

Frameworks of Entrepreneurial Universities: A Systematic Review

Frameworks de Universidades Empreendedoras: Uma Revisão Sistemática

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ABSTRACT



The definition of a model (*framework*) for an entrepreneurial university (EU), together with the definition of elements and characteristics that lead to its existence, have been widely discussed in the literature. This study aims to identify *frameworks* concepts for EU prevalent. The initial sample consisted of 181 surveys extracted from the Web of Science and Scopus databases. From the selection of materials, we performed a reference analysis to identify additional studies. Subsequently, a content analysis was carried out on 50 articles, which made it possible to identify twelve different *frameworks* for the EU from 1998 to 2021. Internal restructuring, innovation, internationalization, hybridization, R&D, sustainability, global interaction with companies, associations and institutions, active methodologies, high-intensity research, among other aspects. These elements jointly raise the level of institutions. Finally, the novelty focuses on the elaboration of a final framework, which synthesizes the models that the literature presents, and the theoretical approaches, in short, follow institutional theory and economic theory and, implicitly, are integrated by formal environmental factors. and informal ones that positively or negatively influence the university development process to different degrees.

Keywords: Entrepreneurial University; *Frameworks* ; Systematic Review of Literature.

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RESUMO

A definição de um modelo (*framework*) para universidade empreendedora (UE), em conjunto com a definição de elementos e características que levam à sua existência, têm sido amplamente discutidos na literatura. Este estudo visa identificar *frameworks* conceituais para UE prevalentes. A amostra inicial constitui-se de 181 pesquisas extraídas do banco de dados Web of Science e Scopus, a partir da seleção dos materiais realizamos uma análise de referências para identificação de estudos adicionais. Posteriormente foi realizada uma análise de conteúdo em 50 artigos, que tornou possível a identificação de

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ABSTRACT

doze *frameworks* distintos para UE desde 1998 à 2021. Entre as principais contribuições destaca-se: Reestruturação interna, inovação, internacionalização, hibridização, P&D, sustentabilidade, interação de forma globalizada com empresas, associações e instituições, metodologias ativas, pesquisa de alta intensidade, entre outros aspectos. Elementos esses que de forma conjunta elevam o patamar das instituições. Por fim, o ineditismo concentra-se na elaboração de um *framework* final, que sintetiza os modelos que a literatura apresenta, sendo que as abordagens teóricas em suma, seguem a teoria institucional e a teoria econômica e, implicitamente, são integrados por fatores ambientais formais e informais que influenciam positiva ou negativamente o processo de desenvolvimento da universidade em diferentes graus.

Palavras-chave: Universidade Empreendedoras; *Frameworks*; Revisão Sistemática da Literatura.

Introduction

An entrepreneurial university acts as a platform for scientific research that works to deepen understanding of social, economic and environmental challenges (Beck et al. 2020). In this new version, the institution has a standard of a regional nature, with strategic management approaches, diversification of funding sources and promotion of a culture of entrepreneurship (PUGH et al., 2018) .

In this way, the entrepreneurial university develops from a traditional model focused on teaching to a broader context, with the inclusion of research in which knowledge is based on innovation. This university model is capable of taking on initiatives that arise from professors, students and technicians. (ETZKOWITZ et al., 2021). The entrepreneurial activities generated by the entire academic community can contribute to the production and dissemination of knowledge, increasing competition and injecting diversity into the market (GUERRERO et al., 2015).

In light of universities, Etzkowitz (2004) developed a model composed of a set of five interrelated factors derived from his analysis of entrepreneurial academic development in the United States of America (USA), Europe and Latin America. It includes the following factors: capitalization of knowledge, interdependence with industry and government, independence from other institutional spheres, hybrid organizational forms and renewal at each time.

In a recent approach, Liu and Van Der Sijde (2021) proposed a model for creating the entrepreneurial university 2.0. This proposal, in addition to the already consolidated characteristics of the entrepreneurial university, includes facing the challenges of the new public management that are imposed by governments in the era of efficient accountability, in addition to promoting innovation for the accountability of the institution itself.

The entrepreneurial university model creates a work structure in which the university is inserted in its region and linked to others. Institutional spheres are integrated into society, with interrelationships with industries and government, so that elements of one are incorporated into the other, through shared resources, people and practices. The end result is the formation of the entrepreneurial university, that is, innovation in higher education (ETZKOWITZ et al., 2021a). The entrepreneurial university takes a proactive stance, putting knowledge to use and operating through an interactive model of innovation, in which the researcher is the main academic actor (ETZKOWITZ, 2013; LIU; VAN DER SIJDE, 2021).

Cunningham and Menter, M. (2021) point out that public policies focused on the higher education landscape seek a paradigm shift among universities that can ultimately lead to the transformation into entrepreneurial universities and that collaborations with industry and the associated orientation to applied research appears to stimulate entrepreneurship across an entire region. In this sense Passaro, Quinto and Thomas (2018), add that public policies create entrepreneurial intention. In their research Menter, Lehmann and Klarl (2018) found that the initiative contributed positively to increasing research performance among universities that promote entrepreneurship, but argue that it is not necessarily the policy initiative itself, but rather the provision of funding that has fostered the performance of the higher education system.

According to Clark (1998), the literature tries, through theoretical models, to explain the emergence of entrepreneurial universities, and designing paths that must be followed to achieve this new mission for institutions that involves entrepreneurship. The research is justified mainly by aspects associated with the need to deepen knowledge about the factors that facilitate or hinder the development of the entrepreneurial university and also the need that institutions have to acquire skills, knowledge, capacities and competences for the university to develop activities of

its third mission, that is, entrepreneurship, thus contributing to the emergence of the entrepreneurial university. Considering the context presented, a systematic review of the literature is important to identify the main concepts, characteristics and elements present in an entrepreneurial university in the view of different researchers on the topic. In this way, the following research question was elaborated: What are the main models “frameworks” that the scientific literature proposes for the construction of an entrepreneurial university?

To achieve this objective, the work is structured in four sections in addition to this introductory one. In the second section, the theoretical foundation with concepts and principles of the entrepreneurial university is presented, based on the data collected for this RSL; in the third section, the methodological path adopted in this study is described; in the fourth section, the identified frameworks are exposed; and, in the fifth section, the final considerations are discussed, with suggestions for future work and indication of the limitations of the study.

Theoretical Foundation

This section presents a conceptual synthesis, characteristics and elements of the entrepreneurial university (UE), based on the data collected in this RSL.

The concept of entrepreneurial university appears only in the mid-1990s, with the study by Burton Clark (1998) entitled “Creating entrepreneurial universities: organizational pathways of transformation”. The concepts present characteristics that are sometimes similar, sometimes different among researchers. Therefore, it is not possible to define a single concept for entrepreneurial university, given the diversity of approaches. Fayolle and Redford (2014) indicate that the variety of entrepreneurial approaches performed by institutions is one of the most formidable features of the concept.

As already mentioned, Etzkowitz (1983) identified that universities needed to seek other sources of income, and these new resources could come from patents, partnerships with private companies, as well as from research. In this sense, Chrisman et al. (1995) propose that universities should foster new business through faculty, technical staff, and student bodies.

The concept of an entrepreneurial university provides for an academic structure and function that are revised through the alignment of economic development with research and teaching as academic missions. In this context, entrepreneurial activities are carried out with the aim of improving regional economic performance, as well as obtaining a financial advantage for the institution itself (ETZKOWITZ et al., 2000).

Defining the mission of an entrepreneurial university is one of the most important issues for the establishment and progression of activities in institutions. The university that contains entrepreneurial activities in its mission carries out a diverse range of actions that are not limited to teaching or basic research (Ahmad et al., 2018). In this way, the direct involvement of the institutions in the exploitation of the results from the research is determined, with strong collaboration from the industry, providing the direct involvement of the university in regional development (LAZZERONI & PICCALUGA, 2003).

