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INCUBAÇÃO DE EMPRESAS COMO INSTRUMENTO DE INOVAÇÃO: A EXPERIÊNCIA DA AMÉRICA DO SUL E NO CARIBE

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Abstract: This paper examines the experience of business incubation as an innovative developmental instrument based on the recent experience of the South American countries of Brazil and Chile and the Caribbean island nation of Trinidad and Tobago. A qualitative research method was adopted involving a review of published reports, journal articles and relevant case studies; and face-to-face semi-structured interviews with incubator managerial staff. The major findings are that there are great similarities among the incubators studied in terms of their links to universities, services offered, and funding challenges, but there is growing acceptance of incubation as a potentially valid tool for promoting business development and innovation although most incubators are at the early stage. The paper is original because the case study application to incubation in Trinidad and Tobago is new with only one related article published, and this study therefore adds value to the body of research because business incubation has been under-researched in the study area. The research is limited to the extent that the case study focuses on a comparison of selected incubator features and did not include the views of clients. The practical implications of this study is that sponsors of incubators and managers need to obtain a deeper understanding of the incubation ecosystem especially with regard to innovation-based incubators, if successful innovative businesses are to emerge. The results of the study can also be generalized over the small island developing states of the Caribbean.

Keywords: Business Incubation, Innovation Ecosystem, Economic Development Strategy, Business Innovation, Entrepreneurship Development, Innovation Management, Review.

Resumo: Este artigo analisa a experiência de incubação de empresas como instrumento de desenvolvimento inovador, baseado na experiência recente dos países da América do Sul do Brasil; Chile e da ilha caribenha de Trinidad e Tobago. O método de pesquisa adotado foi qualitativa, envolvendo uma revisão de relatórios publicados, artigos de revistas e estudos de casos relevantes; e entrevistas semi-estruturadas com incubadora. As principais conclusões são de que existem grandes semelhanças entre as incubadoras estudadas em termos da sua ligação às universidades, serviços oferecidos, e os desafios de financiamento, mas há uma crescente aceitação da incubação como uma ferramenta potencialmente válida para promover o desenvolvimento empresarial e de inovação, embora a maioria das incubadoras estejam na fase inicial. Este artigo é relevante, pois o estudo de caso para incubação em Trinidad e Tobago é recente, com apenas um artigo relacionado publicado, e, portanto, este estudo acrescenta valor as pesquisas já publicadas sobre incubação de empresas. A pesquisa é limitada na medida em que o

estudo de caso centra-se em uma comparação de características incubadora selecionados e não incluem os pontos de vista dos clientes. As implicações práticas deste estudo é que os patrocinadores de incubadoras e os gerentes precisam obter uma compreensão mais profunda do ecossistema de incubação, especialmente no que diz respeito às incubadoras baseadas na inovação. Os resultados do estudo também podem ser generalizadas para os pequenos Estados em desenvolvimento em Caribe.

Palavras-chave: Incubação de Empresas, Inovação Ecossistema, Estratégia de Desenvolvimento Económico, Inovação Empresarial, Desenvolvimento de Empreendedorismo, Gestão da Inovação.

INTRODUCTION

The concept and practice of business incubation (BI) was established in the advanced countries some 50 years ago and where a complex incubation ecosystem has developed over time with a wide range of incubator types and funding mechanisms, as confirmed by recent extensive bibliographic studies (Theodorakopoulos, Kakabadse, & McGowan, 2014; Barbero, Casillas, Wright, and Garcia (2014). More recently, the incubation trend reached countries of South America and the Caribbean (SAC) because of the appeal of producing innovative new businesses which stimulate technology development and job creation. Against this background, the published research reveals a low level of publications addressing the design and operations of BI in SAC as opposed to the developed countries of the United States of America (US) and Europe.

The research problem identified in this paper is the need to address the issue of the dearth of research on the design and operations of BI in the Caribbean region.

The island of Trinidad and Tobago (TT) was selected for study as representative of the most advanced incubation system among the English-speaking Caribbean islands. The paper also examines the experience of incubation in South America (SA) by consolidating the results of studies of Brazil, as the leading incubation example in SA, and Chile which is fast improving as a center for incubation. The main studies that addressed the problem in SA analyzed the design and operations of BI based on studies of: Argentina, Bolivia, Brazil, Chile, and Peru (Robinson, 2010); the US, China, and Brazil (Chandra & Fealey, 2009); and Chile (Chanda & Silva, 2012).

While research in the area of BI represents a growing body of literature in the more advanced economies, the field is significantly under-researched in SAC with studies of countries in SA now emerging, while there is almost a total absence of published work on BI in the Caribbean. The studies that addressed the problem focused mainly on Brazil and Chile as the main centers of BI activity, while similar studies are almost absent for the Caribbean region with one publication available (Ramkissoon-Babwah & McDavid, 2014). Apart from the relative neglect by researchers on the development of BI in SAC, the literature is imbalanced by placing much greater focus on the characteristics of BI as opposed to incubation processes.

This argument was validated by Tietz, Anholon, Ordoñez, and Quelhas (2015) who conducted an extensive bibliographic literature review of incubators in Brazil and identified research deficiencies relating to strategic focus, type of incubated businesses, role of government, interrelationships among incubators, and the triple helix of government-university-industry relationships (p. 25).

