

TECHNOLOGICAL ENTREPRENEURSHIP: THE ROLE SMALL BUSINESS
INNOVATION RESEARCH (SBIR) PROGRAMS PLAY IN DEVELOPING AND
COMMERCIALIZING TECHNOLOGIES

EXTENDED ABSTRACT

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Technology entrepreneurs or technology development firms are companies that seek to differentiate themselves and develop a strategic competitive advantage through innovation. Their focus is on technology development and commercialization. Though idea rich, technology entrepreneurs are typically resource poor. Government programs like the Small Business Innovation Research (SBIR) program can play a vital role in helping technology entrepreneurs develop and commercialize technology. This conceptual paper examines entrepreneurial orientation, the organizational processes, methods, styles, practices, and decision-making activities employed by entrepreneurs that lead to bringing new products to market. It describes the SBIR program and develops a series of research propositions to describe the interaction between entrepreneurial orientation and the SBIR program.

INTRODUCTION

In a seminal book, Michael Porter (1980) identifies three generic strategies for competitive advantage: differentiation, cost leadership, and focus. Differentiation strategies allow companies to build brand loyalty and charge higher prices, as buyers perceive the company's product or service offerings as unique and superior to other products or services offered in the market place. One of the key types of differentiation strategies involves innovation to create new products and services which embody new technologies and offer up-to-date features (Miller, 1986).

Many small business ventures or entrepreneurs develop and commercialize new technologies in order to obtain a sustainable competitive advantage (Kelley & Rice, 2002). Although innovation can be beneficial to many industries or services, innovation is especially important to high-tech industries. Industries such as telecommunications,

biotechnology, artificial intelligence, and the software industry, are built upon innovation (Zahra, 1996a). A coherent technological strategy which harnesses innovation can help lead to superior financial performance (Zahra, 1996b).

Even recognizing the importance of innovation, high-tech start-ups or technology development firms often lack sufficient operating capital to implement a coherent technology strategy. These firms may lack the resources to pursue interesting research ideas, to develop prototypes, and to commercialize products and, investors typically give preference to commercially developed innovations. Given the lack of resources, technology entrepreneurs may need to act entrepreneurially to find the resources to fund R&D and commercialization. One key source of funding for technology entrepreneurs are government programs such as the Small Business Innovation Research (SBIR) program.

This research is motivated by a perceived need for a better understanding of the conditions and drivers that transform technology into value creation and bring it to market. We examine the entrepreneurial orientation of a firm and the relationship between the entrepreneurial orientation and the conceptual role that government technology programs can play in facilitating the entrepreneurial process in high-tech start-ups. Lumpkin and Dess (2001) define entrepreneurial orientation as the “strategy-making processes that firms engage in entrepreneurial activities” (p. 429), and it is conceptualized to have five general domains: autonomy, innovativeness, risk-taking, proactiveness, and competitive aggressiveness (Lumpkin & Dess, 1996). We use the structure posited by Lumpkin and Dess (1996; please see Figure 1) and focus on the interaction between the program and a firm’s entrepreneurial orientation. (The role that government technology programs can play in the environmental and organizational factors is discussed in another paper.)

[Insert Figure 1 here]

Although it is possible to examine the impact of a number of government programs on technological entrepreneurship, it is helpful to focus on a specific program in developing the conceptual framework. As the Small Business Innovation Research (SBIR) program was specifically established to help entrepreneurs and to promote innovation and assist in the commercialization of technology, we have selected the SBIR program as our initial focus. The impact of other government programs, such as those focusing on technology transfer, can be studied in future research projects.

SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR)

Founded in 1982, SBIR was formed to assist in the development and commercialization of technology. The SBIR’s goal is to facilitate the technological development and subsequent commercialization and, at the same time, promote small businesses, create new jobs, and develop alternative sources of supply. Additionally the program is designed to help promote minority and disadvantaged businesses.

The Departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, and Transportation, as well as, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Science Foundation each have at least one SBIR office. Some departments, such as the Department of Defense, have multiple SBIR. For example, the Army, Navy, and Air Force each have SBIR offices. Finally, there may be multiple SBIR offices within an organization. As an example the Navy has an SBIR office devoted to sea defenses and another devoted to air defenses.

US for-profit technology companies with 500 or less employees can apply for grants under the SBIR program. A Phase I grant, capped at \$100,000, is typically used for a feasibility study to explore a technology. A Phase II grant, capped at \$1 million, is usually considered the stage where a prototype is developed though, under special circumstances, the funding may be used to further develop a technology. Although no SBIR funds are awarded for Phase III projects, Phase III of the program is considered the commercialization stage when the technology is successful in attracting funding from customers or other government programs, such as the Transition Assistance Program.