The entrepreneurial university adds a series of attributes that are institutional and adjusted for entrepreneurial behavior (Clark, 1998), unlike the traditional university, which exclusively develops teaching and research for itself, without involving society (ETZKOWITZ, 2003b). For Urbano and Guerrero (2013), the entrepreneurial university emerges as a catalyst for regional development, not only with economic aspects, but also with social aspects, in which new opportunities for generating knowledge appear linked to entrepreneurship.

An entrepreneurial university is one that responds strategically to changes in the environment, acquiring and employing resources in an innovative way, supported by an entrepreneurial culture that provides support structures for institutions to fulfill their strategic objectives aligned with entrepreneurship (Ferreira, 2017).

In summary, the entrepreneurial university is an event that reflects a new type of institution, which brings together economic development as an academic function in parallel with teaching and research, and in which there are external influences on the academic structures related to innovation (ETZKOWITZ, 2013; ETZKOWITZ & ZHOU, 2017). In this “new version”, the institution has a pattern of a regional nature, with strategic management approaches, diversification of funding sources and promotion of a culture of entrepreneurship (Pugh et al., 2018). Univer-

sities are perceived as capable of driving entrepreneurial societies and becoming a global phenomenon.

As for the elements and characteristics that are present in an entrepreneurial university, it can be seen that Etzkowitz (2003a) recognizes knowledge as a marketable capital and considers that the entrepreneurial university has strong interaction with industry and government, being part of society. Lazzeroni and Piccaluga (2003) corroborate this thought and indicate that the entrepreneurial university becomes directly involved in the exploration of research results through intense collaboration with the industry.

In this line of thought, Urbano and Guerrero (2013, p. 43) define that “the entrepreneurial university needs to become an entrepreneurial organization, its members need to become entrepreneurs, and their interaction with the environment needs to follow an entrepreneurial pattern”. Isenberg (2011) expands the discussion, suggesting that institutions are strategically part of an entrepreneurship ecosystem. From this perspective, the entrepreneurial university brings together a set of characteristics that were institutionally adjusted and oriented so that they could achieve entrepreneurial behavior (CLARK, 1998).

Recent studies point to innovation, business creation and internationalization as important elements for the realization of an entrepreneurial university (GIBB et al., 2013; GUERRERO et al., 2015; FOWLE & VASSAUX, 2017; FERNÁNDEZ-NOGUEIRA ET AL. , 2018) and, NOT LEAST IMPORTANTLY, FOR THE SEARCH FOR INSTITUTIONAL SUSTAINABILITY (ROHANI, 2013; GUERRERO et al., 2016).

However, it is necessary for universities to undergo continuous changes in their organizational structures, with changes in regulations and norms to adapt to changes in the environment, so that they can respond to the demands of society (Yokoyama, 2006; Thorp & Goldstein, 2013); Guerrero et al., 2011; Moroz, 2012; Kirby, 2006), in addition to creating strategies for the future (ROHANI, 2013).

The characteristics and elements that make up the entrepreneurial university only promote institutional transformation if they interact with each other, as they are not capable of generating significant results in isolation. Transformation occurs only when entrepreneurial activities create value for its mission and when members of the academic community come together (ETZKOWITZ & KLOFSTEN, 2005).

Methodology

In order to identify the theoretical frameworks proposed on entrepreneurial universities, the literature on the subject was consulted in July 2021. For this purpose, bibliographic search criteria were defined, namely:

- a. protocol and stages proposed by Tranfield, Denyer and Smart (2003).
- b. research question: What are the main framework models that the scientific literature proposes for the construction of an entrepreneurial university?
- c. Tests to define key terms: The terms “framework”; “model” and “entrepreneurial university” in the “AND” and “OR” combination were tested in the Web of Science and Scopus databases, as described by Bonisoli, Galdeano-Gómez and Piedra-Muñoz (2018). Articles aligned with the research proposal were analyzed, and the term “model” was excluded, due to the exponential return of manuscripts and out of scope.
- d. databases: Scopus and Web of Science.
- e. search strings: “framework” AND “entrepreneurial university”.
- f. search within: Title, abstract and keywords
- g. Without chronological restriction, the articles returned are from 1983 to 2021.
- h. inclusion criteria: Full articles published in peer-reviewed journals; English language; Subject Area: All knowledge areas; Studies that address a strict relationship with the focus of work.
- i. exclusion criteria: Duplicate studies; Redundant study by an author (the most complete version was considered); Conference articles, editorials, books, book chapters, book reviews and other reports; Short or technological articles; Studies that do not address issues specifically related to the scope of the research; Articles without full text access.

From the lexical analysis of the titles, keywords and abstract of the 180 articles extracted from the bases, 50 articles were selected for reading in full, with the objective of identifying the main concepts, elements and models that characterize entrepreneurial universities. To identify models, it was necessary to expand the se-

arch through an analysis of research references that mentioned a model of entrepreneurial university. Thus, there was the additional inclusion of 10 articles that met the purpose of this RSL, totaling a sample of 60 studies, which made up the final basis of analysis.

Table 1 Total scientific articles mapped after applying criteria

combinations	Basis	
	Scopus	Web of Science
“framework” AND “entrepreneurial university”	154	27
Total	181	

Findings related to the conceptualization, characteristics and elements necessary for an entrepreneurial university are included in the rationale section. In turn, the findings regarding the models (frameworks) mapped conceptual propositions that guide and present the path for higher education institutions to advance towards becoming an entrepreneurial university. Table 2 presents the list of 14 researches that supported the 12 frameworks that will be presented in the results.

Table 2 Total scientific articles mapped after applying criteria

No	Authors	Year	Title	Journal
1	Clark	1998	The entrepreneurial university: Demand and response.	<i>Tertiary Education and Management</i>
2	Clark	2004	Outlining the character of the entrepreneurial university.	<i>Higher Education Policy</i> ,
3	Etzkowitz e Leydesdorff	2000	The dynamics of innovation: from national systems and “Mode 2” to a triple helix of university-industry-government relations.	<i>Research Policy</i>

4	Etzkowitz	2004	The evolution of the entrepreneurial university.	<i>International Journal of Technology and Globalization</i>
5	Etzkowitz	2013	Anatomy of the business university.	<i>Social Science Information</i> ,
6	Carayannis e Campbell	2009	“Mode 3” and “Quadruple Helix”: Towards a 21st century fractal innovation ecosystem.	<i>International Journal of Technology Management</i>
7	Carayannis e Campbell	2010	Triple Helix, Quadruple Helix and Quintuple Helix and how knowledge, innovation and the environment are related: a proposed framework for a transdisciplinary analysis of sustainable development and social ecology.	<i>International Journal of Social Ecology and Sustainable Development</i>
8	Urbano e Guerrero	2013	Entrepreneurial universities: socioeconomic impacts of academic entrepreneurship in a European region.	<i>Economic Development Quarterly</i>
9	Guerrero, Urbano & Kirby	2006	A review of the literature on entrepreneurial universities.	<i>An institutional approach</i>
10	Salamzadeh et al.	2011	Towards a systematic framework for an entrepreneurial university: a study in the Iranian context with an IPOO model	<i>Global Business and Management Research: An International Journal</i> ,

11	Sooreh, Salamzadeh & Safarzadeh	2011	Defining and measuring entrepreneurial universities: A study in the Iranian context using importance performance analysis and TOPSIS technique.	<i>Global Business and Management Research: An International Journal</i>
12	Ruiz, Martins & da Costa	2020	Entrepreneurial university: an exploratory model for higher education.	<i>Journal of Management Development</i> ,
13	Borhani et al.	2020	A readiness framework to assess the local economy for an entrepreneurial university	<i>Journal of Industry-University Collaboration</i>
14	Liu e Van Der Sijde	2021	Towards the entrepreneurial university 2.0: reaffirming the responsibility of universities in the era of responsibility	<i>Sustainability</i>

The 14 studies (Table 2) present theoretical models for the entrepreneurial university, the articles were read in full and supported the data analysis. The frameworks are listed in the results section. The technique used was content analysis (SALDAÑA, 2013).