This paper is particularly significant to a range of stakeholders involved in promoting BI including governments, universities, industries that support incubation efforts, communities that embrace locallybased incubators, financial institutions, potential entrepreneurs/clients of incubators, and students. Researchers who have an interest in business development mechanisms and innovation-based incubation (IBI) will also find value in this article.

The main purpose of this study is to address the research gaps emphasized as deficiencies in the literature and to generate results which provide a clearer picture of the incubation ecosystem especially for countries where almost no published research is available, such as studies of the Caribbean islands. The paper is intended to serve as a guide to organizations and institutions which are currently operating incubators or plan to establish them.

The strategy of inquiry involves collecting data from multiple sources such as published articles, texts, reports, and case studies as secondary data; and primary data assembled from interviews with incubator managers.

The study is limited to the extent that the investigation is restricted to specific incubators in SA, albeit the most advanced in BI, while the case study of alternative incubator configurations, focuses exclusively on TT-based BI as representative of the Caribbean islands. The main conclusion of the study is that the concept of BI as a major development tool is gaining acceptance among major stakeholders such as governments, universities, research centers, and training institutions who have launched incubators with this objective.

Further, many of the incubators in the SA country examples, and the individual incubators in TT, have a strategic focus that assigns priority to technology and innovation. However, because incubator development is at a nascent stage, there is need for greater understanding of the entire incubator ecosystem so that deficiencies can be recognized and remedied.

THEORETICAL REFERENCE FRAMEWORK

The theoretical framework utilized for this article was developed from insights gleaned from are relatively extensive research of the relevant literature on BI at the international, South American, and Caribbean levels. The literature on international cases of BI is growing with the publication of relevant journal articles particularly over the past 10 years, however, the output generated by researchers does not yet present a coherent or consistent picture of the base theory or the dynamics of industry practice. What is clear from the literature is that incubation

has followed an evolutionary path dating from almost 60 years ago in New York which initiative was built upon in the UK beginning some 45 years ago (Khalid, Gilbert, Huq, 2014; European Union, 2010; Verma, 2004). A reasonably clear picture was also presented in the literature of the main objectives for establishing BI, except there is no universal agreement on these objectives which span: job creation; entrepreneurship stimulation; technology innovation; and economic development (Caiazza, 2014; Theodorakopoulos et al., 2014; Anderson & Al-Mubarak, 2012; Chandra & Fealey, 2009; Voisey, Gornall, Jones, and Thomas, 2006).

Most BI have multiple objectives based on a mix of those cited above, but a new trend is the emergence of incubator specialization particularly with the rise of technology and innovation-based incubators (IBI). The concept of IBI is increasingly being adopted by emerging economies and developing countries, like those of SAC, which are seeking to facilitate the development of technology-oriented and innovative new businesses.

The main purpose of examining the theoretical references was to appreciate the state of knowledge of incubation in the study areas, and to identify the major themes that need to be explored in this paper.

The themes relevant to this study were selected as: definition of incubation; sponsors; types and generational development of incubators; incubation processes; promotion of technology and innovation within incubators; and range of services provided. The search for a definition of BI acceptable to the majority of incubator sponsors continues with several different definitions adopted by stakeholders largely because different researchers have focused on different elements of the BI structure (InBIA, 2015; Bakkali, Messghem, & Sammut, 2014; Khalid et al., 2014; Voisey et al., 2006; Peters, Rice, & Sundarajan, 2004; UKBI, n.d.).

The argument by Khalid et al., that the definitional problem reflects the diversity among sponsors, goals and objectives, developmental focus, the expansion of incubation, and different configurations, is supported by the literature, and will inform the content of this paper.

Eshun (2009) viewed incubators as specially designed to create an environment to generate new innovative businesses with growth potential.

Eshun extended the definition of BI as “a social and managerial process aimed at supporting the development and commercialization of new products, new technologies and new business models” (p. 156). Further, the author distinguished between an incubator which is the social

organization context of the firm, and the processes which encapsulate the programs and services provided by incubators.

Eshun analyzed BI as a strategic activity and identified entrepreneurship, creativity, and innovation as the interrelated pillars which should be incorporated into a BI model. Al-Mubarak & Busler (2013) also treated BI as an economic and social program intended to support start-up companies and accelerate their development. Job creation, technology transfer, commercialization of research and

development (R&D) activity, and wealth creation are seen as outcomes of graduated companies.

The view of BI as an element within the entrepreneurship ecosystem that applies creativity and innovation to produce new products, technology, and business models is acknowledged. Charry, Pérez, Barahona (2014) conducted a content analysis of 11 leading journals of entrepreneurship and technology management and reviewed 50 articles on BI published between 1985 and 2012 and concluded that BI research was an international phenomenon.

Charry et al. determined that “BIs are distinct organizations within the entrepreneurial value chain.... that provide the social environment, technological and organizational resources and managerial expertise for the transformation of a technology-based business idea into an efficient economic organization” (p. 46).

However, the research by Charry et al. revealed gaps in the literature and no coherent framework of analysis except that five themes were detected from the empirical research comprising: creation of BI and impacts; the importance of networks as a new model; the coevolution/co-creation phenomenon; the emergence of university-based incubators (UBI) for developing technology entrepreneurs; and focus on a single area of research whether an incubate, the incubator organization, network, or community. The major issues from this research will be addressed in the paper in the presentation of the main results from the TT case study.

With respect to the South American experience, Robinson (2010) conducted a study of incubation in Bolivia, Peru, Chile, Argentina, and Brazil and identified the major themes in these jurisdictions as: affiliation/sponsor; funding source; attitude towards entrepreneurs; networks; private sector involvement; manager capability; degree of specialization; development programs; services and resources; sources of revenue; long-term development objectives.

