discourse that promote visions beyond the status quo, fostering a culture focused on entrepreneurship. According

to the LMX Theory, Ling et al. (2008) describe four characteristics of transformational leaders: (1) charisma, (2) inspirational motivation, (3) intellectual stimulation—encouraging employees to approach problems from different perspectives, and (4) individualized consideration—guiding and encouraging those they lead (Bass, 1985; Chang et al., 2017).

Barreto et al. (2013) emphasize that culture changes according to the behavior of leaders, specifically what they pay attention to, how they handle adversity, and how they position themselves in different contexts. The literature highlights the prominence of transformational leadership, as this type of leader can influence the behavior of members to adopt an active stance in seeking new opportunities and adapting to environmental changes (Jung et al., 2003; Ling et al., 2008).

In this sense, transformational leadership is crucial for fostering an entrepreneurial culture in universities. Managers whose characteristics reflect transformational leadership play a key role as facilitators and drivers of change by managing and articulating dialogues among different groups within and outside the university (Heaton et al., 2019; Valencia et al., 2019).

Organizational change theory for promoting an entrepreneurial culture

The theory of organizational change considers the organization as a whole and recognizes its constant need to undertake new actions for growth within the innovation ecosystem (Kalar & Antoncic, 2015). This theory defines the promotion of an entrepreneurial culture focused on innovation by outlining three stages of change: unfreezing (recognition of the need for change, such as low profitability, outdated practices, or lack of competitiveness), changing (development and implementation of a change model), and refreezing (Burnes, 2004). In the refreezing stage, a new culture is established through a gradual process, as employees adjust to new procedures. Kurt Lewin's three-stage model of organizational change restructures and positions TTOs as models of entrepreneurship (Ferreira et al., 2018; Kalar & Antoncic, 2015).

To promote a new entrepreneurial culture within the university ecosystem, it is essential for organizational change to encourage meaningful practices and discourse on entrepreneurship, engaging not only managers but also university employees, professors, and students (Moraes et al., 2023). The establishment of an entrepreneurial ecosystem is equally critical, as the promotion of an entrepreneurial culture is tied to the development of policies and practices that support entrepreneurship (Kalar & Antoncic, 2015; Miller & Ács, 2017; Moraes et al., 2023).

One critique of Kurt Lewin's three-stage model is that it implies organizations could operate under static conditions, enabling a seamless transition to a new entrepreneurial culture. But in fact, these organizations function in dynamic and competitive environments characterized by geopolitical, financial, regulatory, and security challenges. Under such conditions, transitioning from one stable state to another often entails negative repercussions associated with change. In this context, managerial support, particularly from transformational leaders, is a critical factor in creating an environment conducive to innovation and entrepreneurship within universities (Harper-Anderson, 2018; Walsh et al., 2021). This is a critical factor for the development of an environment propitious to innovation and entrepreneurship in the context of universities (Walsh et al., 2021).

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METHODOLOGY

Multiple case study

This research is qualitative, as it explains the social phenomenon in the environment in which it occurs (Godoi et al., 2006; Neuman, 1997). It is a multiple case study that investigates a contemporary phenomenon within a real-life context (Yin, 2011), in order to capture and understand the dynamics of the organization in its formal and informal activity, thus obtaining a rich description of the phenomenon (Eisenhardt & Graebner, 2007). The multiple case study was chosen because it was possible to answer the research question: "How does the role of managers of innovation agencies/NITs influence the transformation into a culture focused on entrepreneurship?" (Eisenhardt & Graebner, 2007). The study of multiple cases is a recommended approach in the treatment of questions about "how" a phenomenon happens (Yin, 2017). The seven cases were selected based on two criteria. The first was that the university had to have had a TTO operating for more than two years to ensure that the entrepreneurial university model had already been installed. The second criterion was that the centers were in the state of Paraná, due to the representativeness of the phenomenon and also for the convenience of the researchers. Details and information about each of the seven innovation agencies studied are presented below. The higher Education Institutions (HEIs) received fictitious names to preserve their identities and those of the interviewed professionals.