Results

ENTREPRENEURIAL UNIVERSITY FRAMEWORKS

The literature presents different theoretical models (frameworks) for entrepreneurial universities. Through RLS it was possible to describe the models found in previous studies. Subsequently, through the theoretical models, the researchers studied the adaptation of higher education aimed at an entrepreneurial characteristic.

Clark Framework (1998, 2004)

Clark (1998) was a pioneer in suggesting a model for the entrepreneurial university. In his research “Creating entrepreneurial universities: organizational pathways of transformation”, he investigated five European universities (Warwick, in England; Twente, in the Netherlands; Strathclyde, in Scotland; Chalmers, in Sweden; and Joensuu, in Finland) that carried out the transformation. of the traditional university model, including entrepreneurship in its activities. Through the study, Clark (1998) identified the common elements between these institutions and the problems faced during the transition process.

There were five elements defined by Clark (1998), namely:

- a. strengthened management, with centralized and decentralized processes, managerial and academic values;
- b. expanded periphery, connected research center, with the presence of science and technology parks, business incubators; consultancies; advice;
- c. diversified funding sources, which seek independence for the institution by obtaining its own resources;
- d. stimulated and motivated academic community , which receives stimuli to develop pro-activity and entrepreneurial behavior;
- e. integrated entrepreneurial culture , part of a governance structure to disseminate values and beliefs throughout the institution that favor entrepreneurial thinking, which is then disseminated at the university.

Later, in his 2004 work “ Sustaining change in universities, society for research into higher education” , Burton Clark expanded his research and investigated 14 universities in African countries, Australia, Chile and the USA, in addition to 5 European institutions. of the first study (CLARK, 2004) . As a result, it identified that the success cases occurred in universities that managed, over time, to sustain the transformations carried out over time.

In summary, for Clark (1998 ; 2004) , the traditional university carries out the transformation when it manages to make adjustments to its missions, adapting to the new context, maintaining a close relationship with society, carrying out structural and cultural changes internally, reinforcing the core management, following changes in the environment, being proactive, updating and innovating.

Triple Helix Framework and the Entrepreneurial University – Etzkowitz and Leydesdorff (2000)

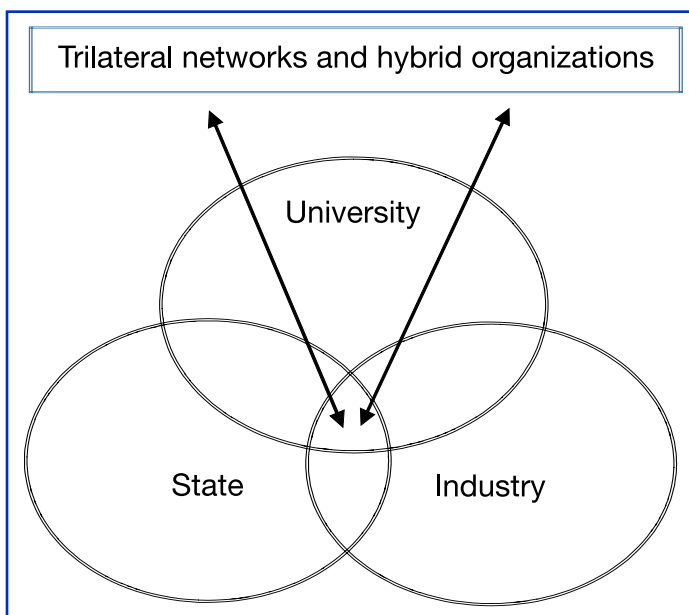
Studies indicate that, in the 1960s, research was carried out to assess the interaction between university, business and government. Sábado and Botana (1968) proposed an approach that would become known as the Sábado Triangle. This model would be the result of the coordinated action of three fundamental elements for social development: the government, the productive structure and the scientific and technological structure. In this model, the actors would be interconnected in a hierarchical triangular structure, in which the upper vertex would be occupied by the government, the other vertex, by the productive sector and the third, by the scientific and technological infrastructure. The basis would be the interaction between the productive sector and the scientific and technological infrastructure available in the country (BORGES, 2006).

Subsequently, the Triple Helix model emerged, which was proposed by (LEYDESDORFF AND ETZKOWITZ 1996). In this model, the objectives are basically the same, as well as the structure is the same, however, the actors (university, government and industry) would be shaped in a network interaction mode, with diversities of understandings and postures, sharing responsibilities in the construction scientific and technological bases, with no hierarchy (ETZKOWITZ and LEYDESDORFF, 2000). In the Triple Helix, the different bodies (university, companies and government) work autonomously, but interdependently, being able to assume different roles at each moment. The university, in this context, is no longer just a supplier of knowledge and human capital, starting to play a leading role in the creation of intellectual property and even new companies (ETZKOWITZ and LEYDESDORFF, 2000). Figure 2, below, represents the Triple Helix.

The organizational principle of the Triple Helix, according to Etzkowitz and Leydesdorff (2000), is the expectation that the university will perform the so-called third mission, in which the traditional academic roles of reproduction and extension of knowledge are maintained, but are also placed in a larger dimension, as part of its new role: the promotion of innovation, fundamental in the economic development of society. In this way, the Triple Helix establishes the university, industry and government as primary institutional spheres that interact to promote development through innovation and entrepreneurship.

In the process of interaction, new secondary institutions are formed, being called hybrid organizations. The dynamics of institutional spheres for development in a Triple Helix synthesizes the internal power and the external power of their interactions (ETZKOWITZ and ZHOU, 2008) . Still, the Triple Helix model is characterized as an evolutionary perspective in which relationships are in constant transformation, showing that borders are flexible and the action of one of the actors influences the action of others (ETZKOWITZ et al., 2008) .

Figure 1 The Triple Helix Model: University-Industry-Government



Source: Adapted from Etzkowitz and Leydesdorff (2000, p. 111).

For Etzkowitz and Zhou (2017), university-industry-government interactions form a Triple Helix of innovation and entrepreneurship, being key to knowledge-based economic growth and social development. In this model, the university expands its activities beyond the current models of action, capitalizing on knowledge and researchers, and it is in this context that the university covers the transfer of technology, the creation and development of companies, starting to be seen as a university entrepreneur (SANTOS and CASEIRO, 2015).

It appears, therefore, that, in this structure, the government occupies a passive place, as it acts to promote the interaction between university and company. In summary, the Triple Helix builds a more efficient relationship between university, industry and government, with the university being the inductor of relations with the other helices (ETZKOWITZ, 2003b). According to the model proposed by Etzkowitz and Leydesdorff (2000), universities that develop their activities based on this conceptual model are considered entrepreneurial.

Third Mission Framework – Etzkowitz (2004, 2013)

In their study that evaluated the emergence of a new kind of university, Martin et al. (2000) explained the emerging mechanisms for the creation of an entrepreneurial university through formal processes (internal restructuring, decentralization of activities, impact outside the institution's walls and collaboration between institutional spheres). Etzkowitz and Leydesdorff's (2000) model explained the mechanism and structures necessary for the development of entrepreneurial universities: (1) an internal transformation that includes a review of existing tasks, (2) an institutional impact with projects that help to seek a stabilization to the previous transformation, (3) the process in which a centralized institution becomes decentralized, and (4) the search for alternative resources with the collaboration of partner organizations.