These themes were further refined into six critical features as a basis for comparing the design and operating components of BI in Brazil and Chile (Chandra & Silva, 2012; Chandra & Fealey, 2009). These features were adopted in this paper for comparing the main operational features of BI in TT as the major result of this study.

METHOD

A qualitative research strategy was adopted for this study the relevance of which is based on an approach that delves deeper into the study area by drawing data from people, organizations, and texts; settings, environments, objects, and artifacts; media products, events, happenings; and the researchers as the key instruments for conducting the research (Creswell, 2009; Cooper and Schindler, 2008).

The research process involved both secondary and primary research techniques.

The secondary approach focused on collection, sorting, and reviewing published documentation including peerreviewed journals downloaded

from major online databases, technical reports sourced from the websites of international development agencies that promote incubation programs, and reviews of case studies from immediately relevant SA countries (Chandra & Silva, 2012; Chandra & Fealey, 2009).

The secondary data were used to identify the major themes that emerged from the area of study and to sort those themes into categories of relevance and priority for discussion and analysis of BI operations in this paper. The primary approach involved visits to the five major incubator facilities in TT, in-depth face-to-face interviews with incubator managers using the comparative features identified from the research to guide open-ended discussions and develop a comparative matrix of the incubators.

The research method generated results and findings in three areas: insights and understandings of BI designs and operations from international experience of BI in relevant jurisdictions; a country-analysis of incubation in Brazil and Chile as the most advanced examples of incubation development in SA with the US used as a comparator benchmark; and presentation of an analysis of the five main operating incubators in TT, based on a matrix which incorporates the critical operating features identified in the example of SA incubation. The analysis is presented in this paper as an original, empirical study for the Caribbean region that is applicable to small island developing states (SIDS) of the Caribbean and other parts of the world.

The analyses conducted and the authenticity of the results were enhanced by the incorporation of the knowledge and 25 years experience of the corresponding author in the study, practice, and teaching of entrepreneurship and innovation; and the co-author's experience as a graduate of the Babson College entrepreneurship program connected to its venture accelerator, and the manager of a UBI.

RESULTS AND DISCUSSION

This section records the results obtained from the study of BI which cover the international experience of incubation as the first set of results; the second set of results were generated from studies of incubation in Brazil and Chile on which a comparative South American case analysis was prepared; and the final result is an original case study of nascent incubators in TT.

International Experience of Incubation

The main features of the international experience of incubation were identified as: categories, types and evolution of incubators; incubation stages and services; importance of innovation-based incubators; incubation process; and role of universities in incubation creation and development.

Incubator categories, types, and evolutionary development

Internationally, there are essentially two main categories of incubators configured as physical incubators (PI) and virtual incubators (VI).

The early incubators were almost exclusively PI in that they provided work spaces or stations in buildings made available by cities or corporations at no cost or highly subsidized rates, and all services were delivered within the confines of the incubator facility on a face-to-face basis.

Most research on incubation focused on the PI model and the emergence of VI derives from the development of digital and internet technology through which services can be delivered to client businesses either through simple email or other digital communications facilities, or via online portals similar to online learning which is now revolutionizing the tertiary education and training industry.

The emergence of VI is indicative of “a shift in emphasis from physical business incubation facilities and tangible aspects, to the business development process and less tangible elements” because such facilities can be easily replicated and are not unique (Theodorakopoulos et al., 2014, pp.608-609).

A more recent addition to the field of incubation is the creation of ‘accelerators’ which are characterized by 3-4 month incubation periods for early business launch.

Several typologies of incubators have developed over time and described as: real estate through lease of space; academic as university-based; mixed or general purpose; for-profit and non-profit; basic research; innovation centers; private/corporate; technology-based; preincubator and hatcheries; and specialized or sector specific (Bakkali et al., 2014; Barbero et al., 2014; EU, 2010; Robinson, 2010). The incubator experience covered in this paper relate more to university-based, mixed, and technology-based incubators.

The results from the secondary research revealed that the evolution of incubators can be viewed in generational terms spanning the past 25 years of development (Khalid et al., 2014; infoDev/The World Bank, 2014; Theodorakopoulos et al., 2014; Verma, 2004).

InfoDev/The World Bank (2014) categorized incubators as belonging to four generations and described them as entrepreneur-led, technology-led, and investment-led within a physical setting while the fourth generation which represented the recent technology-inspired VI model. Khalid et al., (2014) studied six ICT incubators in Malaysia and elaborated on the four-generation approach with: the first generation comprising the initial PI which essentially operated on a landlord-tenant basis leasing space and providing reactive support; the second generation adding advisory services such as business and market planning provided on a proactive basis; the third generation further adding features such as mentoring, coaching, technology labs, access to funding and introducing accelerators; and the fourth generation, covering the past 10 years,

witnessing the creation of IBI with services delivered mainly on a virtual basis (Figure 1).

The evolutionary process of incubator development is an acknowledgment that no one-model can fit all business environments, economic conditions, and cultural contexts which position was supported by Machado, da Silva, Borba, and Catapan (2015) who studied the impact of technology incubators on the economic, social, cultural, and environmental situation in Brazil. Further, Bakkali et al. (2014) suggested that human resource management structures be considered as an incubator focus because the performance of BI depend on the quality support provided by staff.