Case 1: HEI S has a structure that includes 28,190 students and 7,380 employees, distributed across three campuses in Curitiba and in four other cities in Paraná. The HEI offers 164 courses and is a federal state institution. The innovation agency/NIT was established in 2008, with a team of 11 people, and is structured into three main coordination areas: entrepreneurship and business incubation, intellectual property, and technology transfer. The office and other structures of the HEI are located on the same floor and, although there isn't an incubator, there are incubating companies at the institution's laboratories.

Case 2: HEI T is a private, non-profit institution, founded in 1959, that has been in existence for 61 years, and has approximately 30 thousand students and 1,650 teachers, distributed across three fields. The TTO was inaugurated in 2014 and is composed of a team of 18 people. The agency is structured into four main coordination areas: development and innovation, open innovation, acceleration and business incubation, and hub entrepreneurship (entrepreneurial education). The infrastructure includes its own building, which houses the agency, the incubator and a technology park.

Case 3: HEI U, originally founded in 1909, is a 15-year-old federal state institution. The HEI has approximately 32 thousand students and 2,539 teachers, distributed across 13 fields. The TTO was established in 2002 and is made up of a team of nine people, and does not have its own building for its activities. The university has a director of business and community relations and a coordinator, as well as incubators and technology parks.

Case 4: HEI V, founded in 2008, is federal, has been in existence for 12 years, with approximately 3,635 students and 2,229 employees. It is composed of 28 campi distributed throughout the state of Paraná. The TTO was established in two stages: the creation of the office in 2013 and the expansion of activities in 2018. There is no incubator. The team consists of nine people located inside the rectory building. The main office supports the TTOs located in other cities of Paraná.

Case 5: HEI X, founded in 1970, is a state institution and exists for 50 years. The HEI has approximately 5,804 students and 1,345 professors, distributed across a single campus. The TTO was founded in 2000, there is a team of eight people, operating in an exclusive building within the campus and is organized into four main subdivisions: intellectual property office, design office, technology transfer office and business incubation.

Case 6: HEI Y, founded in 1969, is a 51 year old state institution. The TTO was established in 2008, and is composed of a team of five people. Th office is managed in partnership with the local city hall and has its own building joining the incubator and some junior companies. The structure is divided into two main subdivisions: intellectual property and technology transfer.

Case 7: HEI Z, founded in 1987, is 33 year old state public institution. The institution has approximately 8,562 students and a faculty composed of 1,011 permanent professors. The TTO was established in 2004 and there is a team of four. The infrastructure consists of a room in the same building as the rectory, and its activities are focused on the protection of intellectual property and the transfer of technologies developed at the university for the productive sector.

Data collection

The data collection phase took place during the second half of 2019. A total of 36 interviews were conducted with seven directors of the TTOs, 17 employees, seven managers of partner companies and five representatives of companies incubated at the university. The 36 interviewees were chosen as follows: (i) the directors were selected by the leadership position they held; (ii) employees and representatives of companies incubated were selected by sortition; and (iii) the managers of the partner companies were indicated by the directors, based on the criteria of length of partnership and/or importance of the partnership for the institution. Initial contact was made by e-mail, directly to the director and, after explaining the nature of the research the researchers contacted the other participants. The 36 interviews took place in person, according to a semi-structured format, which is based on a flexible script (Neuman, 1997; Yin, 2017). The interviews totaled 20h14min of information and were recorded digitally and later transcribed and sent to each of the interviewees for content review (Creswell, 2010; Yin, 2011). All interviewees then approved the transcribed text. Information about the interviews can be found in Tables 1 and 2.

