

НАМЕРЕНИЯ ЗА РАЗВИТИЕ НА ТЕХНОЛОГИЧНО ПРЕДПРИЕМАЧЕСТВО СРЕД СТУДЕНТИТЕ

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UNDERSTANDING INTENTIONS TOWARDS TECHNOLOGY ENTREPRENEURSHIP AMONG STUDENTS

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Abstract. *Students graduating universities are important source of potential technology entrepreneurs. Pre-venture processes related to technology entrepreneurship including the formation of entrepreneurial intentions are largely underresearched topics. This paper formulates propositions about determinants of intentions for technology entrepreneurship among students and provides recommendations for future research.*

Key words: *technology entrepreneurship, intentions, determinants.*

1. Introduction

During the past decades the academic research in the field of technology entrepreneurship has progressed rapidly in terms of volume, breadth and diversity [1], [2]. However, the number of scholars in this field is not large and the research on technology entrepreneurship has not contributed substantially to other scientific fields such as economics, entrepreneurship, and management [1]. As a relatively underresearched topic, technology entrepreneurship is seen as a promising area for entrepreneurship research and practice [3]. Academic research in technology entrepreneurship has generated a complex and interdisciplinary literature which relies on diverse theoretical backgrounds and addresses a wide number of topics [2]. However, surprisingly little research has focused on explaining why some individuals get involved in technology entrepreneurship. Pre-venture processes related to technology entrepreneurship including the formation of entrepreneurial intentions are largely underresearched topics. Most research on technology entrepreneurship has focused on examining technology venture formation, small technology firms, and mid-sized and large firms [1] or the conditions contributing to the development of technology entrepreneurship [4]. This literature contributes little to understanding the reasons for technology entrepreneurship mainly because determinants of entrepreneurial behaviour are identified retrospectively, which involves the risk of incorrect reporting [5] and leads to exclusion of individuals who try to enter entrepreneurship and fail and those who intend to start a company but may never do so [6] and focus only on businesses that have survived [5].

The purpose of this study is to devise propositions about factors that may contribute to the formation of intentions towards technology entrepreneurship among science and engineering students. This paper is organized as following. The next section discusses the nature and distinctive aspects of technology entrepreneurship. The following section discusses the role of entrepreneurial intentions as antecedents of entrepreneurial behaviour and reviews existing theoretical models of entrepreneurial intentions. The fourth section contains literature review and propositions about determinants of intentions towards technology entrepreneurship among students. The final section presents conclusions and recommendations for future research.

2. Technology Entrepreneurship: definition and distinctive aspects

Technology entrepreneurship is a distinct research line at the nexus of Entrepreneurship and the Management of Technology and Innovation [7]. There is no consensus among scholars about the definition of the concept of technology entrepreneurship. Although available definitions of technology entrepreneurship emphasize on different activities or stages of entrepreneurial process, ascribe different meanings, refer to different levels of analysis and mention explicitly diverse outcomes of technology entrepreneurship, they coincide that technology entrepreneurship is a combination of two different concepts: entrepreneurship and technology [8].

Technology entrepreneurship is seen as a process of “formation, exploitation and renewal of products, services and processes” [7]. The stage of formation involves assembly of resources and systems and opportunity search and recognition. The stage of exploitation is related to pursuing of opportunities. The renewal stage refers to the renewal of products, services and processes of technology-driven firms. Petti (2009:xiii) views technology entrepreneurship as a process incorporating four main sets of activities: 1/ the creation or identification of technologies; 2/ recognition of opportunities; 3/ technology development/application; and 4/ creation of a business that utilizes the technology/application developed to generate value [8].

Bailetti (2012:9) emphasizes that technology entrepreneurship [1]:

- is about creating and capturing value for the firm through projects that combine specialists and assets to produce and adopt technology;
- involves collaborative experimentation and production of new products, new assets, and their attributes, which are intricately linked to scientific and technology advances and the firm’s asset ownership rights;
- may entail projects that search for problems or applications for a particular technology, launch new ventures, introduce new applications, and exploit opportunities that rely on scientific and technical knowledge provided that their ultimate outcome is to create and capture value for the firm;
- is not about the general management practices used to operate small businesses owned by engineers or scientists or just about small businesses.