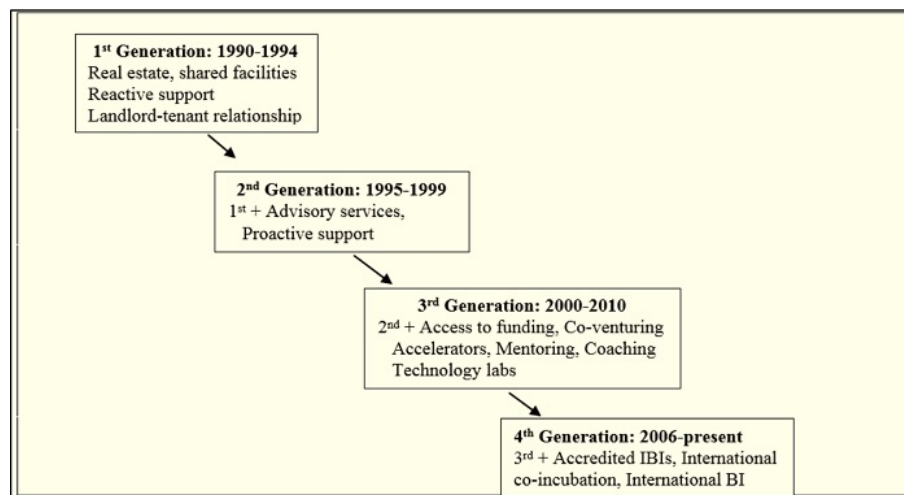


Figure 1

Generations of Business Incubator Development in Malaysia

Adapted from "The Way Forward for Business Incubation Process in ICT Incubators in Malaysia" by F.A. Khalid, D. Gilbert, A. Huq, 2014, *International Journal of Business and Society*, 35(3), pp. 395-412.

Incubation development stages and services

The development of BI was earlier tracked as an example of generational evolution, but the results of this study also confirmed that BI follow a path of staged development involving: start-up where BI typically provide pre-incubation assistance such as innovation assessment, business planning, exploration of business models, and training; early incubation stage where services include access to finance, mentoring, training, hosting, commercialization, and advanced business planning; and the final expansion or post-incubation stage which is the graduation stage where services may cover internationalization efforts, technology commercialization, business development or innovation initiatives, and such BIs are referred to as accelerators (EU, 2010) (Figure 2).

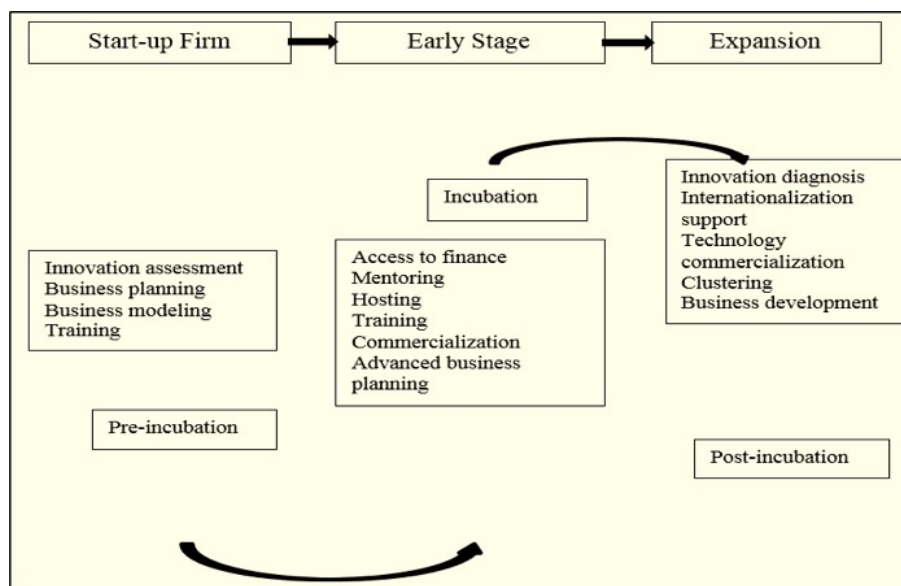


Figure 2

The Incubation Process

Adapted from "The Smart Guide to Innovation-Based Incubators (IBI)", European Union, Regional Policy, 2010, Luxembourg: Publications Office of the European Union.

It was argued that flexibility was critical in the development process and the services offered should depend on what was available in the area, or as suggested by the European Union (2010) services should be tailored to the stage of incubation whether start-up, early stage, or expansion. A leading global promoter of incubation, infoDev, targets services to marginalized groups, women, and people in extreme poverty, minorities, and youth. To facilitate the delivery of such services, infoDev created an incubation network which focuses on specialized new venture enablers such as mobile labs and hubs, climate innovation centers, and agribusiness innovation centers. The network is seen as "an important conduit for enterprises to internationalize their businesses, for the exchange of knowledge, for peer-learning opportunities, and for convening and building trust and collaboration among all innovation ecosystem stakeholders" (infoDev/The World Bank, 2013, p. 6).

Small firm innovation and innovation-based incubators

Innovation is a somewhat misunderstood concept and embodies a mindset which is committed to organizational improvement and business competitiveness. Tidd, Bessant, and Pavitt (2005) identified four types of innovation: product referring to the actual offerings of firms; process which involves the way in which products are created; position alluding to the context in which products are introduced; and paradigm which involves changes in mental models of an organization. Firms entering incubators must be aware of the different types of innovation in order to focus on the type appropriate to the firm's circumstance, business type, and size. These areas of innovation present opportunities for small firms because of the increasing role of services in national economies, and a new

focus placed on small firms which pursue knowledge-intensive business services (KIBS).