Later, Etzkowitz (2004, 2013) proposed the Triple Helix model, indicating a third mission for institutions, which, in addition to teaching and research, should promote economic and social development through university-industry-government interaction. In this most recent study, universities from the USA, Sweden, Brazil, Italy, Portugal and Denmark were investigated, resulting in a model that presents a set of five integrated elements: 1) capitalization of knowledge; 2) constant interaction with industry and government; 3) institutional independence; 4) hybrid ways of carrying out activities; 5) continuous renovation of internal structures according to the influence received from industry and government. In addition to these elements, the study presents the results produced within each entrepreneurial university mission.

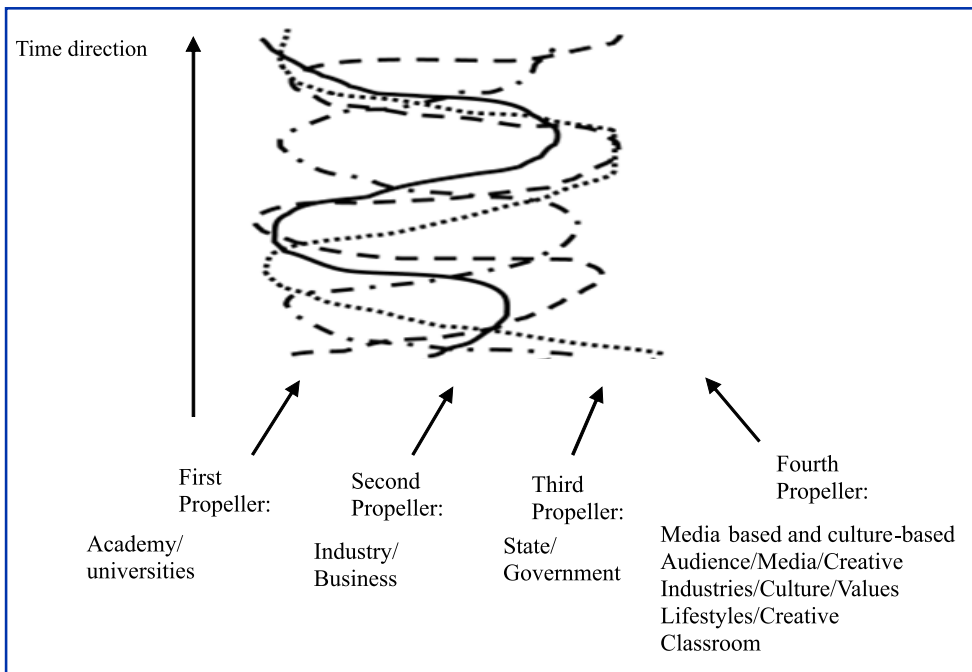
Quadruple Helix Framework – Carayannis and Campbell (2009)

The Quadruple Helix model (Figure 2) adds, to the other helices (Figure 1), the "media and culture-based audience", a helix that is associated with "media", "creative industries", "culture", "values", "lifestyle", "art" beyond the notion of "creative

class” (Carayannis & Campbell, 2009, p. 206) . Figure 3 presents the conceptualization, identifying all the propellers of this model. The Quadruple Helix involves innovation-oriented public policies that can recognize the public’s important role in the successful achievement of goals and objectives. On the one hand, reality is being constructed and communicated by the media, on the other hand, the public is influenced by culture and values.

The potential of the Quadruple Helix lies precisely in the fact that the “culture of innovation” is the key to promoting a knowledge-based economy (research, technology, education associated with concepts of creative industries, culture, values, lifestyle and art). Furthermore, this model has the potential to globally connect the knowledge produced by society and the economy.

Figure 2 Quadruple Helix Conceptualization



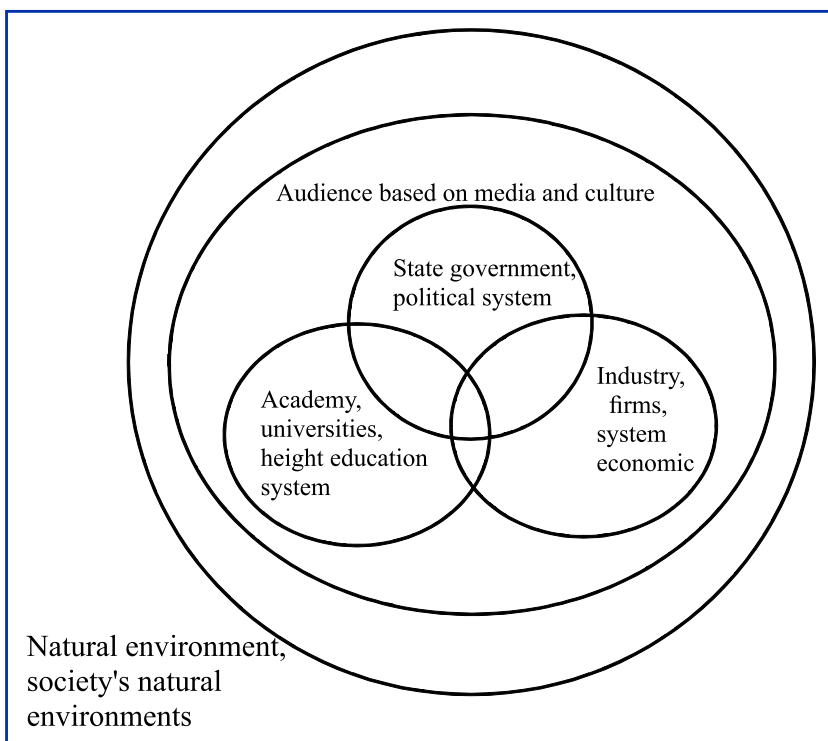
Source: Adapted from Carayannis and Campbell (2009).

Miller et al. (2018) renamed and extended the Quadruple Helix concept to civil society. Thus, it can be said that this new helix is made up of society as a whole.

Quintuple Helix Framework – Carayannis and Campbell (2010)

The Quintuple Helix model incorporates all the previous helices (triple and quadruple helices) and adds knowledge and innovation in the context of the environment (natural environment). This model can also be interpreted as an approach to the development of social ecology, along the lines of “eco-innovation” and “eco-entrepreneurship”, as it involves a broad understanding, uniting knowledge, innovation and the environment. Figure 3 illustrates the model that includes the five propellers.

Figure 3 Quintuple Helix Model



Source: Adapted from Carayannis and Campbell (2010).

The Quintuple Helix proposes a *framework* for transdisciplinarity and interdisciplinarity with the potential to offer an analytical framework for sustainable development and social ecology, conceptually relating sustainable knowledge (which reflects on the performance and quality of the environment) and innovation

For König et al. (2021), the connection of the environmental helix with the other four helices is a challenge and a gap to be filled in the Quintuple Helix model, that is, it remains to answer the question: how to connect the five helices and their respective knowledge and innovation regimes in general considering sustainability? One solution revolves around the notion of ecology, which can be understood as the analysis of the relationships between living organisms (social ecology) or the relationships between living beings and their environments (natural ecology).

Framework by Guerrero, Urbano & Kirby (2006)

In light of institutional theory, Guerrero et al. (2006) considered that micro and macroeconomic environmental factors influence the process and results of the journey from a traditional university to an entrepreneurial university. These elements were classified into two groups: formal and informal.

Formal factors include organizational structure and institutional governance, measures to support university startups, incubators and entrepreneurship education programs. In turn, informal factors include the attitudes of the university community related to entrepreneurship, the inclusion of entrepreneurship subjects in the curriculum as a teaching methodology, as well as models, processes and reward systems. Furthermore, the model proposed by Guerrero et al. (2006) considers the university's relationship with environmental conditions for the development of entrepreneurship, which, in this context, can be positively or negatively affected, according to microeconomic conditions.

