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Does triple helix collaboration matter for the early internationalisation of technology-based firms in emerging Economies?

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ABSTRACT

Firms' early internationalisation (EI) is a complex process derived from uncertain market conditions, entrepreneurial vision, and strategic entry decisions. Academic debates still require deepening and broadening the discussion on early internationalisation of new technology-based firms (NTBFs). This study proposes a framework to analyse how NTBFs are adopting collaborative networks with the triple helix actors (government, university, and industry) to implement an EI strategy in emerging economies. Our findings show that the lack of specialised knowledge and resources stimulates collaboration with multiple triple helix agents to ensure the early entry strategy into international markets. We state the relevant implications and propositions concerning the internationalisation of NTBFs and the relationship with triple helix stakeholders.

SPECIAL DEDICATION

In memory of Juan Arriaga, Department of Innovation and Entrepreneurship, EGADE Business School

1. Introduction

Internationalisation is a strategic orientation implemented by a firm to acquire commitment and participation in international markets (Tuppura et al., 2008). Internationalisation modes have been studied across the mature stages of firms using diverse theoretical perspectives (i.e., organisational learning, the resource and capabilities based-view, evolutionary economics, and institutional theory, amongst others) and methodological approaches (i.e., case studies, quantitative studies, and mixed-method studies) (Schellenberg et al., 2018). Over the last decades, the rise of new firms that internationalise soon after their formation has increased the interest of many scholars who have highlighted the need to understand better how these firms conduct international

business during their early stages of life across countries (Baier-Fuentes et al., 2019). The early internationalisation (EI) is the result of a combination of uncertain market conditions that generate reactive/proactive managerial/entrepreneurial visions/actions that are implemented by strategic entry-mode decisions in abroad markets (Zucchella et al., 2007; Martin et al., 2020).

Although EI has emerged in different industrial sectors (Cavusgil and Knight, 2015), the commercialisation of specialised knowledge and technologies created by new technology-based firms (NTBFs) has captured the attention of the International Entrepreneurship field⁴ almost from its inception (Keupp and Gassmann, 2009; Taylor and Jack, 2013; Hilmersson and Johanson, 2020). Precisely, the International Entrepreneurship literature has converged on the idea that successful technological entrepreneurship and internationalisation processes in uncertain environments demand multiple relationships with different agents (i.e., clients, supply chains, governments, and investors) (Fontes and Coombs, 1996; Kim et al., 2012; Galdino et al., 2019). According to

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E-mail addresses: hbaier@ucsc.cl (H. Baier-Fuentes), maribel.guerrero@northumbria.ac.uk (M. Guerrero), amoros@tec.mx (J.E. Amorós).¹ <https://orcid.org/0000-0002-6436-1222>² <https://orcid.org/0000-0001-7387-1999>³ <https://orcid.org/0000-0001-9601-0892>⁴ The field of international entrepreneurship has emerged from two knowledge fields: International Business (IB) and Entrepreneurship (Oviatt and McDougall, 2000). The early internationalisation is focused on its inception (Baier-Fuentes et al., 2019)<https://doi.org/10.1016/j.techfore.2020.120439>

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Russell and Smorodinskaya (2018), collaborative networks usually respond to the technological and industrial dynamism of economies. As a result, in collaborative environments, NTBFs receive multiple advantages from their collaborative networks by sharing information, duties, resources, and risks (Romero and Molina, 2011). Motivated by the significant societal and economic impacts of NTBFs (Hilmersson, 2014; Hilmersson and Johanson, 2020), governments in emerging economies have implemented specific policies/programmes to enhance entrepreneurial innovations and early internationalisation processes (Douglas Cumming et al., 2015; Finchelstein, 2017). Usually, this government intervention promotes the creation of NTBFs via the collaboration of multiple actors (universities, research centres, and industries) that provide knowledge, resources, and networks for exploiting opportunities in domestic and international markets (Ahuja, 2000; Romero and Molina, 2011; Tomás-Miquel et al., 2018; Guerrero and Urbano, 2019). However, there is little clarity about the different strategies implemented by NTBFs from emerging economies and how they participate in networks that involve triple helix agents as an alternative to acquiring knowledge, resources, and capabilities to carry out EI (Kiss et al., 2012; Guerrero and Urbano, 2020a,b).

Based on previous discussions, this research analyses how NTBFs from emerging economies are adopting/using collaborative networks with triple helix agents (governments, universities, and industries) to implement an EI strategy. Our conceptual framework focused on the collaborative networks between the different actors of a specific ecosystem. The Triple Helix approach has adopted given its capacity to explain the generation of competitive advantages through dynamic relations based on collaboration and cooperation amongst innovation ecosystems' actors (Etzkowitz et al. 2007; Mascarenhas et al., 2019; Vlasisavljevic et al., 2020). Therefore, this approach helps to understand how NTBFs use these networks by facilitating the flows/acquisition of the knowledge/skills needed in their subsequent EI strategy (Sullivan and Marvel, 2011; Kim et al., 2012; Taylor and Jack, 2013; Cahen et al., 2016; Thrassou et al., 2020).

Based on the analysis of multiple dimensions of the EI process (Birkinshaw et al., 2011; Keupp and Gassmann, 2009; Kuivalainen et al., 2012; Welch et al., 2011; McCormick and Somaya, 2020), we conducted a retrospective study of multiple cases of NTBFs located in an emerging economy (Mexico). Retrospective case studies represent longitudinal studies that provide evidence about a phenomenon that happened before the data collection process. This methodological approach has been largely applicable in multiple internationalisation quantitative studies (Baier-Fuentes et al., 2019), which generally underestimate the complexity and context conditions by treating firms as "black boxes" (Fletcher et al., 2018; Tsang, 2013).

Our findings highlight the significant role of the collaborative networks between Triple Helix agents and NTBFs for accessing the required knowledge/capabilities during EI processes. In particular, the fundamental roles of university infrastructures are the acquisition of specialised industrial/technological knowledge and accessing strategic networks to reduce the barriers to entry for domestic/international markets. Our study contributes to the EI literature by providing evidence that in an emerging economy, the EI of NTBFs may be the consequence of complex interactions amongst triple helix actors involved the transfer/acquisition of essential resources. In other words, the participation of NTBFs within an innovation ecosystem is an important mode of entry into international markets (Audretsch et al., 2019; Guerrero and Urbano, 2017, 2020b; Guerrero et al., 2020).

The rest of this paper is structured as follow. The theoretical framework, presented in Section 2, describes how NTBFs are building collaboration networks with the triple helix agents involved in the entrepreneurship and innovation ecosystems to capture knowledge and resources. Section 3 describes the qualitative methodology used in this research. Section 4 analyses and discusses the findings from previous studies. Finally, Section 5 provides the general conclusions, limitations, and implications of this study.