A policy of promoting the development of KIBS was propose as: increasing awareness and strengthening organizational leadership and overall coordination; constructing information infrastructure and building an innovation platform; accelerating the cultivation and introduction of talent; opening up and upgrading international competitiveness; stimulating the demand for knowledge-based services; promoting cluster development; increasing financial support; perfecting the regulatory framework; and establishing a credit system (Yang and Yan, 2010). These factors which are relevant to an incubator design should be included in the postincubation stage.

Innovation-based incubators (IBI) are viewed as operating at “the intersection between the sets of innovation and entrepreneurship supporting entrepreneurs to profit from added value of innovative ideas” (EU, 2010, p.8). IBI can support both tech-oriented or non-tech oriented innovative businesses because “innovation can be found in downstream applications of a generic technology, in advanced and in knowledgeintensive services, in business models, in marketing and customer-led processes, in design, in standards, in organization and management...” (EU, 2010, p. 9). In this context, the concept of ‘innovation habitats’ as comprising the “core of technological innovation, incubators, preincubators, technology parks, innovative cities” and ‘ecoinnovation’ which address environmental issues are relevant to incubator businesses (Machado et al., 2015, p. 71).

In examining types of incubators and the specific area of innovation, Barbero et al., (2014) found that BI that focused on basic research businesses generated more product innovation than economic development; while university and economic development incubators generated less product and technology innovations. Barbero et al. acknowledged that the most innovative type BI followed a focus strategy, while the least innovative followed an economic development and specialized strategy. The presence of networks, both privately created by the client business as well as incubator hosted, are critical to the success of all incubators and particularly relevant to IBI because, according to Correia, Mateus, and Leonor (2015), networks, innovative initiatives, communications strategies, and marketing, are key concepts in promoting innovative businesses. Further, in the case of incubators for biotech companies, a study in Brazil found that access to finance was the greatest obstacle; the human resource gaps needed to be filled; legislation governing the intellectual property system needed greater transparency and predictability; and the requirement for importing machinery and equipment needed to be simplified (Chu and Andreassi, (2011). It can be concluded that the relationship with universities, public and private research centers, and support institutions, are fundamental to the development to technology firms located in IBI.

Role of universities in incubation

Universities moved relatively early to adopt models of BI often as a method of encouraging business start-ups and of promoting innovation in the teaching curriculum. Mansano and Pereira (2016) studied BI as a support mechanism for economic development and explored the importance of BI in facilitating the transfer of technology and innovation in the context of universities, government and private corporations because of the persistent divide between academia and private businesses, and the need to promote university-industry interaction.

Zeng and Callaghan (2016) indicated that the literature on academic entrepreneurship neglected the connection between universities and spin-off companies and identified the need for a high level of interchange among faculty in promoting entrepreneurial academic initiatives which include incubators.

Zeng and Callaghan proposed the development of a faculty co-operative model to “lever some of the founding principles of universities” based on knowledge sharing and mutual support and saw the model as a “virtualized academic co-operative” (p.16).

The literature on BI frequently viewed incubation in a uniform manner neglecting the variation in incubator types and the differing objectives which are reflected in IBI.

Mansano & Pereira (2016) argued that promoting a culture of technology innovation is vital and not confined to R&D considerations but includes investment policies, education, market dynamics, and strategic public-private partnerships. Further, universities must be seen as part of the innovation system and promoters of innovative projects.

The Experience of Incubation in South America

The documentation of the design and operations of BI in SA is relatively sparse and, in the case of the focus on Brazil and Chile in this paper, are limited to a few articles (Tietz, 2015; infoDev, 2014; Chandra & Silva, 2012; Robinson, 2010; Chandra and Fealey, 2009). Robinson (2010) conducted extensive interviews on the operations of BI in Bolivia, Peru, Argentina, Chile, and Brazil and observed that most of the incubators operated on the PI model with fewer operating virtually, while the critical factor of networks varied considerably among the countries. Brazil was the most advanced with 384 operating incubators as quoted by the National Association of Incubators and Science Parks (ANPROTEC, n.d.), followed by Chile with 21 as at 2006 (Robinson, p. 4).

Robinson categorized Bolivia, Peru, Argentina as at a very early or pioneering stage of development, therefore, for the purposes of this paper Brazil and Chile were selected for a comparative country analysis as the second significant result from this study based principally on the work of Chandra and Fealey (2009), Chandra and Silva (2012), Tietz et al., 2015. Tietz et al. (2015) conducted an extensive bibliographic literature review of incubation in Brazil to identify the most significant

themes associated with BI. The results revealed that 85% of the 33 papers reviewed, highlighted the general characteristics of incubators, while only 15% examined incubation processes. The main themes in Brazil were related to incubator services and the quality of management. The main gaps in the literature were identified as studies of strategic focus, type of businesses, role of government, incubator interrelationships, and the triple helix interrelationship among university-industry- government (Tietz et al., 2015).

Six select features of BI were used to compare incubation characteristics and practices in the US, China, and Brazil and the comparative analysis was subsequently applied to the case of Chile (Chandra & Silva, 2012; Chandra & Fealey, 2009). The features of these case studies were used in this paper to prepare a comparative analysis of BI in Brazil, Chile, and the US with Brazil as the example of the major incubator system in SA, Chile as an example of a rapidly developing incubator ecosystem, and the US as the leading BI ecosystem internationally. The features identified as the best base for comparison of BI were: sponsorship and funding; strategic focus; type of business; service profile; financial services; and role of government (Table 1).