Table 1. University TTOs

University TTOs	Controlling bodies	Founding year of Innovation Agencies	Collaborators	Technical park	Own building
S	Federal	2008	11	No	No
T	Private	2014	18	Yes	Yes
U	Federal	2002	9	Yes	Yes
V	Federal	2013	9	No	No
X	State	2000	8	Yes	Yes
Y	State	2008	5	No	Yes
Z	State	2004	4	No	No

Table 2. Information about the interviewees

No.	University TTOs	Interviewee	Job title	Duration
1	S	E1	Agency director	1h15min
2		E2	Agency employee	28min
3		E3	NIT incubator	33min
4		E4	Manager of the partner company	38min
5		E5	Manager of the partner company	52min
Total interview hours				3h46min
6	T	E6	Agency/NIT Director	9min
7		E7	Agency/NIT employee	48min
8		E8	NIT official	40min
9		E9	NIT official	35min
10		E10	NIT incubator	36min
11		E11	Manager of the partner company	25min
Total interview hours				3h13min
12	U	E12	Agency/NIT Director	1h07min
13		E13	Agency/NIT employee	27min
14		E14	Agency/NIT employee	11min
15		E15	Manager of the partner company	26min
16		E16	Incubado do NIT	18min

Continue

Table 2. Information about the interviewees

Concludes

No.	University TTOs	Interviewee	Job title	Duration
Total interview hours				2h29min
17	V	E17	NIT director	1h12
18		E18	Agency/NIT employee	35min
19		E19	Agency/NIT employee	37min
20		E20	Agency/NIT employee	36min
21		E21	Agency/NIT employee	49min
Total interview hours				3h49min
22	X	E22	NIT director	1h22min
23		E23	Agency/NIT employee	19min
24		E24	Agency/NIT employee	20min
25		E25	NIT incubator	18min
26		E26	Manager of the partner company	12min
Total interview hours				2h31min
27	Y	E27	NIT director	48min
28		E28	Agency/NIT employee	9min
29		E29	Agency/NIT employee	32min
30		E30	NIT incubator	15min
31		E31	Manager of the partner company	9min
Total interview hours				1h53min
32	Z	E32	NIT director	1h23min
33		E33	Agency/NIT employee	16min
34		E34	NIT intern	18min
35		E35	Agency/NIT employee	12min
36		E36	Manager of the partner company	24min
Total interview hours				2h33min

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Data analysis

Firstly, the 36 interviews were analyzed in three stages, following the content analysis technique proposed by Bardin (2011). The stages were as follows: (i) pre-analysis—organizing data according to the institution, format, and respondent; (ii) exploration—encoding and categorizing the data based on their respective classifications; and (iii) treatment and interpretation—attributing meaning to the data to characterize the process and its elements.

Additionally, a total of 23 documents were collected and analyzed to provide further insight into the characteristics of the universities, their innovation processes, and the entrepreneurial activities undertaken. These documents included university homepages, TTO's management reports, university notices, regulations, reports, and news. All data were stored and managed using NVivo software (version 11), a tool recommended for analyzing and compiling unstructured material (Woolf & Silver, 2018).

For data analysis, the triangulation of multiple sources of evidence was conducted in accordance with Yin's guidelines (2017). This process included: (a) documents, (b) interviews, and (c) non-participant observation. The triangulation strategy strengthened the analysis and interpretation of results through cross-validation of the data obtained (Creswell, 2010; Miles et al., 2014). To ensure the reliability of the study, a protocol was applied that outlined field collection procedures, the study's questions, and its methodological approaches (Yin, 2017).

The data analysis process adhered to the three stages of cycle coding, as recommended by Miles et al. (2014). In the initial stage, 18 codes were assigned to the data. During the second cycle, these initial codes were condensed into eight categories. Subsequently, the evidence was organized into a case matrix that incorporated a multiformat data input, including text, quotes, interview excerpts, and documents.

In the third cycle, the case matrix proved instrumental in organizing the evidence and enhancing the overall visualization of the cases. This approach enabled the researchers to interpret and abstract the evidence, establishing connections with existing theories and publications on the subject.

RESULTS AND DISCUSSIONS

Organizational culture

In terms of organizational culture, evidence indicated that all the universities have undergone significant transformations, transitioning from a traditional university model to an entrepreneurial university model through the development of entrepreneurship and the implementation of innovation activities. The shift toward an entrepreneurial culture was initiated with the introduction of various innovation policies within the institutions and was formalized following the approval of the Legal Framework for Science, Technology and Innovation Law (2016). This

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legislation mandated that science and technology institutions establish mechanisms for managing their innovation policies, including the protection of intellectual property and technology transfer.