Figure 4 presents the conceptual framework proposed by the authors for the development of the entrepreneurial university.

Through the proposed *framework*, which identifies factors that affect the creation and development of entrepreneurial universities, Guerrero et al. (2006) Universities have been affected by new responsibilities such as regional economic and social development, the reduction of public funds, and the educational market competence. On this, universities are being required to operate more entrepreneurially, commercializing the outcomes of their research and spinning out new, knowledge-based enterprises. In this context, the main purpose of this paper is to revise the literature about the environmental factors that affect the creation and development of the Entrepreneurial Universities. With this aim the study adopts institutional eco-

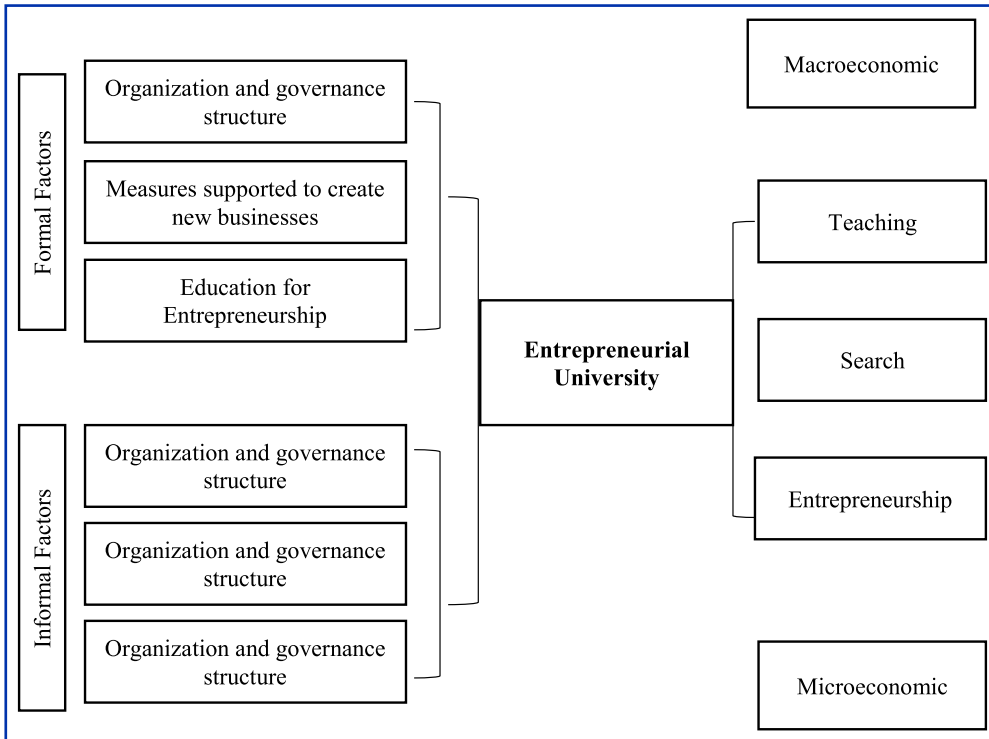
conomic theory, and more specifically the works realized by North (1990, 2005) arrived at the following results related to formal factors :

- a. the clearer the mission transmitted to all university members, the greater the positive impact on an entrepreneurial university;
- b. the larger the organizational structure with fewer hierarchical levels, the greater the positive impact on an entrepreneurial university ;
- c. the more professional managers that enter the university, the greater the positive aspects for an entrepreneurial university;
- d. the greater the autonomy and cooperation with the state, the greater the positive impact on an entrepreneurial university;
- e. the greater the support for development measures at the university, the greater the positive impact on an entrepreneurial university;
- f. the greater the internal diffusion of the development of support measures for the university, the greater the positive impact on an entrepreneurial university;
- g. the more comprehensive the graduate business education programs at the university, the greater the positive impact on an entrepreneurial university;
- h. the more extensive the entrepreneurship course in academic degree programs at the university, the greater the positive impact on an entrepreneurial university.

With regard to informal aspects, the conclusions were:

- a. the more there are entrepreneurial attitudes on the part of students towards entrepreneurship, the greater the positive impact on an entrepreneurial university;
- b. the more research there is in relation to entrepreneurship, the greater the positive impacts on an entrepreneurial university;
- c. the more there are entrepreneurial attitudes of faculty members towards entrepreneurship, the greater the positive impact on an entrepreneurial university;
- d. the greater the presence of theoretical teaching methodologies, the greater the positive impact on an entrepreneurial university;
- e. the greater the presence of methodological teaching practices, the greater the positive impacts on an entrepreneurial university;

Figure 4 Conceptual Framework Proposed for the Development of the Entrepreneurial University.



Source: Adapted from Guerrero et al. (2006, p. 10).

- f. the greater the presence of entrepreneurs in the university, the greater the positive impact on an entrepreneurial university;
- g. the greater the existence of outstanding research at the university, the greater the positive impact on an entrepreneurial university;
- h. the greater the development of reward systems by the university, the greater the positive impact on an entrepreneurial university.

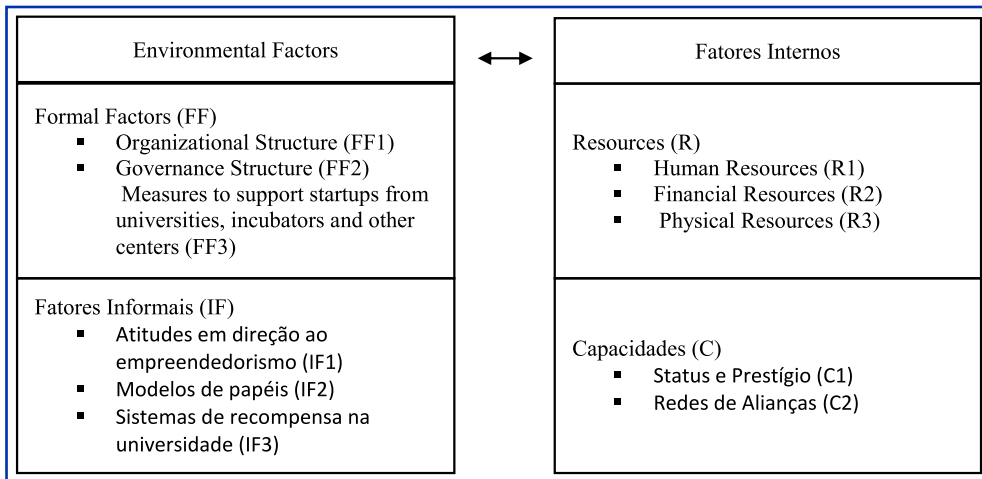
This model does not detail environmental factors, but considers their existence for the development of entrepreneurship. In this context, entrepreneurial universities can be positively or negatively affected by micro and macroeconomic factors.

Framework by Urbano and Guerrero (2013)

Based on the framework presented in Figure 2, the authors made some adjustments to the model and included adaptations from another research carried out by Guerrero and Urbano (2012), in order to identify the similarities and differences between the prevailing factors in institutions located in different environments. In this way, the authors expanded the elements linked to environmental factors, proposing that institutions should formulate integrated policies in order to encourage the creation of companies from their facilities, in addition to promoting research groups, incubators and technology transfer offices. Furthermore, these activities must be developed through flexible governance, reducing bureaucracy in search of results that reflect their missions. The suggested framework can be seen in Figure 6.

The model adopts institutional theory and resource-based approaches, in addition to the endogenous growth approach, to provide a better understanding of the socio-economic impacts of entrepreneurial universities.