Sponsorship and funding

Generally, sponsorship and funding of BI came mainly from governments with universities making major in-kind contributions, and financial support received from private sector interests such as foundations. In Brazil BI are funded through federal government programs such as the National Incubation Support Program (PNI) and a collection of government, industry, and incubator associations like ANPROTEC.

A high degree of public-private arrangements exists. In Chile, government meets the major share of funding requirements, but increasing collaboration among governmental agencies such as the Chilean Economic Development Agency (CORFO), universities where most incubators are housed, private institutions, and research centers, is broadening the base of participation. The Chilean incubator ecosystem is also strengthened by the operation of Fundación Chile, a joint venture between ITT and the government, which promotes technology-based incubation with an approach that involves: identifying opportunities for new products and services; securing the technology; scaling up the business and diffusing knowledge of the technology (infoDev, 2014). In the US, incubator funding is more varied with a greater component of private funding and privately owned BI which benefit from corporate grants and earn income from rental and consulting fees.

Strategic focus

The main focus of BI internationally is economic development, broadly defined, which covers development activity at the local, regional, and

national levels. Because of the development context of SA, invariably, incubators have a significant focus on entrepreneurship development as a method to enhance overall business development, especially at the SME level. BI are also major mechanism for promoting commercialization of R&D and advancing technology development as demonstrated in the case of Brazil, Chile, and the US. In Chile there is also a focus on economic impact in terms of job creation in disadvantaged regions and technological innovation in products, services, and business models.

Type of business

Modern BI tend to cater more to high-tech and highgrowth clients who are involved in computer hardware and software development and biotechnology products as in the Brazil case, while Chile emphasized high impact entrepreneurs but accommodates regional resourcebased ventures over a wide range of industries including wine making.

With the great diversity of BI in the US, the types of client businesses range over all sectors including mixed product and service ventures, high-tech applications, and specialized areas. The types of businesses housed in US incubators depended on the respective type and location, with community-based incubators reflecting the nature of the business sector in the local community while UBI tended to be technology driven.

Service profile

Most incubators offer a standard menu of services which include: work spaces in PI; business advice; mentoring and coaching; training; business plan development; and especially networking opportunities. Brazilian incubators benefit from an innovative support environment which cover physical space, guidance, consulting, access to university labs and infrastructure, training sponsored by the Brazilian Support Service for Micro and Small Businesses (SEBRAE).

Chilean incubators, because of their connection to universities, are able to access infrastructure, faculty and students, technology development and commercialization, innovation activities, and partnerships with government and industry. Chilean BI also emphasized high-value services such as consulting, training, and networking with the latter being the main focus. US incubators tended to focus on a service mix that emphasized higher level services such as networking, while specialized BI focused on the resources of the area or the sector of the corporate sponsor.

Financial services

The literature indicated that private banks were not a viable source for financing client businesses in incubators in Brazil so funds tended to be channeled through universities and the Bank for Social Development (BNDES). The evidence is that a mix of state, federal, some private

funds, venture capital, and seed funds existed, but gaps were observed in satisfying early to mid-stage capital needs. Further, incubators have not ventured significantly into investing in their clients' firms through equity stakes in their businesses. In the Chilean case, BI received financial support of up to 80 percent from the government, mainly through CORFO, and a range of different funds and exclusive seed capital offerings, as a deliberate effort at creating innovative new businesses, and some equity investments by incubators.

However, the issue of red-tape in accessing funds from CORFO was raised by some clients. The US with a highly developed financial services sector, provides a wide menu of financial instruments that can be tapped by incubator clients. Bank loans can be obtained based on a convincing business plan which is facilitated by training and financial networks in the incubator. Angel financing and venture capital are also much more accessible in the US than in Brazil and Chile, because of the extensive range of angel and venture capital networks established by BI and accessible to incubatee-firms.

Role of government

The government in Brazil supports BI through close interaction with universities and industry to meet the objectives of technology and social development, and this interaction is credited with generating several of the innovative new firms supported by BI. The government plays a high visibility role in Brazil and the approach can be described as carrot-and-stick. In the case of Chile, the government's role is very visible, especially in funding incubator activities through seed capital, as the government acts as a catalyst for promoting entrepreneurship and innovation through new financing programs and facilitating entrepreneurs-industry connectivity.

In the US, governments at the local, state, and federal levels provide funding support to BI, but the private sector, including private universities, are a major contributor to incubator development in many regions of the country. The US government operates at a more arms-length manner than in Brazil or Chile.

