Success factors of high-tech SMEs in Iran: A fuzzy MCDM approach

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A B S T R A C T

Purpose: The purpose of this paper is threefold: to provide a comprehensive picture of factors contributing to the success of high-tech SMEs in Iran, to prioritize these factors, and to develop a performance evaluation model for high-tech SMEs based on their critical success factors (CSFs).
Design/methodology/approach: This study is conducted in three phases. First, 47 success factors were identified and categorized into 10 main factors. Second, a fuzzy analytic network process (ANP) method was employed to prioritize the success factors and to determine the CSFs. Third, a fuzzy TOPSIS approach is proposed to evaluate the performance of high-tech SMEs based on the weighted CSFs.
Findings: The results indicate that external factors are more important in the success of studied firms. "Policies and regulations", "technological factors", and "entrepreneur's characteristics" were determined as the most important success factors.
Practical implications: This paper provide managers with a guideline to focus on the most important success factors and improve the overall performance by implementing these CSFs progressively.
Originality/value: Most of the previous research in this area has been conducted in large firms in developed countries, and has focused on a limited number of success factors. This study contributes to the extant literature by investigating the effects of a broad range of factors in the success of high-tech SMEs in the context of a developing country.

1. Introduction

Small and medium-sized enterprises (SMEs) are considered to be the engine for economic growth in both the developed and developing countries and, therefore, their success can directly contribute to the economic development of countries (Singh, Garg, and Deshmukh, 2008). Despite their distinctive strengths, compared to their larger counterparts, SMEs suffer from several common disadvantages, such as lower productivity, low levels of legitimacy, and higher costs of capital, that threaten their success and sustainability (Gibb, 1993). Due to these weaknesses, regardless of the business environment (country and industry) in which they operate, the failure rate among SMEs is alarming, to the extent that most of these firms fail within the first few years of operation (Artinger and Powell, 2016; Franco and Haase, 2010; Headd, 2001). Moreover, in the long-term trend, many survivors often attain only marginal performance (Cooper, Gimeno-Gascon, and Woo, 1994).

While establishing a successful SME is very difficult in any sector of industry, establishing a technology-based SME is even more challenging (Litvak, 1993), and only a small fraction of these firms survive in the highly competitive market (European Commission, 2002). In their study of new technology ventures in the United States, Song, Podoynitsyna, Van Der Bij, and Halman (2008) found that only 21.9% of studied firms survived within their first five years of operation. In view of these alarming figures, there has been growing interest among researchers in finding ways to improve the odds of success and sustainable growth among SMEs in general

and high-tech SMEs in particular.

In order to increase the efficiency and probability of survival of high-tech SMEs, it is imperative to have a comprehensive understanding of the factors contributing to the success of these firms. By being aware of the factors influencing high-tech SMEs performance, managers will be better prepared to adapt to internal and external influences. However, the mere identification of the success factors is not enough because, due to resource constraints, it is often unfeasible for SMEs managers to improve all aspects of their business at the same time. Therefore, there is an urgent need for managers to find an efficient way to improve the overall performance by allocating their limited resources to critical success factors (CSFs) and implementing them with a stepwise mode (Wu, Lee, and Tzeng, 2005).

In spite of the importance of this subject, reviewing the literature reveals that relatively little attention has been given to developing a holistic understanding of SMEs' success factors. Existing empirical results are often controversial and fragmented, and there is no consensus on the CSFs contributing to the performance of these firms (Gadenne, 1998; Simpson, Padmore, and Newman, 2012; Song et al., 2008). Moreover, few efforts have been made to rank CSFs based on their relative importance (Butler and Fitzgerald, 1999). This limited understanding is partly because of the complexity of the topic, and partly due to the researchers' choice of methodology (Dobbs and Hamilton, 2007). Furthermore, previous research in this domain has tended to focus on the operations of large and well-stablished firms based in developed countries. It is unclear whether these findings will also hold true for SMEs in emerging countries such as Iran.