In conjunction with the legal structuring, the universities in the study created or began to strengthen their TTOs, making substantial progress in implementing an entrepreneurial vision. According to the interviewees, the initial stages were challenging, as the institutions were accustomed to a centralized operational approach typical of the traditional model. Overcoming these obstacles requires significant adaptation.

The HEIs directors S and V stated that they played an active role in disseminating the new culture of innovation and entrepreneurship within their universities. This was accomplished by initially sharing information with professors and students and conducting outreach efforts across various campuses. These efforts included organizing events and delivering lectures to promote innovation and foster an entrepreneurial mindset.

> We started the job of disseminating the culture of innovation and intellectual property, as many professors and students were not aware of the potential for entrepreneurship. Once this obstacle was overcomed, we were seen as a university that generates many patents and much applied knowledge. (Interviewee 1/S)

> From 2018 until now, we have approved the innovation policy and encouraged patenting and we went to every campi to hold events and lectures in order to create a culture of innovation. (Interviewed 17/V)

An interesting situation was observed at HEI T, which differed from the other institutions in terms of creating an organizational culture distinct from its original one. The interviewees highlighted the coexistence of two distinct cultures within the institution: one associated with the HEI and another with the TTO. While the last fosters flexibility and openness to new ideas, the HEI maintains a more austere culture and is slower to adapt, as changes depend on senior management (Rectory and Superior Councils).

Despite the coexistence of these parallel cultures, the traditional and more austere culture of the HEI does not negatively impact the results achieved by the TTO, which is attributed to the their flexible, innovative, entrepreneurial and dynamical subculture. As a result, T was able to generate entrepreneurial outcomes by establishing a subculture within the broader organization, as explained by the interviewees.

> If you work here for a month and then a month at the university, you will find we are completely different institutions, because the cultures are very different, here we develop a culture of flexibility and openness to ideas. (Interviewee 7/T)

Organizational change

Regarding the process of change, X and Y directors highlighted that the change from a traditional culture to an entrepreneurial one took many years and had many challenges, and it was necessary to break some paradigms:

> In order to implement simple ideas such as partnerships with companies and to receive royalties over time, we had to break some paradigms for sure, ideological paradigms [...] When I took over, we went through great challenges, because many people at the university thought that we could not "sell" the university, that everything should be 100% state owned, that the state-private partnership was inadequate, these types of things. (Interviewed 22/ X)

> Implementing a culture of innovation at the university is a lot of work that takes years, which involves changing the mentality of both students and researchers. But today we can already say that we are reaping the results from technology transfer by the incubated companies, such as the increase in the number of innovative patents, and government-business-university partnerships. (Interviewee 29/Y).

HEI Z respondents believe that the transition between the traditional and entrepreneurial models is still ongoing. At T, a divergence in culture and *modus operandi* between the office and the university has been noted, as previously highlighted. One of the interviewees described the manager as having a startup way of thinking, characterized by a fast-paced approach, a focus on decentralizing decision-making, and fostering dialogue. The interviewee attributed the success of the office's actions to this managerial characteristic:

> We have a big problem of innovation culture here. There are many people internally who do not accept the activities of the office, who think that we are selling university knowledge to companies. That's one of the reasons why we never took off during those years. (Interviewee 32/Z)

> I have been here for a short time, but I hope to see greater transformations at the university, so that entrepreneurship and innovation become priority activities for Z, as well as achieving status as an institution of the 21st century. (Interviewed 33/Z)

HEIs X, Y, and Z, all public institutions, identified the breaking of ideological paradigms, cultural change, and the reduction of internal resistance as significant challenges in the transition process. Additionally, they reported that the commercialization of university-created innovations was not well received internally. According to one interviewee, the prevailing paradigms reinforced a rejection of state-private partnerships and, consequently, a lack of internal acceptance for their activities.

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This scenario aligns with the findings of Fugino and Stal (2007), who observed that the organizational culture of Brazilian state universities is rooted in ideological values that advocate unrestricted access to all research results produced by these institutions. Similarly, Singh et al. (2020) identified a similar impasse, documenting the resistance faced by managers of TTOs in Brazilian public universities. As a result, the concept of an university office partnering with private companies—which might gain ownership of university's inventions—conflicts with the ideological principles of public institutions and challenges the entrepreneurial university model.