Table 1
Comparison of Features of Major Latin American and United States Incubators

Feature	Brazil	Chile	US
Sponsor/Funding	Government; universities; some private funding	Government main sources of funds; private participation increasing; universities play supporting role	Many government agencies; economic development organizations; private
Strategic Focus	Foster entrepreneurship; economic development; technology commercialization	Fostering high growth, high impact, innovative firms; technological innovation in products, services, business models	Economic development; tech transfer; commercialization
Type of Business	Mainly high-tech (software, hardware, biotech)	High-tech, high-growth preferred; regional resource based ventures (salmon, wine)	Mixed; high-tech; specialized
Service Profile	Both hard and soft services; multiple networks	Administrative & rental; networking emphasis	Tangible and specialized; value adding services
Financial Services	Links to government funding; angel and venture capital; rare case of equity stake	Provides access and information to range of government sources; link to other sources	Links to sources of finance; provides some direct investment
Role of Government	Visible; carrot and stick; synergistic approach	Heavy government financial support; incubators make independent decisions; support for angel networks and trade associations	Low support and non-dictatorial

Adapted from "Business Incubation in the United States, China and Brazil: A Comparison of Role of Government, Incubator Funding and Financial Services", by A. Chandra and T. Fealey, 2009, International Journal of Entrepreneurship, 13, Special Issue, p. 83; and "Business Incubation in Chile Development, Financing and Financial Services" by A. Chandra and M.A.M. Silva, 2012, Journal of Technology Management and Innovation, 7(2), p.9.

Caribbean Case Study

The BI industry in the Caribbean is at a nascent stage with TT the main example of an emerging industry. The authors of this paper conducted a study of the leading BI in TT as the major contribution to the literature and practice of incubation in the Caribbean region comprising the relatively small island, English-speaking independent countries. Based on visits to these incubators and engagement with the managers, a matrix was prepared to summarize the design and operational features of these BI for internal comparative purposes with some crossreferencing to the Brazil and Chile examples. For these purposes the critical features discussed in the SA cases, were adapted for the TT case. The five BI addressed in this paper comprised reasonably diversified options for incubator clients with two incubators linked to universities (BizBooster and U-Start); one an integral part of the major state-owned entrepreneurship development organization (IBIS);, one based at an industrial research institute (CED); and the last tied to a youth training agency of the government (Y-trepreneur) (Table 2).

Sponsor

The five incubators are all sponsored by the government directly by transfer of funds from the national budget, or indirectly through allocations to parent organizations for general operations and incubation support. The BizBooster is housed at the Arthur Lok Jack Graduate School of Business (ALJGSB) of the University of the West Indies (UWI) which is a regional institution. The Integrated Business Incubation System (IBIS) was established as a unit of the state-owned National Entrepreneurship Development Company (NEDCO), and the Centre for Enterprise Development (CED) falls under the ambit of the Caribbean Industrial Research Institute (CARIRI).

U-Start is the incubator of the national University of Trinidad and Tobago (UTT), and Y-trepreneur was established by the Youth Training and Employment Partnership Programme (YTEPP). These BI represent the main effort at instituting the practice of incubation in TT and the presence of universities is similar to the Brazil and Chile cases.

Strategic focus

The five incubators all share the strategic focus of economic development, job creation in the service of a developing country, and technology development. The main differences in focus derives from the mandate of the respective sponsors with the BizBooster concerned with entrepreneurship development and social impact aimed at university graduates and the wider SME community. IBIS serves the wider SME sector and focuses on communitybased business development as well as commercial-type enterprises. The CED focuses on technology commercialization, market development, businesses oriented to export, and green technology and climate change related ventures. U-Start's focus as a national university, is entrepreneurship development and research commercialization, while Y-trepreneur, with its youth focus, targets job creation and high-growth micro entrepreneurs. The focus of TT incubators coincides with the country examples in SA, except that IBI are not as prominent as in Brazil.

Type of business

The incubators generally target ICT type businesses but the BizBooster includes agri-business and creative enterprises; IBIS manufacturing, entertainment, and hospitality; CED technology and innovation driven and climate change associated businesses; U-Start serves its inhouse student clientele and emphasizes fashion and design, animation; agro-processing, and studio recording technology; and Y-trepreneur business types cover mixed micro and small producers and service providers. In terms of promoting innovative businesses, most of the BI have innovation as an objective, but, while the prospects seem bright, it is too early to

make a definitive statement on the link between incubation and the development of innovative businesses in TT.

Service profile

The TT incubators provide the standard range of services offered in most incubators internationally such as physical work spaces, mentoring, training, and access to networks. These services are provided in a built environment by IBIS, CED, and U-Start. Virtual services, which cover a similar menu, are offered using internet technology by BizBooster and Y-trepreneur, and partially by IBIS and U-Start. All the incubators followed an acceptable incubation system comprising the following stages: client selection; screening of entrepreneur and business idea; pre-incubation; full incubation; and postincubation. The range of services offered by TT incubators accord with the examples of Brazil and Chile except that the scope of networking services is greater in SA.

Funding/Client financial services

The BizBooster receives the bulk of its operational funds from the ALJGSB and the government, with future prospects for financing client businesses. The incubator assists clients with access to financing sources by pointing to appropriate sources including angel financing and venture capital. IBIS is funded almost exclusively by the government and provides seed capital, equipment financing, and loan funds to clients. CED is funded mainly through government allocations to its parent, which is supplemented by tenant charges and management fees earned from the management of climate change related projects. Clients benefit from grants for businesses that pursue climate change issues. U-Start and Y-trepreneur are funded directly by budget allocations to their parent organizations but client business are not financed from internal sources but benefit from links to official public and private sources and referrals to lending institutions. The cases of Brazil and Chile are not much different in their reliance on governmental sources of finance. Graham (2010) argued that reliance on governmental subsidies can be detrimental to incubator programs and the preferred structure is a for-profit model which ensures a focus on delivering value-based funding and establishes an incubator culture of delivering value. BI in TT should set a target for a reasonable level of financial sustainability to reduce the influence of the government.