Figure 5 Framework for Entrepreneurial University



Source: Adapted from Guerrero et al. (2013).

Framework by Salamzadeh et al. (2011)

As a result, entrepreneurship was identified as a phenomenon observed at all university levels: in management, academics and researchers, as well as potential

entrepreneurs among undergraduate and graduate students. In this context, university authorities need to recognize their role, not only building, but also enforcing, at the university itself, an entrepreneurship ecosystem that nurtures an entrepreneurial potential with incentives for new learning tools and behavioral models.

The framework developed by Salamzadeh et al. (2011), in the light of systems theory, has a systematic approach to categorizing the IPOO model (inputs – processes – outputs – results). The study was carried out through 25 semi-structured interviews. The proposed framework is shown in Figure 6. The model is based on a dynamic system, with special inputs, processes, outputs and results, and aims to move resources, skills and capabilities to achieve the third mission, that is, the transformation of a traditional university at an entrepreneurial university.

Figure 6 Systemic Framework for Entrepreneurial Universities

Context			
Environmental Factors	Law Suit	Outputs	Results
Context Resources (human, financial, physical information) Rules and regulations Structure Mission Entrepreneurial capabilities Expectations from society, industry, government and market	Teaching	Entrepreneurial human resources (including teachers, students and technicians)	Context Third Mission
	Research		
	Management	Effective research according to market needs	
	Logistics Marketing		
	Selection(Student s, teachers and staff)	Innovations and Inventions	
	Financing and finance		
	Relationship networks	Entrepreneurial networks entrepreneurship centers (incubators, science parks, etc.)	
Multilateral interaction of processes			
Innovation in research and activities developed			
Context			

Source: Adapted from Salamzadeh et al. (2011).

Framework by Sooreh, Salamzadeh & Safarzadeh (2011)

This model starts from the one presented in Figure 6 and is expanded, involving the use of nine blocks: formal, informal and internal entries; formal, informal and internal processes; formal, informal and internal outcomes. In the block of inputs, the environmental factors identified by Guerrero et al. (2006) are categorized; while, in the outputs block, the elements were defined through the authors' research results. This framework (Figure 7) was defined from an Iranian study in which the authors highlight that it is suitable for the context in which the research was carried out, that is, in Iran.

For formal entries, the following variables are considered: available communication channels ; corporate policies and missions of the higher education system; entrepreneurship courses available; business programs available; types of support measures; and characteristics of the university manager. For informal entries, aspects related to academics recruited by entrepreneurial universities are considered, whose intentions, feasibility and desire are of great importance. With regard to internal inputs, inputs are those that reveal what the university has, such as its business capabilities, informational and financial resources, which are considered the most important variables (SOOREH, SALAMZADEH; SAFARZADEH (2011)).

Regarding the analysis of formal processes of the entrepreneurial university, the model fits three categories: formal, informal and internal. The first two are related to the environmental factors that affect the institution, and the last one deals with its internal variables. These variables include: systems and procedures, expenses invested in communication, channels, organizational structuring, autonomy, determination of hierarchical levels and expenses invested in support measures. Among the informal ones are: teacher training, didactic resources and awards for environmental processes. Internal processes include: processes of multilateral interaction between students, professors, employees, industrial researchers, business centers, policymakers, society, networks, management and innovation methods, R&D activities, teaching methods, student selection, logistics , in addition to commercialization processes (SOOREH, SALAMZADEH; SAFARZADEH, 2011) .

Regarding the output analysis, the results of an entrepreneurial university are also categorized, according to Sooreh, Salamzadeh & Safarzadeh (2011) into

Figure 7 Framework by Sooreh, Salamzadeh & Safarzadeh (2011)

		Environmental Factors		Internal Factors
		Formal	Informal	
Formal Factors		<ul style="list-style-type: none"> ▪ Entrepreneurial policies in the mission of the higher education system ▪ Entrepreneurial characteristics in managers ▪ Available communication channels ▪ Available business courses and programs 	<ul style="list-style-type: none"> ▪ Students with potential intentions, desires and viability ▪ Academic intentions ▪ Academic Feasibility 	<ul style="list-style-type: none"> ▪ Existing students, academics and staff ▪ Funding resources ▪ Informational resources ▪ Entrepreneurial skills ▪ Expectations from society, industry, government and market
	Law Suit	<ul style="list-style-type: none"> ▪ Organizational structure ▪ Systems and procedures ▪ State Autonomy ▪ Determined hierarchy levels ▪ Expenditure invested in support measures ▪ Expenses invested in communication channels 	<ul style="list-style-type: none"> ▪ Teaching resources ▪ Teacher training ▪ Rewards and Processes ▪ Treinamento dos professores 	<ul style="list-style-type: none"> ▪ Rules and regulations ▪ Teaching methods ▪ Management methodologies ▪ Logistics methods ▪ Marketing processes ▪ Student selection methods ▪ Financing methods ▪ Relationship networks ▪ Interaction of multilateral processes
	Saídas	<ul style="list-style-type: none"> ▪ Entrepreneurial network system ▪ strategic alliances ▪ Marketing Systems ▪ Submit 	<ul style="list-style-type: none"> ▪ Custom models ▪ Corporative culture 	<ul style="list-style-type: none"> • Entrepreneurial human resources (students, teachers and technicians) • Effective research according to market needs • Innovation and invention • Entrepreneurship centers

Source: Adapted from Sooreh, Salamzadeh & Safarzadeh (2011)

three groups: formal, informal and internal. The formal products of an entrepreneurial university include: entrepreneurial network systems; marketing systems; and strategic conventions and alliances. Informal products include entrepreneurial culture and custom templates. The main internal results are as follows: entrepreneurship centers such as incubators, science and technology parks and *spin-offs*, as well as business networks including university professors, graduates, researchers and employees, effective research in line with market needs and innovations and inventions.

In this model, performance analysis was used to classify, determine and measure entrepreneurial universities. In conclusion, Sooreh, Salamzadeh & Safarzadeh (2011) point out that entrepreneurial activities are becoming an integral part of the third generation of universities, for which interaction with the environment is a fundamental point.

Framework by Ruiz, Martens & da Costa (2020)

The following model is proposed from the Brazilian context and aggregates elements grouped in dimensions that characterize the profile of the entrepreneurial university. The case studied was a public higher education institution, the State University of Campinas (Unicamp). The research results found that the university has strong evidence of an entrepreneurial university, considering that several elements highlighted in the proposed model were identified (RUIZ, MARTENS; COSTA, 2020). Table 3 presents the proposition constructed by the author. The model built is based on the Triple Helix guidelines by (ETZKOWITZ and LEYDESDORFF, 2000). This finding is possible since the studied university directs efforts to obtain intellectual property and licensing and develops research subsidized by government funds.

It was identified, in the institution, organizational restructuring, governance and infrastructure, which were promoted by the university in order to seek the necessary transformation towards becoming an entrepreneurial university.

In addition to the elements identified as necessary, the research also listed guidelines that institutions can follow to *start* their transformation journey, indicating possibilities related to the execution of entrepreneurial actions (RUIZ, MARTENS; COSTA, 2020) .