When asked about the practices implemented internally to disseminate the culture of innovation and entrepreneurship, the interviewees' responses were summarized in Table 3. Common practices included organizing events and lectures, forming partnerships between government, companies, and universities, and addressing internal resistance. The interviewees also highlighted specific actions, such as encouraging the registration of intellectual property and patents (HEIs S, U, V), establishing internal innovation policies (HEIs S, U, V), and fostering the generation of new ideas (HEIs U, V, T, Y).

Other studies have similarly emphasized the importance of hosting informative lectures to raise awareness within the academic community about the benefits of an entrepreneurial institution (Katz et al., 2018; Machado & Sartori, 2015) and tackling internal resistance (Arbix & Consoni, 2011; Leih & Teece, 2016).

Table 3. Dissemination practices of the entrepreneurial culture

How is the culture of innovation disseminated internally?	S	U	V	T	X	Y	Z
Incentive to register intellectual property and patents	X	X	X			X	
Creation of internal innovation policy	X	X	X				
Organization of events and lectures	X	X	X	X	X	X	X
Encouragement of new ideas		X	X	X		X	
Partnership between government-company-university	X	X	X	X	X	X	X
Confronting resistance	X	X	X	X	X	X	X

Decentralization of decision making

Several directors interviewed emphasized that the decentralization of decision-making is a critical condition for achieving the objectives of the TTO:

> I feel that I have freedom when making a decision on my own about a project, but if the opinion involves the director, I sit down with him right away, pass on what I understood of the process, he reads it and we share opinions. It's all very accessible here, they are not old-fashioned centralizing managers. (Interviewee 18/V)

> Access to the Rectory is very fluid, there is an alignment between our objectives and the role of each one is quite clear – decisions that are the responsibility of the Rectory and decisions that are my responsibility as manager of the agency – there is therefore, a certain decentralization. (Interviewed 22/X)

HEI Z interviewed recognizes that decentralization is not an aspect of this university culture, but expressed the belief that this could change in the future:

> I don't think there is much decentralization in management here, but I realize that in recent times we have received more attention from the Rectory, they have been more interested, and even the innovation agenda is part of the discourse by the rector candidates. This is very positive us, in the future I think that we can achieve more flexibility (E33/Z).

According to Teece (2007), decentralizing decision-making through the deconstruction of organizational structures is strongly recommended to facilitate governance and improve management. In support of this view, Oliveira et al. (2016) argue that decentralization enhances the formation and effective management of strategic alliances, enabling more agile and adaptable responses to collaboration and business opportunities. Furthermore, organizations cannot dynamically meet customer demands or adopt new technologies effectively if decision-making processes remain heavily centralized.

Furthermore, Begeç and Akyuz (2023) emphasize that decision decentralization is particularly critical in the digital age, as it enables multiple partners and stakeholders to actively engage in the decision-making process. This approach facilitates decisions that are more closely aligned with operations and the specific needs of all parties involved. Additionally, these authors highlight that decentralization fosters a sense of shared responsibility and engagement among members of the collaboration network.

In this context, universities T and U have demonstrated a more decentralized management model. At these institutions, the management of the innovation agency is divided, with one area dedicated to entrepreneurial activities and another to university administration. The manager at University U underscored his autonomy in managing the innovation agency, stating that he has been granted carte blanche from the Rectory.

Table 4 presents the levels of centralization versus decentralization in decision-making processes within the offices, comparing the seven universities analyzed. Among them, only two reported operating under a centralized decision-making model. The remaining institutions follow a decentralized system, which grants managers the autonomy to make decisions that benefit the activities of the center. This decentralized structure enables greater agility, dynamism, and effectiveness in achieving organizational results.

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Table 4. Centralization of decision making

Decentralization of the decision-making process	S	U	V	T	X	Y	Z
Decentralization		X	X	X	X	X	
Centralization	X						X

Transformational leadership

Overall, the findings indicate that NITs with transformational leadership have significantly impacted and continue to influence the shift from a traditional university culture to an entrepreneurial culture. Interviewees from HEIs S, T, U, and V emphasized the importance of the transformational commitment of their managers in advancing university entrepreneurship and supporting the activities of innovation agencies/NITs.