2. Theoretical framework

Macro-economic conditions in recent decades (i.e., technological development and accelerated globalisation) have encouraged the creation and internationalisation of NTBFs (Oviatt and McDougall, 1994). NTBFs are known in the literature as "International New Ventures," "Born Globals" or "Early Internationalising Firms" (Baier-Fuentes et al., 2019) since they are looking to expand their products into international markets from an early stage of growth (Martin et al., 2020). NTBFs take generally take advantage of technological gaps between the country of origin and the host country (Cavusgil and Knight, 2009). Despite the significant advance in the study of these firms (McDougall et al. 2014), the literature continues to contain important gaps that should be analysed.

First, the economic context in which IE research is conducted seems to be the subject of several academic discussions. To date, a large majority of the studies, models and theories in international business (including EI) have been developed using traditional or developed economies, and there are significant research gaps regarding the EI of new firms from emerging economies (Teagarden et al., 2018). These economies are increasingly playing key roles in the global economy (Tan and Sousa, 2018). Concretely, in emerging economies, NTBFs face particular limitations (i.e., unfavourable macro-economic conditions, difficulties acquiring resources, a lack of internal capabilities, and limited networking) when they try to enter competitive and international markets (Lau and Bruton, 2011; Uner et al., 2013; Cahen et al., 2016). However, since these several institutional weaknesses and infrastructure limitations could hinder the operations of new firms, including international ones (McCormick and Somaya, 2020), the context of emerging economies offers an interesting opportunity to study how these entrepreneurs can enter more demanding international markets.

Second, some academic debates have focused on how firms take advantage of technology gaps between countries, particularly between the home and host countries (Cavusgil and Knight, 2009). Studies have shown that firms exploit the technological distance as an opportunity for introducing innovative products (Filatotchev et al., 2009), extending their learning capacity about the host market (Voudouris et al., 2011), and developing networks/alliances (Al-Laham and Souitaris, 2008) for positioning the firm in diverse locations (Libaers and Meyer, 2011) or for avoiding institutional voids that affect their entry modes (Coeurde-roy and Murray, 2008). Although EI has been analysed across industries, there are still unanswered questions regarding the international commercialisation of knowledge/technologies by new technology-based firms (NTBFs) (Taylor and Jack, 2013).

Third, previous EI studies have explored entry modes by adopting organisational learning, resource based-view, institutional theory, and strategic orientation, amongst others (Baier-Fuentes et al., 2019). These studies, however, still do not explore the adoption of complex and systemic approaches such as the Triple Helix Model (Kwon et al., 2012; Ponds, 2009; Sørensen and Hu, 2014). The EI literature has recognised that successful technological entrepreneurship and internationalisation processes require multiple relationships (i.e., clients, supply chains, governments, and investors) (Fontes and Coombs, 1996; Cooper and Park, 2008; Kim et al., 2012). Motivated by the significant impacts of NTBFs (Hilmersson, 2014), governments have implemented policies/programmes to enhance the entrepreneurial innovations and early internationalisation processes of technological firms (Douglas Cumming et al., 2015; Finchelstein, 2017; Guerrero and Urbano, 2019b). As a result of government intervention, several NTBFs have been created in collaboration with triple helix actors (universities, research centres, and industries) in domestic and international markets (Ahuja, 2000; Etzkowitz et al., 2007; Guerrero and Urbano, 2017, 2019, 2020b; Tomás-Miquel et al., 2018).

Finally, other academic discussions focused on how firms have created/captured the value of the technological collaborations and

networks with the agents involved in ecosystems in their home-country and host-country (Cavusgil and Knight, 2015; Ramírez-Alesón and Fernández-Olmos, 2018). According to Romero and Molina (2011), NTBFs capture multiple advantages from their collaborative networks by sharing information, duties, resources, and risks. However, collaborative networks respond to technological and industrial dynamism, which logically differ between types of economies (Russell and Smorodinskaya, 2018). Therefore, in an emerging economy context, participating in these networks could be a useful strategy to mitigate their resource limitations, identify international market opportunities, and improve their performance strategies (Rugman et al., 2012; Möller and Halinen, 2017; Bembom and Schwens, 2018). More concretely, collaborative networks between NTBFs and triple helix agents facilitate the access to subsidies for innovation/internationalisation offered by local governments, the exchange of scarce information amongst international market opportunities across sectors, and the incorporation of new advances in technologies/innovations generated in collaboration with research centres or universities (Etzkowitz and Leydesdorff, 2000; Champenois and Etzkowitz, 2018; Russell and Smorodinskaya, 2018).

Based on previous arguments, this study combines the literature on entrepreneurship, internationalisation, and triple helix collaborative ecosystems to understand the early internationalisation process of the NTBFs based in emerging economies.

2.1. NTBFs and collaborative networks with triple helix agents in emerging economies

The triple helix approach explains the development of knowledge-based economies based on the fundamental collaboration amongst universities, industries, and governments (Etzkowitz, 2008; Champenois and Etzkowitz, 2018; Li et al., 2018). The triple helix approach has played a relevant role in the design of policies and the implementation of programmes that foster entrepreneurship and innovation initiatives (Guerrero and Urbano, 2017), especially in the context of emerging economies. However, there is no definition of the boundary between the producers and users of knowledge, but rather, there is an exchange of knowledge, information, new ideas, talented human resources, and other resources between the actors (Choi et al., 2015). As a result, the collaborative agents are involved in the design/development of entrepreneurial innovation projects to share intellectual capabilities, resources, and risks amongst the participants (Chen et al., 2020; Martínez Ardila et al., 2020; Van Horne and Dutot, 2016). Now, we explain the role of each agent in the configuration of collaborative networks.

Building collaborative networks with university agents: Audretsch (2014) points out that the role of the universities has changed until to be considered a key factor in regional development. Universities are relevant contributors within entrepreneurship and innovation ecosystems through the transference, dissemination and generation of knowledge (Audretsch, 2014; Guerrero et al., 2015). A university collaborative network refers to the interaction amongst any organisational structure of universities (i.e., researchers, research groups, faculties, and incubators) with any organisational structure of firms (i.e., teams, departments, subsidiaries, and entire organisations) with specific collaborative purposes (i.e., developing new product/processes/technologies, training human resources, and sharing knowledge). This type of collaboration network is motivated by the exchange of specific knowledge and the transference of new technology (Vlaisavljevic et al., 2020). In the context of NTBFs, this relationship is favourable for the generation of diverse channels and pathways that facilitate knowledge generation/transfer (Gulbrandsen et al., 2011), as well as new technologies (Bruneel et al., 2010). For NTBFs with an internationalisation orientation, university-industry collaboration facilitates the acceleration of entrepreneurial innovations by providing access to financial support, attracting/training talented employees (Fraser et al., 2015; Pauwels et al., 2016; York and Danes, 2014). Indeed, university-industry collaboration provides contacts that can be key to explore and exploit

entrepreneurial innovation opportunities in local and international markets (Bruneel et al., 2012; Malek et al., 2014; Miller and Bound, 2011). In this view, in the context of emerging economies, the university-NTBF collaboration could facilitate the identification of new business opportunities during the early internationalisation process.