Table 3 Proposition of a Model Aimed at Transforming Traditional Universities into Entrepreneurs

Dimension	Elements
Management	<ul style="list-style-type: none"> • Transition to strategic management and entrepreneurial culture, in which opportunities are geared towards the economic and social function, oriented towards the creation of public values. • Renewal of curricula and programs. • Entrepreneurial, participatory, professionalized, committed, dynamic and reinforced leadership. • Entrepreneurial and shared governance.
Infrastructure	<ul style="list-style-type: none"> • Entrepreneurship and innovation center, not just technology transfer and intellectual property. • Centers to meet the demands of society, including industries. • Social technology incubators/accelerators. • Technology-based incubators/accelerators. • Technology parks. • Modern and interdisciplinary research centers.
Internationalization	<ul style="list-style-type: none"> • International cooperation agreements and agreements. • Budget (financial autonomy). • Raising external resources.
Capital Financial	<ul style="list-style-type: none"> • Orçamento (autonomia financeira). • Captação de recursos externos.
Community academic	<ul style="list-style-type: none"> • Implementation of collective and collaborative work between courses and other educational institutions (sharing of practices and research). • Programs for entrepreneurial education. • Training of its professionals for an entrepreneurial culture. • Consulting for the academic community, from the ideation to the creation of the enterprise. • Recognition/award to faculty and students.
Ecosystem entrepreneur and at partnerships	<ul style="list-style-type: none"> • Internal partnerships. • External partnerships (university x government). • External partnerships (university x companies). • External partnerships (university x other HEIs).

Source: Adapted from Ruiz, Martens & da Costa (2020).

In the field of management, the author of the conceptual model suggests: implementing strategic management aimed at satisfying society's demands; to develop leadership skills aimed at entrepreneurship in a participatory and professionalized way; collectively enter decision-making; restructure academic curricula in teaching, research and extension, in addition to inserting innovation in an integrated manner.

For infrastructure, (RUIZ, MARTENS; COSTA, 2020). They emphasize that the entrepreneurial university needs to maintain in its structure values developed by the different areas, and not just be concerned with the commercialization of knowledge. It is necessary to expand the activities of technology transfer offices in order to insert the development of entrepreneurship on different fronts: commercial, social and cultural; identify the university's intangible heritage through the identification of all its research groups, promoting interaction between them to provide more optimization of laboratories, in addition to enhancing research ; provide autonomy to technology parks, in addition to reducing bureaucracy; investing in the creation of incubators, to accelerate new businesses and keep them inserted in the ecosystem; and, finally, to make room for society to direct its requests to the university.

In terms of financial capital, the proposal points out that the university needs to seek diversified sources of resources; seek the integration of projects and research groups with the objective of raising greater financial sum; create an endowment fund; and outline strategies to promote the transfer of intellectual property.

With regard to the dimension of the academic community, the proposed model points to the implementation of collective work through the interaction of different universities; the development of an entrepreneurial education that crosses the borders of traditional teaching; promote teacher training in order to develop, among teachers, an entrepreneurial profile; support academics in entrepreneurial activities, encouraging student movements that have this characteristic; and, finally, to value, throughout the institution, actions aimed at entrepreneurship.

In terms of internationalization, the model in question emphasizes that the institution must create teams with skills capable of promoting international partnerships; provide the exchange of students and teachers; support and encourage international publications; and enter into agreements that add value and mutual return.

Finally, in the dimension of the entrepreneurial ecosystem and partnerships, the model identifies actions to promote external partnerships both with other uni-

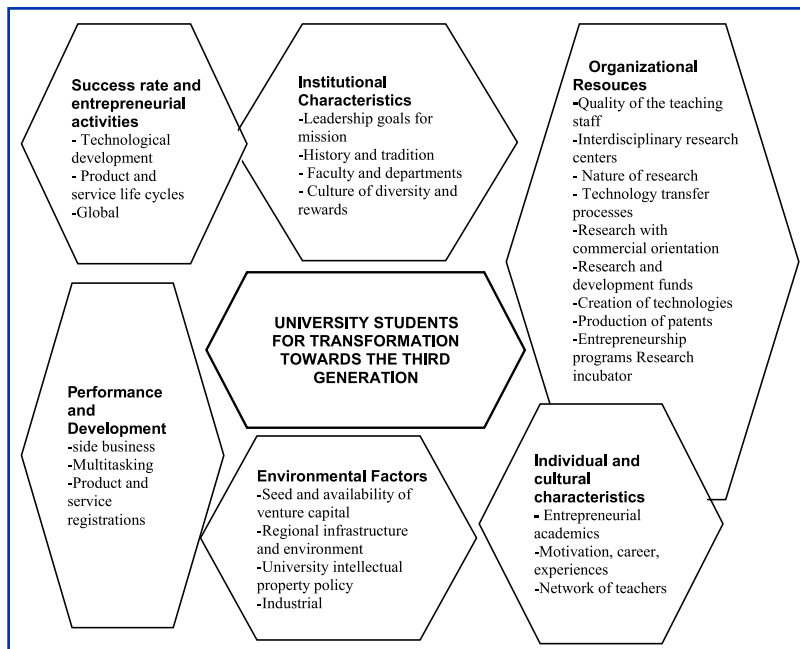
versities and with different organizations, in addition to the institution's own internal partnerships.

Ruiz, Martens and da Costa (2020) complement stating that, in this type of university, the academic community becomes proactive, responds to challenges and is in constant internal and external development, and the institution creates economic, social, cultural and environmental values, through knowledge generation.

Borhani et al. (2020)

Based on a literature review, Borhani et al. (2020) proposed a model that contemplates factors for the creation of development of entrepreneurial universities adopting institutional and economic theory and, specifically, focusing on formal and informal institutional factors (Figure 9). The model is based on a set of factors that influence in an integrated way the transformation of a second-generation university into a third-generation university that proactively acts on local economic development.

Figure 9 Factors for the Transformation of a Traditional University into a Third Generation University



Source: Adapted from Borhani et al. (2020).

According to the model, the interference of these universities in the local economy does not depend only on the activities and characteristics of the student body, but also on variations in the environment where the university is located (BORHANI et al., 2020). Four main factors were identified as necessary for the transformation to take place, namely:

- a. individual characteristics, including entrepreneurial academics and their motivations (such as career experiences and faculty *networking*), are some of the reasons that influence academics to engage in entrepreneurial activities and, in this way, drive the university towards being an entrepreneurial university;
- b. organizational resources, qualified faculty, research centers, technology transfer with commercialization-oriented processes, resources and experience, R&D funding, patents, development of entrepreneurship programs and incubators are some of the attributes necessary for universities to be able to start their own transformation to third-generation universities;
- c. cultural and institutional characteristics, such as leadership, history, tradition, faculty culture, and proposed rewards for entrepreneurial activities, are some of the broader social contexts of the university that influence the success of the transformation;
- d. environmental factors, including the availability of venture capital, regional infrastructure and the environment, the university's intellectual property policy, and local industry characteristics are external characteristics that affect the readiness to create a third-generation university.

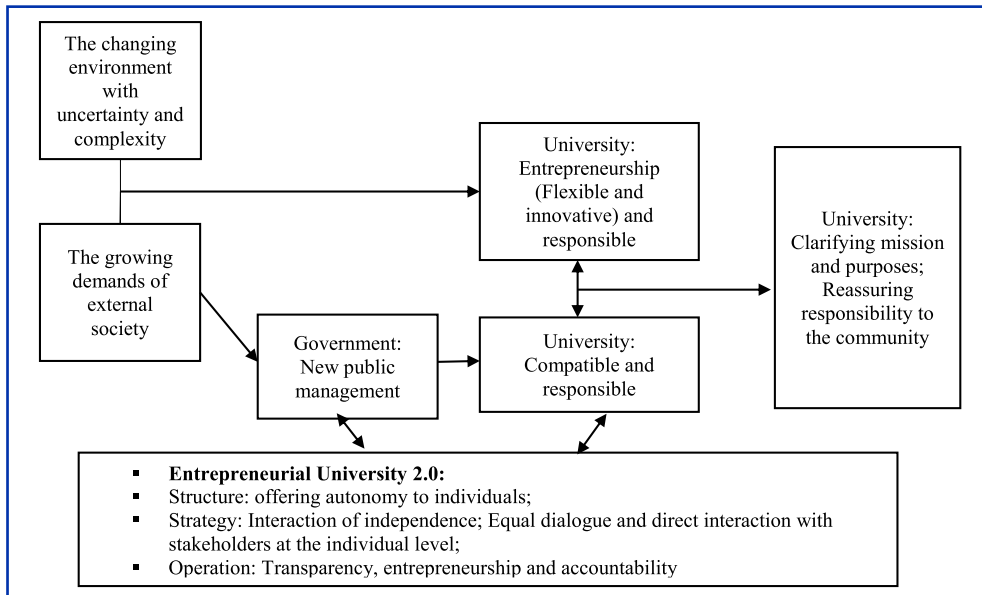
Liu and Van Der Sijde Framework (2021)

Liu and Van Der Sijde (2021) proposed a model for the creation of the entrepreneurial university 2.0, in which, in addition to the already consolidated characteristics of the entrepreneurial university, the need to face the challenges of the new public management, which are imposed by governments in the era of efficient accountability, and promoting innovation for accountability itself.