SBIR has multiple stakeholders, including small businesses, the government agency or department interested in exploring the technology, and the SBIR program office, itself. The small businesses can be technology development firms that specialize in developing and commercializing new technologies or newly formed entrepreneurial business ventures organized to develop and commercialize a specific technology. On the micro-level, the program manager of the program office that originates the topic call for the new technology is a direct stakeholder. On the macro-level, the public is a major stakeholder and is represented by the Congress which funds and oversees the program.

The level of success of an SBIR project is related to the goals and objectives of each stakeholder. The project manager of the sponsoring agency and SBIR are interested in a project outcome, was the technology developed within a reasonable time-frame at a reasonable cost. The firm can have multiple goals, such as, implementing a component of its technological strategy, technological or production superiority through innovation and profitability, and developing a new technology in order to license, sell or spin-off the technology. Sometimes, the firm's objective can be as basic as survival. SBIR and, depending upon their objectives, the firm also want to commercialize the technology.

The conceptual relationships between the SBIR and technological entrepreneurs and a series of research propositions are developed in this paper.

Entrepreneurial Orientation

Entrepreneurship can be distinguished from entrepreneurial orientation. Entrepreneurship can be thought of as a dynamic process of creating something new and assuming the risks and reward (Schumpeter, 1976). Entrepreneurial orientation involves the organizational processes, methods, styles, practices, and decision-making activities employed by entrepreneurs that lead to new entry (Stevenson & Jarillo, 1990; Lumpkin & Dess, 1996;

Lumpkin & Dess, 2001). We discuss and develop a series of research propositions for each of the five components of entrepreneurial orientation --- autonomy, innovativeness, risk-taking, proactiveness, and competitive aggressiveness --- along with possible relationships with the SBIR program. The proposed conceptual interactions between participation in SBIR and entrepreneurial orientations are shown in Figure 2.

[Insert Figure 2 here]

Autonomy

Autonomy can be thought of as the initiative or independent spirit used to develop ideas and visions and to carry them through to completion. Lumpkin and Dess (2001, p. 431) conceptualize autonomy as “independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion.” Autonomy can involve a relative freedom from organizational constraints and an empowerment to act. Autonomous organizations often empower a key manager to be the primary decision maker or product champion (Shrinivastava & Grant, 1985; Burgelman, 1983).

Participation in a program such as the SBIR can potentially place limitations on a firm’s independence through program oversight, reporting requirements, and other program specifics. Therefore, entrepreneurial firms that are more autonomous would be less likely to become involved with a government program.

P1: There is an inverse relationship between autonomy and willingness to participate in government programs that support technology development.

Innovativeness

Innovativeness “reflects a firm’s tendency to engage in and support new ideas, novelty, experimentation, and creative processes that may result in new products, services, or technological processes” (Lumpkin & Dess, 1996, p. 142). Activities associated with innovativeness include developing new processes, introducing new products/services, supporting R&D, and focusing on technological leadership (Lumpkin & Dess, 2001, Lumpkin, 2002). Market pioneering is often considered an expression of an entrepreneurial orientation (Covin et al., 1999). Technology strategy involves a firm’s commitment to acquire, develop, and deploy technology which is inherently linked to innovation (Lumpkin & Dess, 1996). As the SBIR program was developed specifically to promote innovation, innovative entrepreneurial organizations may be more likely to take advantage of available resources. Therefore

P2: There is a positive relationship between the innovation component of entrepreneurial orientation and willingness to participate in a government program that supports technology development.

Proactiveness

Proactiveness is a forward-thinking perspective which includes activities such as opportunities identification and assessment and forming teams to develop and exploit the opportunities (Kropp et al., 2004). It involves introducing new products/services and acting in anticipation of future demand, and acting opportunistically. Proactiveness is especially important to firms in the early stages of industry development (Lumpkin & Dess, 2001). Proactive firms may be more willing to seek assistance in turning their visions into reality. Therefore,

P3: There is a positive relationship between the proactiveness component of entrepreneurial orientation and willingness to participate in a government program that supports technology development.

Risk-taking

In the context of entrepreneurial orientation, risk can be conceptualized as the “uncertainty and potential losses associated with the outcomes which may follow from a given set of behaviors” (Forlani & Mullins, 2000, p. 309). Strategic risk may include significant borrowing, committing a relatively large share of assets to a project, and venturing into new and unknown territory (Baird & Thomas, 1985, p. 231-232, cited in Lumpkin & Dess, 1996). Although entrepreneurs generally are willing to take risks in return for potential rewards, arguably, when possible, they would prefer to lower the risk aspect of the risk-return equation. Since the SBIR program provides funds to explore technologies and develop prototypes, it helps lower exposure to financial risks. Therefore,

P4: There is an inverse relationship between the risk component of entrepreneurial orientation and willingness to participate in a government program that supports technology development.