Building collaborative networks with government agents: According to Minniti (2008) and Galindo and Méndez (2014), government intervention has promoted the creation of NTBFs as a strategy to enhance economic growth. In emerging economies, the implementation of governmental policies provides favourable conditions for NTBFs interested in the early internationalisation of entrepreneurial innovations (Audretsch and Link, 2012; Autio et al., 2014). By building collaborative networks with governments, NTBFs can be benefited from government programmes that facilitate the intensive exportation of technological products/services (Douglas Cumming et al., 2015). In Latin-American countries, governments have designed/implemented internationalisation programmes to offer training supports for managers/employees, to upgrade technological and intellectual capabilities, to control/improve quality and productivity, to identify new market opportunities, and to promote exports (Cardoza et al., 2016). In this type of collaboration, the NTBFs receive technical support/assistance, sponsorship, and policy tools for the provision of resources and capabilities during the first years of the EI process (Brown and De Clercq, 2008; Douglas Cumming et al., 2015). Based on these arguments, we assume that government-NTBF collaboration could facilitate the identification of new business opportunities during the early internationalisation process.

Building simultaneous collaborative networks with government and university agents: Prior studies have recognised the crucial role of universities as generators of the factors of production (knowledge capital, human capital, and entrepreneurship capital) that are associated with the economic and technological development of regions/countries (Benneworth et al., 2010; Huggins and Thompson, 2015; Urbano and Guerrero, 2013). Given the universities activities (teaching, research and knowledge transference), universities have actively participated with multiple agents in the design/implementation of innovation and entrepreneurial agendas (Abbas et al., 2019; Miller et al., 2014). In emerging economies, we have identified several university-government practices to facilitate the development of entrepreneurial innovation initiatives (Guerrero et al., 2016). For example, the provision of subsidies for promoting university-industry technological partnerships (Guerrero and Urbano, 2017), incubation and acceleration programmes (Wann et al., 2017), and supporting the configuration of entrepreneurship and innovation ecosystems (Autio et al., 2014). Based on these insights, we assume that simultaneous university-government-NTBF collaboration could facilitate the identification of new business opportunities during the early internationalisation process.

2.2. Collaborative networks with triple helix agents as a platform for knowledge acquisition/transfer

The knowledge-based view suggests that knowledge is the most important element to achieve a competitive advantage (Grant, 2013). Regarding NTBFs, recent studies have found that knowledge-based resources and collaborative networks are the most relevant determinants of performance in early internationalisation activities (Martin and Javalgi, 2019; Suseno et al., 2018). Indeed, extant studies have explained the knowledge that has been needed within any early internationalisation process (Burgers et al., 2008; Stoian et al., 2018). Therefore, NTBFs and triple helix collaborations facilitate the acquisition of knowledge to take advantage of the technological distances between home and host countries along the early internationalisation process (Soetanto and van Geenhuizen, 2019; van Weele et al., 2017). In this view, NTBFs can adopt triple helix collaborative networks to complement their initial knowledge base, and to improve strategic processes such as performance, internationalisation, and diversification (Costa et al., 2016).

A successful early internationalisation strategy demands

sophisticated knowledge and familiarisation of international markets (Hilmersson and Johanson, 2020; Sullivan and Marvel, 2011). The internationalisation literature recognises three types of knowledge required along the NTBFs' early internationalisation process. First, technological knowledge involves technologies or innovations that allow the NTBFs' commercialisation of entrepreneurial initiatives (Burgers et al., 2008; Clarysse et al., 2011). The accumulation of technological knowledge represents a competitive advantage during the creation of new products/services. Second, market knowledge represents a good understanding of potential clients in terms of needs, cultures, and technological distances from the host market (Burgers et al., 2008; Johanson and Vahlne, 1990, 1977; Dhanaraj and Beamish, 2003; Fletcher and Harris, 2012). The accumulation of market knowledge reduces NTBFs' uncertainty within dynamic/disruptive environments, as well as provides a competitive advantage in terms of growth opportunities (Riviere et al., 2018). Third, internationalisation knowledge represents the experience/knowledge about entry barriers/requirements to commercialise products/services in international markets (Eriksson et al., 1997; Deligianni et al., 2015). The accumulation of internationalisation knowledge about customers/competitors facilitates the exploration and exploitation of opportunities in new foreign markets (Oviatt and McDougall, 2005; Voudouris et al., 2011).

3. Methodology

3.1. Qualitative approach

Inspired on the previous NTBFs' internationalisation studies (Hewerdine and Welch, 2013; Kontinen and Ojala, 2011; Nummela et al., 2006), the methodology was designed taking into account the analysis of multiple, longitudinal and retrospective cases. This qualitative approach is based on analysing facts/events of multiple case studies that happened at the time of the data collection (Street and Ward, 2010). Qualitative studies have received several criticisms (Birkinshaw et al., 2011) related to convenience or biased sampling (Bono and McNamara, 2011; Flyvbjerg, 2006), which can distort findings (Fletcher et al., 2018). Likewise, retrospective approaches have been criticised in terms of the reliability of informants that recall past events (Miller et al., 1997). Despite these critics, a retrospective approach has provided rich and detailed empirical descriptions to explain internationalisation phenomena in previous studies (Birkinshaw et al., 2011; Nummela and Welch, 2006). Given the retrospective nature of our study, we adopted this approach by assuring the validity of the information following Miller's et al. (1997) recommendations in terms of informants' confidentiality and usefulness of the data to the project.

In this view, all informants were motivated to (1) describe past facts and events and (2) provide accurate information rather than overly long and complex opinions. By adopting a deductive logic, we established causal relationships, as well as provide insights about existing early internationalisation theories (Welch et al., 2011). Therefore, by combining the retrospective and deductive approaches, we analysed how NTBFs in emerging economies build collaborative networks with triple helix agents. We also analyse how knowledge/resources are exchanged during collaborations, as well as their effects on the early internationalisation processes, by individually integrating the existing theoretical relationships evidenced in the literature. Finally, using deductive logic (Welch et al., 2011), we offered logic interpretations about the complex links amongst all agents involved in the early internationalisation phenomenon (Birkinshaw et al., 2011).

3.2. Data collection

Our research setting was the Mexican innovation and entrepreneurship ecosystem.⁵ By following Yin's (2014) and Miller's et al. (1997) suggestions, we collected data from multiple sources to ensure the triangulation of retrospectives cases. Our primary source of information was semi-structured interviews that captured the experiences of all participants, including triple helix agents and NTBFs. The fieldwork took place from January 2014 to November 2015. A set of the semi-structured interview was conducted with a university representative (the university business accelerator). Then, a set of four semi-structured interviews were conducted with representatives of the industry (NTBFs). Each interview had a duration of 2–3 h that were recorded and transcribed. Given confidentiality agreements, we adopted pseudonyms to refer to the informants. We complement interviews by collecting secondary sources of information like governmental programmes, official documents and annual reports. It helps to provide in-depth details about each interview and analysed themes.

First, for the university representation, we interviewed the top manager of the University Business Accelerator (UBA)⁶. The UBA is associated with the EGADE Business School at the Tecnológico de Monterrey.⁷ Applying a semi-structured interview protocol (Yin, 2014), we asked the UBA's top manager about (a) the services provided to NTBFs based on the different UBA programmes, (b) the most representative networking events that have been organised with other triple helix agents, and (c) the programme's relationships with entrepreneurship and innovation agents (Guerrero et al., 2017). To complement this, we collected secondary data from annual reports, official documents, and websites.