There are different levels of analysis in technology entrepreneurship [7], [9]. Technology entrepreneurship “can involve one individual (*individual* entrepreneurship) or the combined activities of multiple participants in an organization (*corporate* entrepreneurship)” [9]. Spiegel and Marxt (2011) identify three levels of analysis related to product / service, business / firm, and the system as a whole and distinguish between new entrants and existing firms [7].

Bailetti (2012:10) identifies several differentiating aspects of technology entrepreneurship relative to economics, entrepreneurship and management which require particular attention [1]:

- the interdependence between scientific and technological change and the selection and development of new products, assets, and their attributes;
- the application of technology entrepreneurship to both new and established firms as well as to both small and large firms;
- conceptualization of technology entrepreneurship as an investment in a project;
- the interdependence between technology entrepreneurship and the resource-based view of sustainable competitive advantage;
- the interdependence between technology entrepreneurship and the theory of the firm.

As technology entrepreneurship research is growing in volume, breadth and diversity, several studies tried to review technology entrepreneurship research in terms of terminology, structure and content and to identify directions for future research [1], [2], [4], [7]. Examining various definitions of technology entrepreneurship proposed in the literature, Bailetti (2012:9) concludes that technology entrepreneurship is about [1]:

- operating small business owned by engineers or scientists;
- finding problems or applications for a particular technology;
- launching new ventures, introducing new applications, or exploiting opportunities that rely on scientific and technical knowledge; and
- working with others to produce technology change.

Spiegel and Marxt (2011) develop a comprehensive framework which describes the scope of technology entrepreneurship and identifies research topics and research questions specific to the field of technology entrepreneurship [7]. At the product and service level, the main research interests are related to creativity and idea management, development of products and services, and life cycle and technological trajectory management [7]. At the business/ firm level the main research themes include opportunity recognition, business model creation, operations, program and project management, organizational learning and knowledge management, strategic renewal, and business model innovation [7]. At the system level, research investigates how technology-based firms are embedded in the environment and the necessary conditions for their success [7].

A major critique to the existing literature on technology entrepreneurship is the lack of research attention to pre-venture processes including the formation of entrepreneurial intentions for technology entrepreneurship.

3. Entrepreneurial Intentions: nature and importance for understanding entrepreneurial behaviour

Entrepreneurial behaviour is a planned, intentional act, which requires planning how the perceived opportunity will be exploited [10], [1], [12], [13], [14]. Entrepreneurial intentions are a cognitive aspect of the pre-founding stage. Intention is a conscious state of mind toward the goal of founding a business [10] that indicates “how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior” [15]. Entrepreneur’ intentions have tremendous influence on new organizations determining organizational goals and directions [10]. Indeed, “entrepreneurs’ intentions guide their goal setting, communication, commitment, organization, and other kinds of work” during new venture creation and development [10]. Intentionality is important property of emerging organizations (Katz and Gartner, 1988) and includes both

rational/analytical thinking implying goal setting and intuitive/holistic thinking requiring vision [10].

The study of entrepreneurial intentions is seen as a promising field for a theory-based research in entrepreneurship [10] for several reasons. First, the emphasis on intentions is especially valuable when investigating phenomena that are rare, hard to observe and involving unpredictable time lags such as entrepreneurship [16]. Second, intentions-based models contribute to understanding why individuals make certain decisions in the process of new venture creation by revealing what is inside the “black-box” of the entrepreneurial decision-making process [12]. Third, entrepreneurial intentions “offer a means to better explain – and predict – entrepreneurship” because they play a mediating role between potential exogenous antecedents – such as demographics, traits, perceived availability of critical resources, and situational role beliefs – and the act of new venture formation [12]. Forth, in contrast to comparisons between entrepreneurs and non-entrepreneurs, the study of entrepreneurial intentions avoids the mistake of identifying individual characteristics as determinants of entrepreneurial behaviour, which have developed as a consequence of founding and running a business [17]. And finally, intentions and their underlying antecedents are perception-based and therefore could be changed [15], [18]. Thus, studying entrepreneurial intentions and their antecedents will help to formulate policy recommendations for enhancing entrepreneurial activity.