The university's responsibility to its *stakeholders* encourages mutual dialogue and direct interaction, both individually and collectively. In addition to meeting the criteria of excellence that are predefined externally, special attention is paid to

meeting the needs of stakeholders, as well as society as a whole. Thus, the entrepreneurial university 2.0 is able to meet the more complex demands of the external environment. Figure 10 represents the model.

Figure 10 Entrepreneurial University Framework 2.0



Source: Adapted from Liu and Van Deijde (2021)

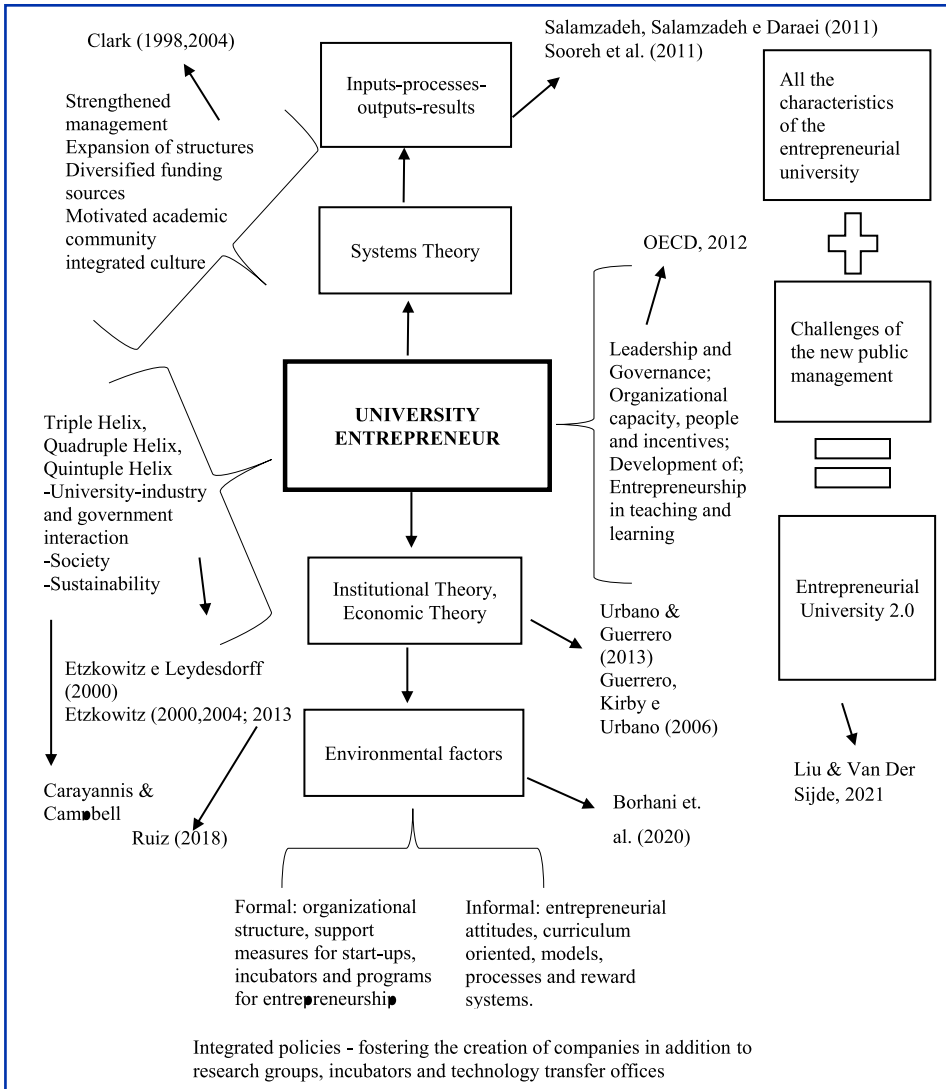
In this context, it is believed that the entrepreneurial university 2.0 offers autonomy to individual collaborators, establishes equal dialogue and direct interaction between the internal members of the universities and their *stakeholders*, and embeds operational actions with entrepreneurship, transparency and responsibility (LIU and VAN DER SIJDE, 2021).

Summary of Entrepreneurial University Frameworks

Most of the proposed models considered the development of entrepreneurial activities by the institution and its academic community (teachers, students and technicians) as fundamental for the creation of entrepreneurial universities. The expectation and growing demands of the external environment have also made the transfer and application of knowledge predominant in all *frameworks*.

The decline in public financial support led institutions to seek new sources of funds so that, in their own way, they could maintain their sustainability. This aspect has driven universities to become entrepreneurial. Figure 11 demonstrates a synthesis of the frameworks presented above.

Figure 11 Summary of Entrepreneurial University Frameworks



Source: Prepared by the author (2021).

The theoretical approaches, that is, the development models of entrepreneurial universities, in short, follow institutional theory and economic theory and, implicitly, are integrated by formal and informal environmental factors that positively or negatively influence the university development process in different degrees. In addition, such models are considered by the academy as results of an entrepreneurial university.

Final Considerations

The objective of this RSL is to offer a comprehensive review to identify the theoretical frameworks about entrepreneurial universities, exhaustive searches were carried out in the Scopus and Web of Science databases, after applying inclusion and exclusion criteria, we obtained a sample of 181 articles, which from refined form led to the reading of 60 studies in full.

It was possible to conceptualize, characterize and present the main frameworks developed with the objective of taking higher education institutions to a level of entrepreneurship. Thus, the research question: What are the main models “frameworks” that the scientific literature proposes for the construction of an entrepreneurial university? was answered based on the results presented.

Through content analysis, it was possible to identify the main concepts and elements regarding the entrepreneurial university, which in turn revealed the existence of several strands among researchers on the subject.

Among them, the following stand out: Internal restructuring, innovation, internationalization, hybridization, R&D, sustainability, global interaction with companies, associations and institutions, active methodologies, high-intensity research, among other aspects. These elements together raise the level of institutions.

Regarding the frameworks, it is inferred that scholars focus on empirical research to explain the phenomenon and design conceptual propositions that can safely guide institutions and indicate which paths they should take to become entrepreneurial and consequently sustainable. In this sense, this study contributes to the advance in the literature, as it presents the elaboration of an unprecedented framework that groups the synthesis of all frameworks extracted from the studies evaluated in this research.

For future studies, it is suggested to expand the searches in other databases, including theses and dissertations, in addition to inserting additional search terms in order to identify models that this RSL did not present and additionally analyze the different frameworks based on university models. studied, fragmenting by country of operation.

This RSL has some limitations such as: level of precision, to resolve this issue the analysis started broadly and then focused on research that presented a model/framework, which is still an evolving phenomenon, and thus cannot generalize, since empirical studies were carried out in different contexts, and each institution has its particularities, both geographical and structural.

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