Second, the industry sector was represented by four Mexican NTBFs. Based on previous studies (Guerrero et al., 2018, 2017; Oviatt and McDougall, 1994), the criteria for selecting the four Mexican NTBFs were as follows: (a) firms that participated and also concluded the mentoring programmes offered by the UBA,⁸ (b) firms that have designed an internationalisation strategy based on their participation in the UBA programme, and (c) firms that have conducted early internationalisation before ten years⁹ after inception and after their involvement in the UBA programme. Applying an in-depth interview protocol with a retrospective focus (Andriopoulos and Slater, 2013; Chetty, 1996; Miller et al., 1997), we interviewed four NTBFs' founders regarding their experience related to (a) the process of creating

⁵ For a further description of the Mexican National Innovation System (NIS), Guerrero and Urbano (2017) offer a detailed explanation of the role of each agent involved in the mentioned NIS.

⁶ In the UBA, highly qualified mentors and academics work in education, consulting, research and other activities that seek to promote new firms with potential to grow and impact the markets. Moreover, the main business sectors involved in the UBA have been energy and sustainable development, information technology and telecommunications, design and manufacturing, and biotechnology and health, among others.

⁷ It is the largest and the most prestigious private university in Latin America (Guerrero et al., 2018, 2017).

⁸ The EGADE Business Accelerator (UBA) has advised more than 200 firms in different areas since 2005, but not all of them met our selection criteria, i.e., being new technology firms that have participated in the UBA programme and have subsequently undergone an internationalisation process.

⁹ In the IE literature, there is no consensus about the time that must elapse between creation and internationalisation for a venture to be considered an early internationalisation firm. We identify that the time criteria vary from up to 3 years (Madsen and Servais, 1997), up to 6 years (Zahra et al., 2000), up to 8 years (McDougall and Oviatt, 1996), and even up to 10 years (Gassmann and Keupp, 2007) after the creation of the firm. According to Oyna and Alon (2018), these criteria should be assessed in the context of the firm, the industry and the country. Therefore, taking into account the criteria previously presented and the disadvantages that starting a business in emerging economies may imply, we believe that the selected firms were suitable for this study.

technological initiatives and resources/capabilities required during the new firm creation process, (b) the motivations/reasons for participating in the UBA programme, as well as experiences along with their involvement in this programme, (c) the description of the early internationalisation process, and (d) their relationship with agents involved in entrepreneurship and innovation ecosystems, as well as how they were building networks to acquire internationalisation, market and technological knowledge. Table 1 summarises the NTBF's profile.

Third, the government agents' information was obtained by triangulating the information and results of different public programmes. During UBA's and NTBFs' interviews, we collected data regarding their collaborative networks with the government related to NTBFs' internationalisation processes. In particular, we obtained insights into collaboration agreements with the government via the TechBA programme. The TechBA programme was promoted by the Mexican Ministry of Economy and was managed by the United States-Mexico Foundation for Science (FUMEC). The TechBA programme supported the creation and internationalisation of NTBFs through the identification of potential markets, international capacity, and high-value employment. Likewise, we also obtained information related to university-industry programmes incentives promoted by the Mexican Science and Technology National Council (CONACYT) (Guerrero and Urbano, 2017). The data came from annual reports, websites, and official documents.

3.3. Data analysis

We recorded all interviews and, in some cases, we conducted follow-ups to clarify/collect additional information. By following Miles's et al. (2014), Saldaña's (2013), and Yin's (2014) and suggestions, we coded, triangulated and created a dataset that allows analysing the information by identifying patterns related to the early internationalisation literature. The data analysis' strategy strengthened the internal validity of our study (Eisenhardt, 1989). Consequently, our data analysis allowed us to find relevant findings related to the intersection of the triple helix approach, entrepreneurship and early internationalisation.

4. Findings

4.1. University-NTBF collaborative relationships

The Mexican NTBFs showed a wide variety of interactions with university agents during their creation and subsequent internationalisation.

Case 1: NTBF Alpha is a firm that offers services in the medical sector using three-dimensional (3D) image technology. Then, the founder participated in the UBA programme after the creation of the firm. Founder looked for pieces of advice from academics, mentors and coaches related to the development of the business plan, strategic planning, and acquisition of complementary technological knowledge. During the NTBF's creation, students and professors enrolled in the MBA programme of the university developed market research that provided a better understanding of the NTBF's technological market possibilities. This collaboration defined the strategy for entering the international market. The UBA programme provided access to different networks. First, to capture technological capabilities, NTBF Alpha signed a collaboration agreement with the Centre for Innovation and Technology Transfer in Health (CiTES) at San José Hospital (part of the university health system). This network opened up opportunities to validate and to improve the technology and the business model. Second, to capture financing, NTBF Alpha established connections with public/private networks like the trustee programme of the Tecnológico de Monterrey, the innovation fund from the State of Nuevo León (FONLIN), and the public programme from Nacional Financiera (NAFIN). Third, to capture mixed funds and technological capabilities, NTBF Alpha participated in specific programmes sponsored by the CONACYT during their initial

stages. In this point, NTBF Alpha's founder points out: "My participation in the EGADE Accelerator was particularly rich. Thanks to the collaboration with San José Hospital, I accessed specialised knowledge about the technology of my product. Additionally, I received support from the university's mentors that helped me to understand the market problem and the technology offered by my firm" (NTBF Alpha's founder). The collaboration of NTBF Alpha with the university was crucial for its access to other networks that reduced the time spent developing the products, minimised the disadvantages, and opened the door to Silicon Valley's partners.

Case 2: NTBF Beta provides IT solutions for organisational connectivity. The founder contacted the UBA programme based on his/her affinity as an alumnus of the university. The founder started the venture with a local orientation that changed when he/she was involved in the UBA programme. In this respect, the founder mentioned, "When we started, our market was orientated to the local clients... We thought that with entry into new markets (e.g., Mexico City), our clients would reject our product and press us to go back to our local clients". The knowledge acquired from the UBA mentors facilitated the formulation of a business plan, the implementation of a growth strategy, and diversified market orientation. Based on local/international customers' information (government agencies and international firms), the UBA programme strengthened the NTBF's entrepreneurial skills. During the UBA programme, the formation of an international business plan allowed for differentiated entry into the global market with the SOA technology developed by Oracle and offered by NTBF Beta. In this case, the founder states, "...The university helped me to contact strategic people with the right knowledge that complemented my product ... The success of my collaboration with the UBA was learning about the different ways of thinking in each market ... with the right advice, it's easier" (NTBF Beta's Founder). Also, the UBA programme supported NTBF Beta's application to the TechBA programme, which provided the internationalisation knowledge that was necessary for the NTBF's expansion into Silicon Valley and the building of international networks with consultants. NTBF Beta's participation in the UBA programme was crucial for connecting with international and specialised consultants/researchers. It allows capturing market information that reduced liabilities related to size, newness and foreignness. An important feature of NTBF Beta's networks was the recommendations given by the participants in situ in a laboratory (controlled environment) to reduce risks before commercialising the product.

