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Technology Business Incubation: An overview of the state of knowledge

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ABSTRACT

This paper introduces Technology Business Incubation (TBI) as a field of study and practice, exploring the concept, its evolution, and scholarship. Science parks, incubators and accelerators are TBI mechanisms considered to be important policy tools for supporting innovation and technology-oriented entrepreneurial growth. Their popularity is premised on the belief that these mechanisms provide critical value-added inputs essential for the creation and development of innovative Technology-Based Firms (TBFs). However, determining what type of TBI mechanisms and policies are most conducive to achieving the desired results is very much mission-driven and context-specific. A review of the past three decades of incubation literature, emerging practice, and future trends reveals that despite ongoing debate about their contribution and challenges, the future of TBIs is promising, and there are rich opportunities for research.

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1. Introduction

This article introduces the Special Issue on Technology Business Incubation (TBI) and addresses the following key questions: *How do we define TBIs? Where do we stand in terms of understanding the incubation process and developing theory? How have TBI models, along with related research, emerged over the past three decades? And, what are the future prospects and challenges?*

While Technology-Based Firms (TBFs) lay the foundation for new wealth-creating industries, the race to develop appropriate policy and program mechanisms to help create and develop regions that enable new technology start-ups continues to pose challenges for policy makers seeking relevance in their planned interventions (Mian, 2011). This warrants policies that place an emphasis on the effective exploitation of new knowledge and the development of innovative technologies that are rapidly commercialized for economic gain. Consequently, scholars, policymakers, and practitioners increasingly recognize the importance of seeding and accelerating entrepreneurship and technological innovation through incubation mechanisms that offer economic well-being through sustainable competitive advantage (Aernoudt, 2004; Barbero et al., 2012). Consequently, there is a tremendous value in understanding the mechanisms that make TBIs more effective.

TBI are operationalized as science parks, technology incubators, innovation centers and accelerators. They are considered to be promising policy tools that support innovation and technology-oriented entrepreneurial growth. TBIs are generally established through public-private collaborations among universities, industry, and all levels of government (Etzkowitz, 2002). The purpose of TBIs is promoting technology transfer and diffusion of products, thereby developing local innovative firms (EU, 2010).

The modern business incubation movement began with the establishment of an incubator program in New York (1959) and a research park in California (1951). Subsequently, Birch (1979) and others (Kirchhoff, 1994) highlight the importance of innovative small firms in both employment and economic growth. This research provided the impetus to the burgeoning incubation industry. A core set of TBI mechanisms have developed during the past half-century and are in use globally. As several thousand TBIs operate throughout the globe (InBIA, 2015), further consideration through special issues such as this are needed.

After defining Technology Based Incubators (TBIs), the development of different incubator mechanisms is summarized. The gaps between incubation practice and scholarship are illuminated through a systematic review of the extant literature. Next, an introduction to the papers included in this special issue highlighting their contributions is provided. Finally, concluding remarks provide research direction for further study.

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2. Defining TBIs and understanding the incubation process

Technology Business Incubators (TBIs) are recognized by different names such as technology/business incubators, innovation/technology centers, science/research/technology parks, and business/seed accelerators. The terminology reflects scope of function as well as location.

Smilor and Gill (1986) first articulated the concept of TBIs as offering a link between: technology, know-how, entrepreneurial talent, and capital. TBIs are property-based initiatives providing tenant firms with a portfolio of new venture support infrastructure, including: business services, networking (Bergek and Norrman, 2008), access to professional services (Sherman and Chappell, 1998), university resources (Mian, 1996) and capital (Aernoudt, 2004). The intent is to help start-ups by providing enabling linkages to help the new businesses survive, scale up, and grow.

Hochberg (2015) describes accelerators as fixed-term, cohort-based TBIs providing education and mentoring for start-up founders. Additionally exposing new venture teams to former entrepreneurs, venture capitalists, angel investors, and corporate executives. Thereby, preparing founders for *public pitch events* in which *graduates* pitch their businesses to large groups of potential investors. In practice, accelerator programs combine distinct services and functions that are difficult and costly for an entrepreneur to find and obtain. Accelerator programs have been widely adopted by both public and private sponsors of TBIs (Cohen and Hochberg, 2014).

Table 1
Phases of the Incubation Process and associated Technology Business Incubator Mechanisms.