Role of Government

The BizBooster is independently operated with its own board of directors with private sector members, but abides by broad governmental policy guidelines documented in policy statements, national plans, and annual budgets. IBIS is governed by a politically appointed board

and as such follows government-enunciated policy and is subject to direct governmental interventions but not in an invasive manner. CED is independently operated but subject to the board and executive management of its parent while observing the guidelines for national economic development. U-Start operates as a unit of UTT and is therefore subject to its direction which is consistent with national development objectives.

Y-trepreneur is controlled by its parent board which is politically appointed and therefore operates in consonance with the government's stated objectives. As indicated in the literature, the BI in Brazil and Chile abide by the national policy, but decision making is relatively independent. However, in both countries the governments

Y-trepreneur is controlled by its parent board which is politically appointed and therefore operates in consonance with the government's stated objectives. As indicated in the literature, the BI in Brazil and Chile abide by the national policy, but decision making is relatively independent. However, in both countries the governments play a high visibility role which carries specific operational risks.

Table 2
Experience of Business Incubator Development in Trinidad and Tobago

Incubator/Features	BizBooster University of the West Indies Business Booster	IBIS (Integrated Business Incubation System)	CED (Centre for Enterprise Development)	U Start	Y-trepreneur
Sponsor	Arthur Lok Lack Graduate School of Business, University of the West Indies.	National Enterprise Development Company.	Caribbean Industrial Research Institute.	University of Trinidad and Tobago.	Youth Training and Enterprise Partnership Program.
Strategic Focus	Economic development; job creation; entrepreneurship development; social impact - geared to university graduates and SMEs.	Job creation; community development; innovation; client revenue generation – aimed at broad-based clientele.	Technology commercialization & market development; MSMEs with export potential – for graduates of its hatchery program and others.	Entrepreneurship development; research commercialization; job creation targeting graduates and staff of the university.	Job creation; entrepreneurship; potential high-growth micro-entrepreneurs - targeting graduates of the program.
Type of Business	IT; social networks applications; agri-business, creative enterprises.	Light manufacturing; ICT; Services; Entertainment; Hospitality.	Technology and innovation oriented; climate change	Fashion; Graphic design; Animation; IT; Agro-processing; Studio recording	Mixed micro and small business products and services
Service profile	Virtual services including mentoring, coaching, networking, streaming of training to clients.	Physical work spaces; mentoring; training; option for operating in own-space.	Physical work spaces and hatchery facilities for tenants; and virtual support for some clients.	Physical workstations for tenants and virtual services for some clients; mentorship; training; networking.	Virtual services comprising; business advice; management training; partner linkages; exhibition events
Funding / Client financial Services	Government and the business school for operating funds. Access to business angels and venture capital.	Mainly government. Provides seed capital and equipment financing	Government funds supplemented by tenant fees and management fees. Provides links to sources of finance; climate change grants.	Government. Provides links to sources of finance	Provides links and referrals to sources of finance
Role of Government	An independent university-based incubator with own board but guided by national policy.	Appoints governing board and provides policy guidelines.	Independently operated but observes national policy on development.	A state-owned university-led incubator which is guided by the development objectives of the government as the main funder	Appoints the board of the sponsor and provides policy guidelines.

Authors' research

CONCLUSIONS AND POLICY IMPLICATIONS

The literature on BI pointed to the emergence of research on incubation as “a legitimate academic pursuit” which involves consideration of “the different theories of management, organization, strategy, economics and business” (Charry et al., 2014, p. 44). In this context, this paper set out to distil the experience of BI from international initiatives, compare the major features of incubation in SA based on the Brazilian and

Chilean experiences with the US used as a benchmark, and to present an analysis of BI in TT as a proxy for the nascent Caribbean attempts at incubation. The overall purpose is to provide a guide to stakeholders in SIDS to the implications for undertaking incubation ventures. According to infoDev/The World Bank (2013), incubation in developing countries suffer from a lack of affordable infrastructure, an innovation system, mentors and business coaches, training opportunities, finance, business angels, seed capital, sound policy and regulatory environment, and connections with marketing channels. This assessment was confirmed as accurate in several respects from the results and discussion of the features of the BI included in this study.

The main conclusion from this study is that the success of incubation in TT and the wider Caribbean islands, particularly in the development of innovative businesses, will depend on the creation of an effective innovation ecosystem. The elements of such a system, which require policy formulation and strategic interventions, were identified as: placing entrepreneurs and enterprises at the center of the system; investing significant capital in R&D; orienting the education system especially at the tertiary level toward entrepreneurship, creativity, and innovation; fashioning a method for making finance and risk capital more accessible; simplifying the tax and regulatory environment; developing appropriate public policy instruments and efficient institutions for implementing such policy (Innovation Ireland, 2010). The results from the study of BI in TT point to the potential for the development of innovative business, especially in the area of ICT, the creative areas of fashion design, and entertainment, and climate change related ventures which are highly relevant to islands prone to negative impacts.

This study is limited to the extent that the incubators examined were at the nascent or early development stage and, therefore, performance results were now emerging. This was inescapable because of the development stage of incubation, but critical insights were provided to guide future development of BI. Future research should investigate the evolution of the incubators highlighted in this paper and their performance in terms of the success of graduate businesses as well as the extent to which innovation has been stimulated. Future research is also relevant to the creation of 'accelerators' which are currently being promoted under the infoDev/World Bank Entrepreneurship Program for Innovation in the Caribbean with the training of incubator managers (Accelerate Caribbean, 2016).

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