Case 3: NTBF Gamma is a high-tech venture specialising in image processing applications. The NTBF Gamma started to collaborate with UBA's technology-based business development programme since 2005. During his/her involvement in this programme, the NTBF Gamma founder validated the business model in both domestic and international markets. The UBA programme reinforced entrepreneurial skills, like selling projects to both partners and future investors. In this view, the UBA programme strengthened international knowledge and market knowledge. In this process, the NTBF Gamma contacted the Mexican Institute of Industrial Property (IMPI) and the United States Patent and Trademark Office (USPTO) to protect the intellectual property of its technological advances. In this respect, the founder notes, "The UBA provided us with a quick overview of the entrepreneurial skills required... We opened our eyes in many ways... We as engineers often think that technological aspects are relevant, but it is true, that a balance of considerable knowledge and skills is needed...". Also, the NTBF Gamma was benefiting from the UBA programme by accessing to the NTBF Delta Group (an incubated venture in the UBA programme and developer of the DARIUS Project¹⁰). Through this collaboration, NTBF Gamma worked as a technological partner and acquired knowledge about design, programming and implementation of the render engine. Likewise, NTBF Gamma applied to the TechBA programme in Silicon Valley. NTBF Gamma's founder has considered collaboration networks to be crucial components

¹⁰ This project improved the processing of high-quality graphics and images using FPGA technology algorithms.

Table 1
NTBFs' profile.

	Case 1: NTBF Alpha	Case 2: NTBF Beta	Case 3: NTBF Gamma	Case 4: NTBF Delta
Year Founded	2005	1998	2006	2002
Business Model	Sale of software and hardware to Hospitals/Clinics and Radiology specialists	Sale of software developed jointly with a business partner - Oracle	Development of digital visualisation products to assist in industry-specific applications	Design and development of specific software. Sale of digital content through associated firms.
Product or Service	Virtual Colonoscopy based on 3D technology for colon cancer detection	Business specialised solutions based on Oracle Technology	Applications of Industrial visualisation	Design and development of specialised software and distribution of digital content through optical media or web platforms.
Year joined UBA	2006	2005	2006	2006
Year of Internationalisation	2008	2008	2008	2010
Speed of Internationalisation (in Years)	3	10	2	8
Internationalisation Strategy	Export	FDI	Export	Export and FDI
Scope of internationalisation	USA	USA, Chile, Argentina, and Peru	USA	Spain, Denmark, Holland, Israel, and Canada

Source: Authors.

in the early internationalisation process. Concretely, *NTBF Gamma's* founder mentioned that *"it is like a paradox, because when you want to have an international presence, you can travel and do many things, but you still need to have the necessary contacts..."* The founder of *NTBF Gamma's* also pointed out that collaborative networks represent a continuous flow of knowledge about markets and industrial sectors. Therefore, networks of collaboration clarified the plans/actions that were to be implemented with the main customers or significant industry players. In this vein, the founder added, *"In these collaborative networks, we often get information from potential users of our products... This helps us to understand the route we must follow... For example, at NVIDIA, a firm we had access to, we learned about the plans and directions that the big guys are taking... Our goal was not to compete with them but rather to complement each other"*.

Case 4: *NTBF Delta Group* is a consortium of new firms in the ICT sector. The CEO of the consortium is the founder himself. Three *NTBF Delta Group* firms were invited to participate in the UBA's technology-based business development programme in 2006. Some MBA academics and students developed market research for the three firms. From this research, the *NTBF Delta Group* defined an early internationalisation strategy. The participation of the group was vital to interact with experts and to conduct an in-depth assessment of the group. To develop a platform for digital content distribution, the *NTBF Delta Group* raised public funds from CONACYT, NAFIN and ProMexico. Also, the *NTBF Delta Group* collaborated with *NTBF Gamma* in the development of several projects (i.e., Digital Minds and the DARIUS Project) that represented a significant cost reduction and focused on a global scale. The UBA programme celebrated a commercial agreement between *NTBF Delta Group* and the leader of the Mexican telecommunications sector (Alestra firm). The UBA programme also promoted the early internationalisation process by connecting the *NTBF Delta Group* firms with the TechBA programme of the Ministry of Economy. It allowed entry in the Canadian and Spanish markets. The *NTBF Delta Group* founder stated that *"...The UBA contributed with key aspects in the internationalisation of our firms, which allowed us to acquire knowledge and access other resources, such as commercial partners. These, in turn, allowed us to access other clients, to which we would not otherwise have access. This collaborative network reduced the liability of being an outsider in the market ..."*

The NTBFs acquired direct diverse knowledge during their participation in the UBA programme. Moreover, the UBA programme facilitated access to relevant collaboration networks with public/private actors involved in the entrepreneurship and innovation ecosystem, which allowed NTBFs to complement and strengthen their knowledge base. Prior studies have recognised that one of the most relevant benefits offered by incubation centres is knowledge dissemination (Pauwels et al., 2016; Rubin et al., 2015). Based on these findings, this study considers that the NTBFs directly acquired two types of knowledge

through the collaboration with the UBA: market knowledge and early internationalisation knowledge. Meanwhile, the NTBFs reinforced their market, technological and internationalisation knowledge bases.

4.2. Government-NTBF collaborative relationships

The NTBFs and government collaborations were related to access to financial resources associated with the protection of technologies, develop entrepreneurial initiatives or internationalisation supports.

Case 1: *NTBF Alpha* and government collaboration allowed multiple funds to develop entrepreneurial innovations (i.e., FONLIN and INVITE programmes). *NTBF Alpha* also participated in the CONACYT-NAFIN programme that supported technology-based firms. Moreover, *NTBF Alpha* acquired funds from Silicon Valley's TechBA programme sponsored by the Mexican Ministry of Economy. The Silicon Valley's TechBA programme supported the expansion and commercialisation of *NTBF Alpha's* technologies into the United States market, as well as facilitated the access to a global network of specialists/investors that were members of the Advisory Board. As a result, this NTBF improved its business model and gained expertise in multiple dimensions (business, financial, technological, international). The collaboration was associated with the early internationalisation of *NTBF Alpha*.

Case 2: The *NTBF Beta* collaborated with the Mexican Ministry of Economy through the Prosoft programme related to the quality certification of the software industry. The *NTBF Beta's* certification represented the high-quality standards of software developers. The impact of this certification was the early internationalisation process of *NTBF Beta* through Silicon Valley's TechBA programme. Concretely, the TechBA programme facilitated the collaboration with Oracle (leading IT solutions and databases), as well as the interaction with major international consulting and industrial players in the global market. Indeed, *NTBF Beta* to get its first significant customer from the government of Chile, and it opened the firms' expansion to other Latin American countries.