Phase 1: Pre-Incubation/Idea development	Phase 2: Incubation and Acceleration	Phase 3: Post-Incubation, Consolidation and Growth
Technology Business Incubator/ German Innovation Center	Science Park/Research Park Accelerator	
French Academic Incubator	Pépinière and Hatchery	Technopolis

(Adapted from EU (2002))

Table 2
Theoretical Lenses Employed to Study the Business Incubation Process.

Theoretical Lens Employed	Authors
<i>New Venture Creation or Addressing Market Failure</i> – The incubator compensates for perceived failures or imperfections in the market place to counter the problems caused by an inefficient allocation of resources.	Plosila and Allen (1985); Bøllingtoft and Ulhøi (2005)
<i>Resource Based View</i> – The incubator as an organization awarding a stock of tangible and intangible resources to client firms that result in development of the client firms.	McAdam and McAdam (2008); Patton et al., (2009); Todorovic and Moenter (2010); Mian et al., (2012)
<i>Stakeholders' View</i> – Incubators act as a bridging mechanisms to implement the interests of key regional stakeholders (triple, quadruple helix).	Mian (1997); Corona et al. (2006); Etkowitz (2002)
<i>Structural Contingency Theory</i> – Incubation mechanisms are configured to fit the external environment and be tailored to local needs and norms.	Ketchen et al., (1993); Phan et al., (2005)
<i>Social Network Theory</i> – Incubation mechanism as a system for increasing client firms' internal and external network density, hence social learning.	Tötterman and Sten (2005); Hansen et al., (2000)
<i>Real Options View</i> – Client firms are supported from a pool of available options through selection criteria based on fit with incubator strategy.	Hackett and Dilts (2004)
<i>Dyadic Theory</i> – An interdependent co-production dyad where incubation assistance is co-produced by the incubator and tenant entrepreneur.	Rice (2002); Warren et al., (2009)
<i>Institutional Theory</i> – The incubator's support mechanism rules and contracts offer a more structured approach to reduce uncertainty and risk, and accelerate the process.	Guerrero and Urbano (2012); Phan et al., (2005)
<i>Mechanisms-Driven Theory</i> – The incubator implements its own internal policies through an understanding of the relations that are value laden and context-based within the incubator organization.	Ahmad (2014); Bergek and Norrman (2008)
<i>Virtual Incubation View</i> – The Incubator offers knowledge brokering and information dissemination in the market space of ideas to develop innovative ventures.	Nowak and Grantham (2000); Gans and Stern (2003)

The start-up cycle of a technology business is considered to better understand the relationship of each TBI mechanism to the incubation support process (Table 1). While some science parks support the entire incubation continuum – germination, incubation and consolidation – most facilities do not. This heterogeneity leads to inconsistent: definitions, criteria for evaluating effectiveness, determination of how much value TBIs add, and determination of key success factors (Albort-Morant and Ribeiro-Soriano, 2015). These differences in organizational structure and objectives hamper the development of a unified conceptual framework for TBI research.

Researchers have used various theoretical lenses to study the business incubation process (Table 2). Table 2 illustrates how incubation theory spans various disciplines. Much of the incubation literature is fragmented and anecdotal with a focus on success stories and outcomes, hence most of the research is best described as atheoretical (Hackett and Dilts, 2004). These complexities coupled with the lack of systematic longitudinal research, make development of generalizable theory challenging. Phan et al. (2005) note that generalizable theory may not be possible due to the idiosyncrasies of science parks, incubators (and accelerators) in relation to geographic, political, social, and economic systems. Therefore, the major challenges for research on Technology Business Incubators (TBIs) is the lack of an agreed upon definition and unified theory.

3. Tracking the evolution of TBIs

Two pioneering programs—Stanford Research Park, California, established in 1951 and the Industrial Center of Batavia, New York, an incubator established in 1959 – started the TBI movement. The *first wave* (till 1980) of incubator programs aimed at economic restructuring and job creation. These programs provided affordable space and shared services. By 1980, there were 20 research parks and 11 business incubators in the United States. By 2000, an estimated 600 incubators and 160 research parks were in the United States. The research/science park model evolved from a stand-alone *technology garden* to a *networked commercialization enabler*. The *second wave* of incubation programs offered a more complete menu of value-adding services, including: counselling, skills enhancement

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