Competitive Aggressiveness

Competitive aggressiveness involves a willingness to gain market share by challenging rivals directly (Lumpkin & Dess, 1996). Competitive aggressiveness is more helpful to firms in later stages of industry development (Lumpkin & Dess, 2001). Earlier-stage ventures technology entrepreneurs may often lack the ability or motivation to be competitively aggressive. However, more mature technology development firms may be willing to participate in programs that support technology development as these programs may provide a competitive advantage. Therefore,

P5A: There is a positive relationship between the competitive aggressiveness component of entrepreneurial orientation for a mature technology entrepreneur and willingness to participate in a government program that supports technology development.

P5B: The relationship between competitive aggressiveness and willingness to participate in a government program will be mediated by the firm's stage of development such that earlier forms will be less motivated than later firms.

DIRECTIONS FOR FUTURE RESEARCH

This paper is conceptual and only examines the interactions between entrepreneurial orientation and SBIR. Linkages between environmental and organizational factors need to be examined. The entire model then needs to be tested empirically. Subsequent research should focus on participants in other SBIR programs, and participants in other technology development programs.

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Figure 1: Conceptual Framework of Entrepreneurial Orientation (Lumpkin & Dess, 1996)

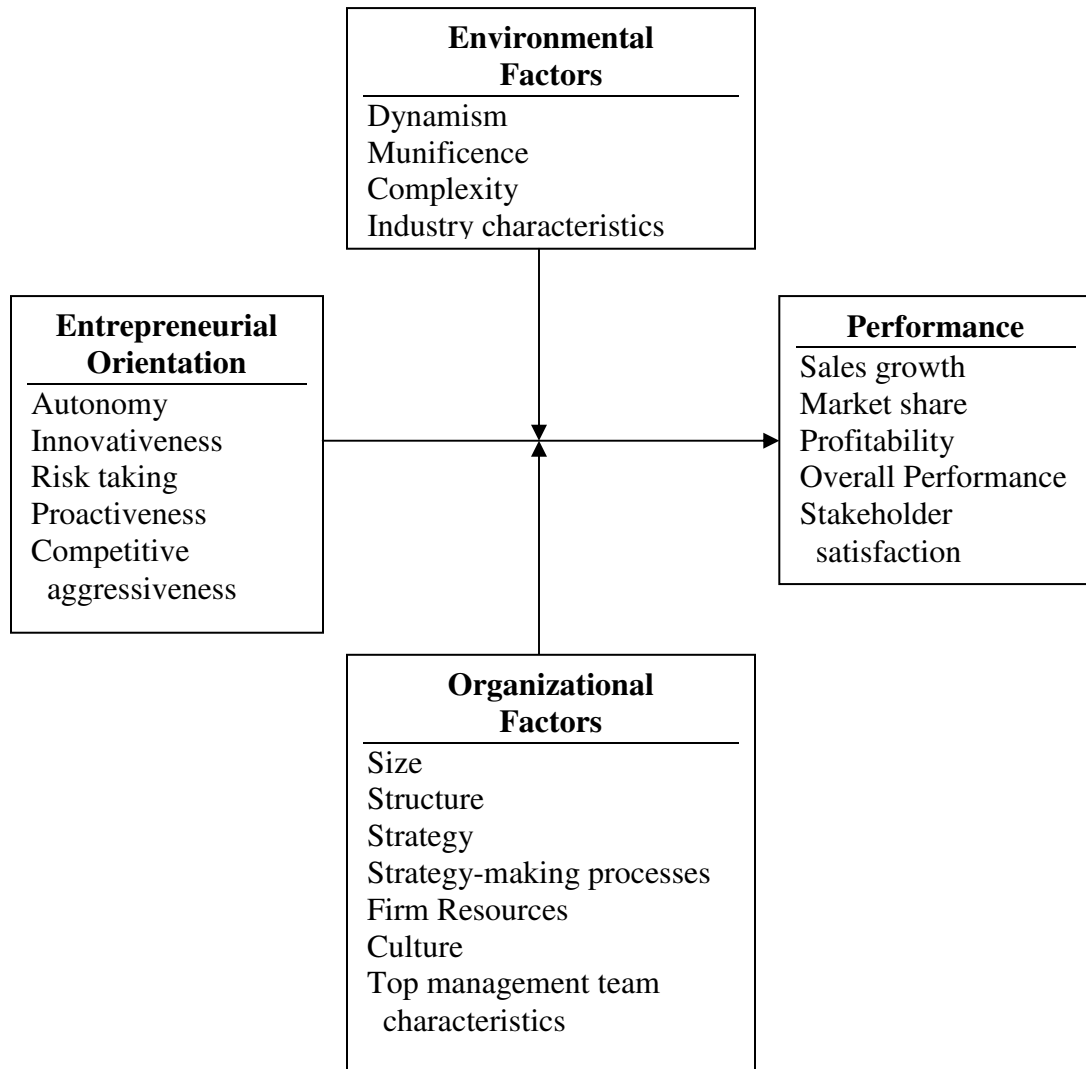


Figure 2 Theoretical model predicting the effects of entrepreneurial orientation on willingness to participate in technology development programs.