Case 3: *NTBF Gamma* obtained seed funds from the Mexican Ministry of Economy. The financial resources were used in the development of technological products and protected them via the Mexican Institute of Industrial Property (IMPI). The TechBA collaboration networks also facilitated the early internationalisation process of *NTBF Gamma* through specialised actors related to the technological developer, competitors and global clients. Also, TechBA networks facilitated NTBF Gamma's first international contract with Electroglas (a U.S. firm), as well as the patenting process at the USPTO. These actions facilitated the creation of the *NTBF Gamma International* based in the United States.

Case 4: *NTBF Delta Group's* collaborative relationship with the Mexican government was through public subsidies obtained from CONACYT. These subsidies allowed the creation of the DARIUS Project.

Like previous cases, *NTBF Delta Group* also participated in the TechBA programme. This participation allowed the exportation of products and services to the Canadian, Spanish and other European markets. Also, the *NTBF Delta Group* received funds from the NAFIN to complete the implementation of one of its firms as the Centre for Advanced Design, Animation and Special Effects. Finally, the early internationalisation of *NTBF Delta Group* was supported by ProMéxico

4.3. University-Government relationships

The university-government collaboration was possible through the UBA programme and different government agencies. The first edition of the EGADE Business School's UBA programme supported the technology-based business development using funds from CONACYT (USD\$370,000). Given the success of the programme, the Mexican Ministry of Economy supported the second edition (USD\$590,000). As a member of the National and International Business Accelerators Networks, the UBA programme had the opportunity to participate in Silicon Valley's TechBA programme to promote the early internationalisation of the UBA's NTBFs. The interaction of the triple helix agents supported the diffusion of technological, market and internationalisation knowledge. In this view, Table 2 summarises the findings behind the interaction amongst the triple helix actors.

5. Discussions and propositions

According to the collaborative relationships between the triple helix agents and the four NTBFs, we provide the following propositions.

Table 2
Findings behind triple helix interactions.

University-Government Relationship	The relationship links between government organisations and the UBA involved public funds, which allowed the implementation of the programme for the acceleration of technology-based firms. The funds also facilitated UBA's membership in the National and International Network of Business Accelerators.			
	Case 1: NTBF Alpha	Case 2: NTBF Beta	Case 3: NTBF Gamma	Case 4: NTBF Delta Group
University-Industry Relationship	<ul style="list-style-type: none"> Through the UBA Programme The entrepreneurs interacted with advisors from whom they acquired knowledge related to the market. Through the networks provided by the UBA Programme The entrepreneurs interacted with MBA students from the EGADE Business School from whom they acquired market knowledge. The entrepreneurs interacted with CITES, from whom they were able to acquire technological knowledge, thus improving their product technologically. The entrepreneurs had access to several investment networks, both public and private. 	<ul style="list-style-type: none"> Through the UBA Programme The entrepreneurs developed their business plan; they also know the needs of national and international clients. Through the networks provided by the UBA Programme The entrepreneurs interacted with TechBA, who provided market and internationalisation knowledge. 	<ul style="list-style-type: none"> Through the UBA Programme Knowledge about potential customers was provided for both the domestic and international markets. The advisors contributed the knowledge required to develop the firm's internationalisation strategy. Through the networks provided by the UBA Programme The entrepreneurs interacted with several public and private organisations (NTBF Delta Group and TechBA, amongst others) from whom they acquired specific information on business issues that were relevant to the diversification of their markets. 	<ul style="list-style-type: none"> Through the UBA Programme The entrepreneurs acquired knowledge related to the internal market. Also, an internationalisation strategy was created for each firm. Through the networks provided by the UBA Programme The entrepreneurs interacted with private firms such as NTBF Gamma and Alestra, from whom they acquired market knowledge. The entrepreneurs interacted with public organisations such as NAFIN, ProMexico and TechBA, from whom they acquired market and internationalisation knowledge.
Industry-Government Relationship	<ul style="list-style-type: none"> Through the government organisations The firm was able to access public financing and business advisory programmes such as INVITE, TechBA, NAFIN and FONLIN. 	<ul style="list-style-type: none"> Through government organisations, The firm was able to access public financing and business consulting programmes, such as TechBA. This collaboration led to contact with other important partners such as ORACLE and the Chilean Government. 	<ul style="list-style-type: none"> Through the government organisations The firm was able to access public financing and business consulting programmes, such as TechBA. This collaboration caused the link with an important international client like Electrogas, Inc. The firm was able to access public funding programmes for patent registration at the national and international level, through IMPI and TechBA respectively. 	<ul style="list-style-type: none"> Through the government organisations The firms were able to access public financing and business advisory programmes such as TechBA, CONACYT, ProMexico, NAFIN. Some of these organisations led to the entry of the Business Group into international markets.

Source: Author.

First, we argue that technology entrepreneurs in emerging economies have a unique profile in comparison to their peers in developed economies. Previous studies have highlighted individual particularities (i.e. risk-taking, high-innovative orientation, high-growth orientation) associated with a global entrepreneurial mindset (Nummela et al., 2009). Founders of early internationalised firms are characterised by a positive global entrepreneurial mindset towards globalisation (Harvestone et al., 2000). In emerging economies, NTBFs tend to face several institutional voids that limit the creation and internationalisation of entrepreneurial innovations. It explains why the government often uses triple helix agents as intermediaries to promote innovation and entrepreneurship, as well as to reduce the effects of institutional voids (Armanios et al., 2016; Guerrero et al., 2020; Guerrero and Urbano, 2020a).

We identified two cases that did not show a favourable attitude to early internationalisation. A plausible explanation could be linked to their interactions with innovation and entrepreneurship ecosystems' actors—several NTBF associated their change of mentality with the involvement in university incubation/acceleration programmes. In this vein, one founder states that “*We saw that it was good to have a firm and cover some industry needs. However, when we approached the EGADE accelerator and were able to reach experts and acquire knowledge to reach an international market, it was when we ‘clicked’*”... Our results suggest that, in emerging economies, technology-based entrepreneurs should need the assistance of intermediary agents to transform their attitudes towards internalisation processes. Based on these arguments, we propose the following:

Proposition 1: In emerging economies, NTBFs' entrepreneurs should

collaborate with triple helix agents to trigger a favourable attitude towards entrepreneurial internationalisation processes.

Second, the acquisition of knowledge could introduce a transformation of NTBFs' entrepreneurs. Business internationalisation literature has recognised that the exploration/exploitation of new international market's opportunities are positively related to a good combination of resources, capabilities and knowledge (Burgers et al., 2008). In this perspective, triple helix agents collaborative networks represent a relevant source of knowledge/resources needed in early internationalisation process (Etzkowitz et al., 2007). Our results showed how NTBFs acceded to multiple sources of resources/knowledge through their collaborations with triple helix networks. According to Dutt et al. (2016), intermediaries addressed institutional voids and facilitated early internationalisation experiences of new technology-based firms in emerging markets. It explains the emergence of new research lines orientated to analyse the influence of ecosystems' agents on the development/internationalisation of entrepreneurial innovations (Chang et al., 2017; Cavusgil and Knight, 2015; McCormick and Somaya, 2020; Guerrero et al., 2020).