Members of the NITs highlighted the critical role of managers in creating and disseminating a culture of entrepreneurship within their institutions while fostering internal relationships to drive cultural change. These findings align with Siegel and Leih (2018), who stress the importance of university leaders being actively involved in identifying problems, formulating strategies, and determining the capabilities needed to respond to challenges and achieve institutional goals. Similarly, Desidério and Zilber (2014) emphasized the necessity of focusing transformational efforts on communication to strengthen the culture of innovation and entrepreneurship across Brazilian university campuses.

Furthermore, the study corroborates previous research, which identifies the competence of managers at innovation agencies/NITs as a key factor in gaining recognition within the academic environment for promoting an entrepreneurial culture (Rosa & Frega, 2017; Singh et al., 2020). According to Rosa and Frega (2017), open communication is a significant challenge in universities, where managers must raise awareness among academic members about the need for change. This involves demonstrating the importance of these agencies in managing intellectual capital and fostering innovation.

To achieve it, leaders must possess the ability to influence other academic members, ensuring the integration of entrepreneurial culture and creating value through entrepreneurship (Heaton et al., 2019).

The entrepreneurial innovation agency model proposal

The results facilitated the development of a model that explains how the TTOs managed the transition from a traditional university culture model to an entrepreneurial model. Figure 1 illustrates how this migration occurred in most of the universities included in the research. Notably, the managers played a pivotal role within their institutions by stimulating technological innovation and promoting a culture of adaptability, flexibility, and innovation. This, in turn, activated entrepreneurial thinking, leading to greater incentives for registering intellectual

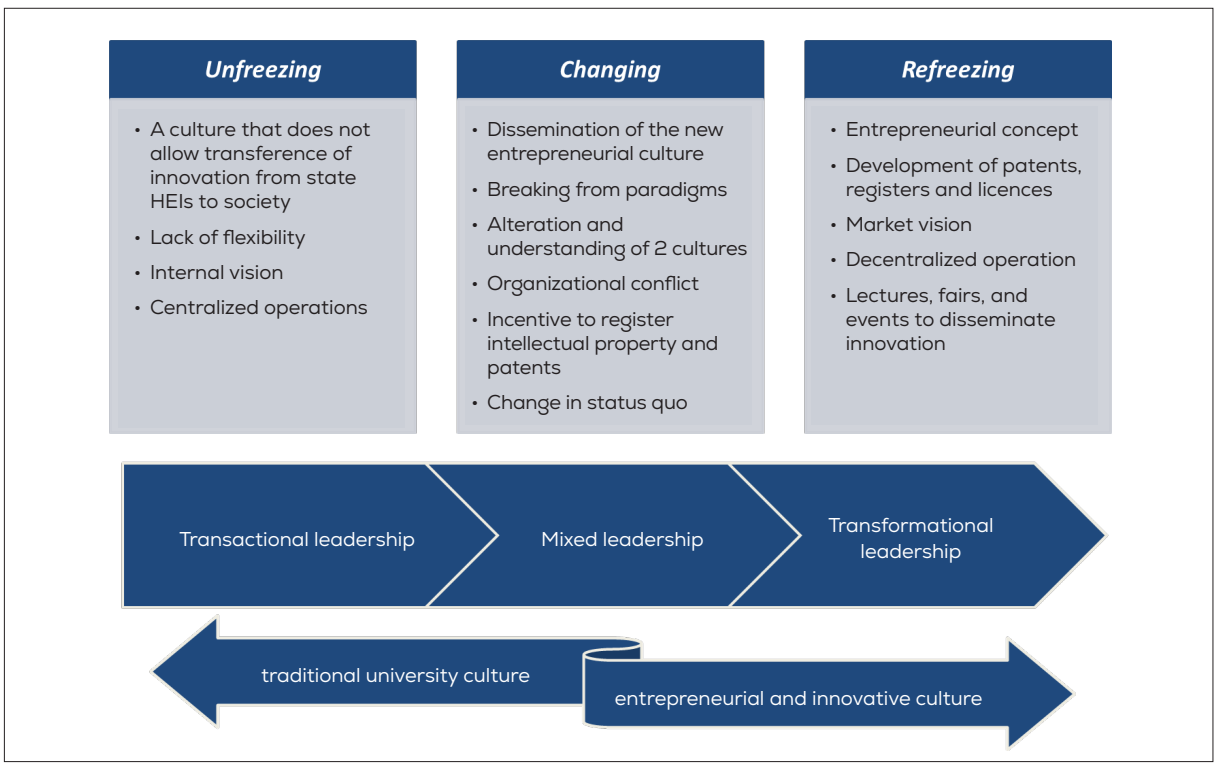
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property and patents. These efforts were complemented by the establishment of internal innovation policies, reinforced through events and the encouragement of new ideas.