Various intention models have been proposed in the literature for understanding and predicting entrepreneurial intentions [10], [15], [17], [18], [19]. According to the Entrepreneurial Event Model (Shapiro, 1982) entrepreneurial intentions are derived from perceived desirability, perceived feasibility and a propensity to act upon opportunities. Intentionality develops within the structure of a person’s rational and intuitive thinking. Intentionality leads to action and certain personal and contextual factors can inhibit the formation of entrepreneurial intentions by affecting both rational and intuitive thought processes [10]. The Theory of Planned Behaviour [15] posits that the performance of behaviour is a function of intentions and perceived behavioural control. Intentions are determined by three conceptually independent attitudinal constructs: perceived attractiveness of the behaviour (attitude toward the behaviour), perceived subjective norms about the behaviour, and perceived behavioural control [15]. Boyd and Vozikis (1994) extend Bird’s (1988) model by suggesting that entrepreneurial intentions and actions are influenced by individual self-efficacy, which is defined as a person’s belief in his or her capability to perform a task [19]. Krueger and Brazeal (1994) develop an entrepreneurial potential model [18]. The concept of entrepreneurial potential is defined as a personal preparedness to accept an attractive opportunity. Entrepreneurial potential precedes both causally and temporally intentions to start a business. Entrepreneurial event requires entrepreneurial potential in order to translate into intentions. Entrepreneurial potential is determined by three constructs: perceived desirability, perceived feasibility, and propensity to act. The economic-psychological model of determinants of entrepreneurial intentions assumes that intentions precede business start-up, which is regarded as planned behaviour [17]. The model suggests that the major determinant of entrepreneurial intentions is the conviction that entrepreneurial career is suitable for a person. Situational factors can influence either directly the behaviour or the strength of the relationship between intentions and behaviour. Conviction is determined by general attitudes and domain attitudes concerning entrepreneurship and small firms.

4. Determinants of Intentions for Technology Entrepreneurship Among Students: Literature Review and Propositions

A consistent finding in the research on factors influencing entrepreneurial intentions is that women have lower entrepreneurial intentions than men. The effects of gender on entrepreneurial intentions can be explained with differences in attitudes, subjective norms and perceived behavioural control between men and women [20]. Raijman (2001) finds that differences in risk disposition between women and men account for women's lower entrepreneurial intentions. Women continue to exhibit lower entrepreneurial intentions after controlling for education, entrepreneurial parents and proactive personality [23], personal background, attitudes, and current employment status [17], education, experience, family status, work motivation, compensation, industry sector, functional area and career history [21]. The gender effect on entrepreneurial interest is partially mediated by the lack of entrepreneurial knowledge [24].

Proposition 1: Female students exhibit lower intentions for technology entrepreneurship than male students.

Empirical research reveals that attitudes in general and the attitudinal constructs suggested in the TPB in particular have statistically significant influence on entrepreneurial intentions. Attitudes toward entrepreneurship and autonomy emerge as the best predictor of entrepreneurial intentions among students [25]. People with more positive attitudes toward risk and independence have higher entrepreneurial intentions [26]. The conviction that running one's own business is a desirable alternative is the primary explanation for variations in entrepreneurial intentions [17]. The attitude toward entrepreneurship and perceived self-efficacy act as significant predictors of entrepreneurial intentions [12]. Kolvereid (1996) illustrates that all attitudinal constructs in the TPB contribute significantly to the explanation of the variance in intentions and the effect of background variables on intentions is completely mediated by the three attitudinal variables [20]. The attitude toward self-employment, subjective norm, and perceived behavioural control are significantly and positively correlated to intentions to become self-employed in a sample of science and engineering student in two major European universities (in UK and France) [27].