Our results, therefore, addressed this concern by providing insights about the role of triple helix agents across the early internationalisation process of NTBFs based on emerging economies.

Regarding the NTBF-university relationship, our study showed how NTBFs involved in university acceleration programmes had acquired knowledge like market, international and technological. Consistent with previous studies (Somsuk and Laosirihongthong, 2004), the UBA programme was designed to provide updated knowledge based on the NTBFs' needs and growth aspirations. Universities are the providers of updated knowledge and technological capabilities to ecosystems' actors (Guerrero and Urbano, 2020b). The knowledge transfer evidence is still scarce in emerging economies. For instance, the NTBF Beta's founder argues, *"The greatest benefit of participating in the EGADE Accelerator was, first of all, the knowledge... with it, we improved our practices. We had access to researchers, doctors who spend a lot of their time mentoring firms that have already gone through our situation... These experiences allowed us to polish ourselves"*. In this vein, NTBFs are benefited from universities through the (re)building of specific knowledge and capabilities. NTBF Beta's founder explained that *"These networks gave us market information to make decisions. They taught us how to manage this type of business in other countries... they taught us which sectors to focus on and which not to focus on"*. Therefore, university business accelerators produce direct and indirect value-added for NTBFs. Based on these insights, we propose the following:

Proposition 2a: In emerging economies, university business accelerators act as suppliers of different types of knowledge — market, technological, and internationalisation — which are directly related to NTBFs' early internationalisation; and

Proposition 2b: In emerging economies, university business accelerators act as brokers of new networks that are directly related to NTBFs' early internationalisation.

Third, NTBFs-governmental collaboration is motivated by the transference of public funds (Chen et al., 2013) orientated to growth (Dalmarco et al., 2018; Hou et al., 2019), as well as based the knowledge acquisition from specialised contacts (Baier-Fuentes et al., 2019). The NTBF Delta group's founder pointed out that *"the ProMéxico support facilitates the process of their early internationalisation. They teach you how to do business in the place where you go... They contact you with other people who teach you a lot... Yeah... all this, all this, it is related to the process of internationalisation... definitely."* Therefore, the intermediary role of government agencies is crucial to reduce institutional voids in emerging economies (Armanios et al., 2016; Chang et al., 2017). According to O'Gorman and Evers (2011), the Irish government export promotion organisation (EPO) has played a key intermediary role by shaping networking and facilitating the internationalisation of NTBFs. Based on these arguments, we propose the following:

Proposition 3a: In emerging economies, governments could play a

role as providers of resources during the NTBFs' early internationalisation process; and

Proposition 3b: In emerging economies, governments could play a role as brokers of required knowledge networks during the NTBFs' early internationalisation process of new firms.

Fourth, we found that the interaction amongst multiple triple helix actors is more effective in early internationalisation process than the interaction with one actor. Triple helix structure has been promoted by governments to encourage the universities-industry collaborations (Guerrero and Urbano, 2017, 2020b). In this assumption, public programmes have incentivised the knowledge exchange between universities and industry (Yusuf, 2008), as well as hybrid infrastructures (incubators, accelerators) for stimulating the creation of NTBFs (Sansone et al., 2020; Wang et al., 2020). Our results show how governmental agencies (the Ministry of Economy and CONACYT) have supported the UBA programme to strengthen collaborative relationships between universities and NTBFs. Directly or indirectly, these type of collaborations stimulates innovation, competitiveness, and entry into global markets (Guerrero and Urbano, 2017). Based on these arguments, we propose the following:

Proposition 4: In emerging economies, governments can design public policies to encourage university-NTBFs collaborations that could influence the NTBFs' early internationalisation.

Based on our propositions, Fig. 1 shows triple helix interactions related to the NTBFs' early internationalisation process in emerging economies.

6. Conclusions

6.1. Conclusions and contributions

This study investigated the role of triple helix agents in the NTBFs' early internationalisation process based in an emerging economy. Our proposed conceptual model was tested using longitudinal and retrospective multiple NTBFs' cases located in Mexico. Based on our results, this study contributes to the early internationalisation academic debate as follows.

First, our results suggested that the NTBFs' early internationalisation is the result of dynamic interactions amongst the triple helix actors involved in entrepreneurship and innovation ecosystems. Triple helix collaborations are intensified when the NTBFs has a high growth orientation (Guerrero and Urbano, 2017). This study responds to the ongoing academic debate about how NTBFs deploy their resources and networks before/after the early internationalisation (Keupp and Gassmann, 2009). In this vein, this research contributes to EI literature by providing insights about the critical role of triple helix collaboration networks across the NTBFs' acquisition of knowledge and capabilities required for early internationalisation process (García-Cabrera et al., 2016).

Second, our results showed the knowledge transference amongst triple helix agents. Diversified resources, capabilities and knowledge are positively related to the NTBFs' creation and early internationalisation. Our results also provide insights into the performance of triple helix actors (Guerrero et al., 2018; Lee and Kim, 2016). Our research contributes to the academic debate related to the triple helix' roles as facilitator/provider of knowledge, resources and capabilities in emerging economies (Guerrero and Urbano, 2017). More concretely, our study contributes to the *International Entrepreneurship* literature by adopting a collaborative networks perspective based on the triple helix approach. This mixed theoretical approach allows explaining the transfer of different types of knowledge that should act as a catalyst during the NTBFs' early internationalisation in emerging economies.

Third, our results show how knowledge acquisition positively influence the NTBFs' early internationalisation. A dynamic perspective has debated how collaborative networks embedded knowledge acquisition within innovation ecosystems (Freeman et al., 2010) and their use

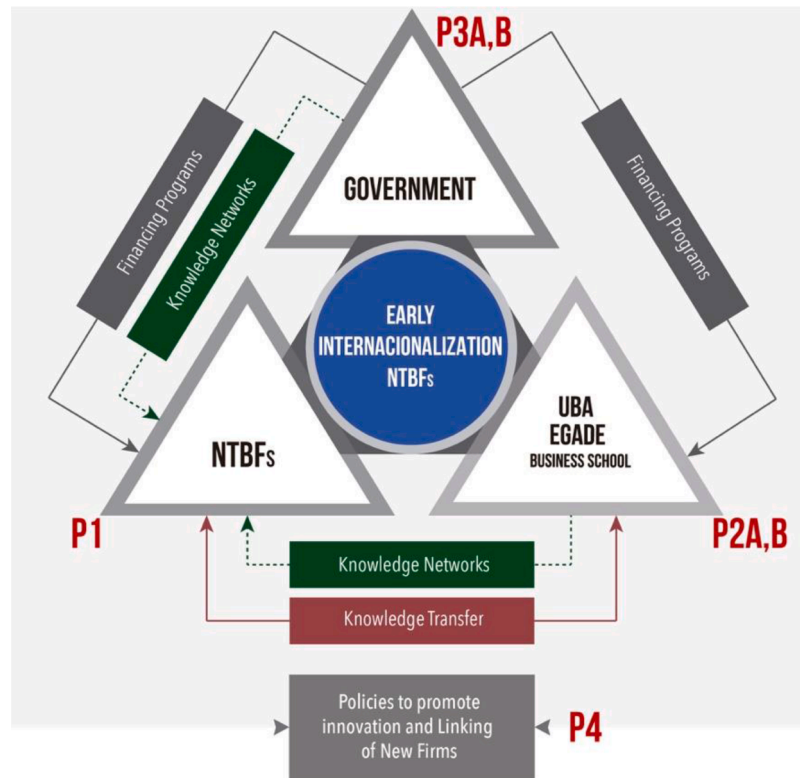


Fig. 1. NTBFs' early internationalisation process based on the triple helix interactions. Source: Authors.

to expand technological-based firms in the international markets (Cavusgil and Knight, 2015). By considering constraints and barriers faced by NTBFs in emerging economies, our research contributes to the academic debate about how the triple helix actors' interaction could represent an alternative for the NTBFs' early internationalisation in emerging economies (Ciravegna et al., 2014; García-Cabrera et al., 2016; Verbeke and Ciravegna, 2018).