These actions contributed significantly to the shift toward an entrepreneurial culture. This transition was largely enabled by the decentralization of power in TTOs, providing greater flexibility in decision-making and operations (Hayter & Cahoy, 2016). Furthermore, this process allowed the offices to incorporate market-oriented perspectives on the innovations developed by the universities, aligning the objectives of the universities with those of companies, government institutions, and the TTOs themselves (Heaton et al., 2019).

This process supports the sustainability of the HEIs by increasing their chances of survival and growth through the successful transfer of innovations to the market and society (Leih & Teece, 2016).

Figure 1. Model of change from a traditional culture to an entrepreneurial one



CONCLUSION

The objective of this study was to understand the role of TTOs managers and the impact of their actions in facilitating the transition from the traditional university model to the entrepreneurial model. This objective was successfully achieved, and the results can be summarized into four key groups.

Firstly, the role of office leaders was identified as fundamental in driving cultural transformation. This was accomplished through breaking ideological paradigms, ensuring clear

communication, and addressing internal resistance. The study contributes to the theoretical understanding of the role of Brazilian TTOs leaders, emphasizing the actions and management structures they employed to effectively transform their institutions' internal cultures.

Secondly, regarding centralization and decision-making, the evidence indicates that institutions allowing decentralized decision-making processes within their TTOs achieved better results. Two of the institutions studied had notably advanced in this regard, benefiting from greater agility and dynamism in management.

Thirdly, the commitment leaders proved essential in transforming their universities and incorporating entrepreneurial objectives into institutional practices.

Lastly, the study's findings allowed a proposal of a theoretical model that explains how cultural change occurs in universities transitioning to an entrepreneurial model. These universities demonstrated greater alignment with entrepreneurial thinking by granting their leaders with flexibility in decision-making, enabling them to fulfill the missions of their respective institutions.

This study also contributed with a theoretical framework that enhances understanding of the cultural transformation process in universities while offering practical insights for other institutions and university leaders aiming to implement entrepreneurial university models.

This research is not free of limitations, which can be categorized into two main points. Firstly, the findings cannot be analytically generalized to institutions in other regions of the country, as the study focused exclusively on universities located in the state of Paraná. Secondly, the criteria used to select universities were limited to those containing structured TTOs. Consequently, the study may have excluded other universities that may operate under entrepreneurial models by other kinds of denominations.

To address these limitations, future studies are recommended to collect data on across various regions of Brazil. Additionally, conducting longitudinal research could provide insights into the evolution of practices and roles of the managers, particularly from the inception of such initiatives. Another suggestion is to investigate the best management practices of Brazilian TTOs to better understand how they fulfill their missions related to disseminating university-generated inventions. Such research is believed to be valuable to companies, communities, and society in general.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

AUTHORSHIP CONTRIBUTION

Vivien Mariane Massaneiro Kaniak: Conceptualization; Formal analysis; Investigation; Methodology; Validation; Writing – original draft.

Elizandra Severgnini: Conceptualization; Data curation; Formal analysis; Validation; Visualization; Writing – review and editing.

Jéssica Cristina Ceni: Conceptualization; Formal analysis; Writing – original draft; Writing – review and editing.

Rivanda Meira Teixeira: Conceptualization; Formal analysis; Methodology; Supervision; Validation; Writing – review.