Proposition 2: Positive attitudes toward technology entrepreneurship influence positively intentions for technology entrepreneurship among students.

Entrepreneurship education provides access to role models that make entrepreneurship an attractive career choice [28]. Entrepreneurship education is also considered as a socialization process into entrepreneurship [28]. Empirical research confirms that entrepreneurship education has a positive impact on entrepreneurial intentions and their attitudinal antecedents. Some studies trace the effect of particular entrepreneurship education programs on students' attitudes and entrepreneurial intentions and find significant positive effects [29], [27]. Entrepreneurship education was found to enhance entrepreneurial self-efficacy [30]. Several studies compare entrepreneurial intentions and behaviour of students in entrepreneurship and students in other fields. Graduates with major in entrepreneurship are more likely to exhibit stronger entrepreneurial intentions and to start new ventures [30], [31]. Graduates in entrepreneurship are more likely to develop entrepreneurial self-efficacy than graduates in management or another discipline [31].

Proposition 3: Entrepreneurship education influences positively intentions for technology entrepreneurship among students.

Entrepreneurship research offers consistent empirical evidence that individuals with close entrepreneurial role models are more likely to exhibit entrepreneurial intentions and behaviour. Davidsson (1995) uses a large sample of Swedish population and finds that individuals who lack role models are less likely to intend to start a business [17]. Crant (1996) found that subjects without role models reported lower entrepreneurial intentions and the presence of entrepreneurial parents explained an additional 5 percent ($p < 0,01$) of the variance in entrepreneurial intentions over and above variance accounted for gender and education [23]. Latent entrepreneurs are more likely to have close family members who are self-employed or own a business [22].

Proposition 4: The presence of positive entrepreneurial role models influences positively intentions for technology entrepreneurship among students.

Entrepreneurship is largely influenced by the institutional environment and there is empirical evidence to suggest that perceptual variables influence entrepreneurial behaviour. There is a direct link between perceived entrepreneurship-related barriers and supporting factors and entrepreneurial intentions [25]. Students who realize an antagonistic environment for business founders are less likely to intend to start a business [25]. A positive perception of available support to business founders such as help and facilities is associated with higher entrepreneurial intentions [25]. The perceived image of entrepreneurship as a career alternative and the degree to which the university is perceived as supporting entrepreneurial aspirations influence entrepreneurial conviction among university students, which in turn emerges as the most important influence on entrepreneurial intentions [32]. The perception of administrative complexity affects negatively both preferences and actual self-employment, while the perception of an unfavorable climate affects negatively only self-employment preferences [33].

Proposition 5: The perceptions of environment influence intentions for technology entrepreneurship among students.

Concluding Remarks

In the global economy, entrepreneurship and technology are considered as two important engines for economic growth and sustainability and their combination may create value for firms and may increase the wealth of nations and regions (McPhee and Bailetti, 2012; Bailetti, 2012). Technology entrepreneurship is an important and fascinating scientific field which is relatively unexplored and therefore presents many new research opportunities (Shane and Venkataraman, 2003). Research on pre-venture processes including the formation of entrepreneurial intentions may provide useful insights why some individuals get involved in technology entrepreneurship. Drawing upon a review of existing theoretical models of entrepreneurial intentions and the empirical research on determinants of entrepreneurial intentions, this paper formulates propositions about the effects of gender, attitudes, entrepreneurship education, the presence of entrepreneurial role models, and the perceptions of environment on intentions for technology entrepreneurship among students. Future research on determinants of entrepreneurial intentions among students may be undertaken in several directions. First, the formulated hypotheses have to be tested empirically in a representative sample of students. This research could also be extended by identifying and controlling for other variables relevant for the formation of entrepreneurial intentions in relation to which students may differ such as internships in technology businesses and participation in research activities at the university. A possible line of related research could explore what factors contribute to the transition from goal intentions to implementation intentions for technology entrepreneurship among students. A longitudinal research is necessary in order to confirm the presence of causal relationships.

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