Fourth, this study also responds to the debate of requesting qualitative studies that integrate the multidimensionality of the early internationalisation phenomenon (Delios, 2017; Sinkovics et al., 2008; Tsang, 2013). Our study adopted a longitudinal and retrospective perspective of multiple case studies to analyse the NTBFs' early internationalisation as an integrative point of view. Prior studies have suggested the need for in-depth qualitative studies in emerging economies (Blackburne and Buckley, 2019; O'Gorman and Evers, 2011; Guerrero et al., 2016). Our study also contributes by proposing a methodological design for studying the early internationalisation phenomenon through a dynamic/integrative perspective based on multidimensional relationships/agents that may influence the analysed phenomenon (Tsang, 2013).

Based on these arguments, our research contributes widely to the international entrepreneurship field by showing the dynamic NTBFs' early internationalisation process. Therefore, we could explain that early internationalisation requires more than an entrepreneurial behaviour or an intervention of intermediaries (Blackburne and Buckley, 2019). An integrated coordination/collaboration amongst ecosystems' agents facilitates the creation and internationalisation of NTBFs in emerging economies. The triple helix interactions are capable of filling organisational gaps and compensating the lack of resources, knowledge and networks. Therefore, in an emerging economy, an efficient innovation and entrepreneurship ecosystem should be committed into the development of entry methods to international markets (Guerrero et al., 2020). In short, the integration of previously poorly intersected pieces of literature (i.e., early internationalisation, innovation ecosystems, entrepreneurship ecosystems, collaborative networks, and the

knowledge-based vision) is also a contribution to the field of International Entrepreneurship.

6.2. Limitations and further directions for research

This research has several limitations.

First, although the early internationalisation was analysed using an integrative perspective, the nature of this qualitative research implies that our findings should be taken with caution. Methodological experts suggest that the number of cases should provide a pool of situations suitable to explain the analysed phenomenon (Eisenhardt and Graebner, 2007). Although our research satisfied the criteria, future research in the EI field should make an effort to conduct a quantitative analysis of the triple helix actors' influence on the NTBFs' early internationalisation in emerging economies. A natural extension of this study will be testing the set of proposition across different emerging economies (Fischer et al., 2020). We believe that the contextual conditions are relevant in the early internationalisation of NTBFs.

Second, the analysed NTBFs were obtained from a participant list of the acceleration programme of the EGADE Business School. Given the entry requirements, the majority of the NTBFs were not able to participate in the university-driven business acceleration programmes. University-industry collaborations may occur through research contract, research consortia, consultancy services or other collaboration agreements (Scandura, 2016). A natural extension of this study could be the analysis of diverse types of university-industry collaborations, as well as the analysis of their impact on the NTBFs' early internationalisation process (Guerrero et al., 2020). It is crucial to include a control group integrated by university-industry collaborations without an internationalisation profile. Especially in emerging economies, universities are the bridges between the entrepreneurship and innovation ecosystems' for reducing the effects of institutional voids (Guerrero and Urbano, 2020a,b).

Third, this study explored different types of knowledge. However, this research does not examine the processes that NTBFs used to manage

the different types of knowledge. A successful NTBFs' internationalisation process is positively related to the decision-makers' abilities to manage the production and acquisition of knowledge (Costa et al., 2016; Hsu et al., 2013). Knowledge management is required in all early internationalisation processes (Gaviria-Marin et al., 2019; Thrassou et al., 2020). Therefore, future studies should analyse the knowledge management process, as well as the efficiency of knowledge transfer programmes (Guerrero and Urbano, 2019).

Fourth, we are aware that the results of linkage/collaboration between triple helix agents may be different depending on the context. Actors can interact in different ways across emerging economies that could facilitate/reduce access to resources or knowledge needed for the NTBFs' early internationalisation. Recent research has suggested the emergence of new models of innovation driven by "civil society" called "Quadruple or Quintuple Helix" (Carayannis et al., 2018; Miller et al., 2016; Van Horne and Dutot, 2016; Zhang et al., 2019). Although this would be relevant for the international entrepreneurship literature (Kwon et al., 2012; Sørensen and Hu, 2014), further research should consider the adoption of mixed conceptual frameworks for understanding the determinants/outcomes phenomenon across countries (institutional theory and knowledge spillover theory), as well as considering the final users/consumers (quadruple helix and open innovation).

6.3. Implications

Based on the analysis of our research setting, several implications have emerged from our results.

For Mexican triple helix networks, if policymakers are interested in improving the NTBFs' competitiveness, local/international networks between value-chain actors and /entre ecosystems' agents/entrepreneurs still need to be facilitated (Guerrero and Urbano, 2017). An efficient practice could be strengthening the internationalisation agencies in home-host countries that disseminate crucial information for NTBFs.

For the Mexican government, our study showed the crucial role of collaborations amongst agents for stimulating the NTBFs' early internationalisation. Indirectly, our results provide insights into the effectiveness of government intervention in this emerging economy. Another relevant implication is the exploitation of their international agreements with the U.S.A., Canada, and other countries for encouraging strategic and technological alliances/networks with the triple helix agents.

For Mexican NTBFs, our results showed the benefits of collaborating with public/private actors. The NTBFs' participation in incubation/acceleration programmes provided successful experiences in the acquisition of resources, knowledge and internationalisation patterns. Therefore, in emerging economies, the involvement in collaboration networks with triple helix agents is the best practice for reducing the barriers produced by the lack of quality in the institutional environment (Guerrero and Santamaría-Velasco, 2020).

For Mexican universities, the creation of hybrid infrastructures (incubation or accelerators) facilitates the collaboration with ecosystems' agents, the NTBFs' competitiveness, the impact on regional development, as well as the reduction of differences amongst entrepreneurs (Guerrero et al., 2017). Therefore, universities should legitimise their crucial impact on regional development and on reducing the effects of institutional gaps in emerging economies.

Author statement

Authors state that all authors contributed equally to the manuscript entitled "Does triple helix collaboration matter for the early internationalisation of technology-based firms in emerging Economies?" as well as to respond to the reviewers' suggestions.

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