In this article, we aim to contribute towards bridging these gaps by adopting a systematic approach to investigate the effects of a broad range of factors on high-tech SMEs success and to prioritize these factors. To achieve this goal, this study is conducted in three phases. In the first phase, a preliminary list of factors associated with the success of high-tech SMEs was identified through a comprehensive literature review. These factors are further modified and validated through interviews with experts and business owners. However, as will be explained later, these success factors are interconnected and cannot be treated as independent factors. Because of these interdependencies, the factors that are less important individually may turn out to be more important when evaluated collectively (Akyildiz, Kadaifci, and Topcu, 2015).

To address this issue, in the second phase, we propose the use of a fuzzy Analytic Network Process (ANP) method to obtain the weight distribution of success factors and identify the CSFs. ANP proves to be an effective approach for assessing the models with complex interdependent factors and provides a rigorous basis for addressing the problems involving both quantitative and qualitative factors (Huang, Tzeng, and Ong, 2005). The fuzzy relative weights of the CSFs obtained in the second phase are used as inputs for the third phase. In this phase, we propose a fuzzy TOPSIS technique to develop a performance measurement tool by incorporating ANP-weighted CSFs as criteria for evaluating performance. The proposed approach is applied in a biotechnology incubator to assess the performance and rank a group of 17 high-tech SMEs. The usefulness of employing CSFs as specific measures for monitoring progress and performance has been acknowledged by many researchers (Chin, Pun, and Lau, 2003; de Waal and Kourtit, 2013; Israeli, Barkan, and Fleishman, 2006; Zahedi, 1987).

The remainder of this paper is organized as follows: Section 2 briefly introduces the role of SMEs in the economy of Iran. A comprehensive literature review on the factors contributing to the success of SMEs in general, and high-tech SMEs in particular is provided in Section 3. In Sections 4 and 5, fuzzy ANP and fuzzy TOPSIS are explained and the application of the proposed methodology is presented. Finally, we discuss our results in Section 6, followed by a summary of major conclusions in the last section.

2. The role of SMEs and high-tech industry in the Iranian economy

According to World Bank (2015) report, Iran is the second largest economy in the Middle East and North Africa region in terms of GDP (with US$406 billion). The economy of Iran is, to a large extent, characterized by large public and quasi-public enterprises, which control around 80% of the economy (UNIDO, 2003). However, Iranian authorities are committed to gradually move towards a market-oriented economy and development of the private sector. According to the Government's 20-year Vision document and Iran's fifth Five-Year Development Plan, the government aims to privatize some 20% of state-owned enterprises each year (UNCTAD, 2005; World Bank, 2015). The positive outcomes of these movements are reflected in a recent report on the "Global Entrepreneurship Index (GEI)" (Acs, Szerb, and Autio, 2015). GEI utilizes a combination of variables at the individual and institutional levels to measure the quality and the scale of the entrepreneurial process in different countries. Despite the relatively low ranking of Iran (94th out of 130 countries), surprisingly, among all the studied countries, Iran had the highest one-year gain in this ranking by moving up seven places from 2014.

There is no unique and standard definition for SMEs in Iran and different ministries, institutions and organizations provide specific categories and definitions for SMEs. In this study, based on the Ministry of Industries and Mines' definition, we define SMEs as businesses with less than 50 employees (UNIDO, 2003). Unfortunately, official statistics on Iranian SMEs are scattered and incomplete. According to Molanezhad (2010), the number of formally registered industrial SMEs in 2009 was around 345,000. It is estimated that firms with less than 9 employees constitute the majority of enterprises (about 96.1%). Also, small enterprises (with 10–49 employees) and medium-sized enterprises (with 50–99 employees) account for 3.3% and 0.3% of all businesses respectively. Finally, only 0.4 of industrial firms in Iran are businesses with more than 100 employees (Molanezhad, 2010).

This study focuses particularly on high-tech SMEs. Defining high-tech or technology-based SMEs has been the subject of debate, and there is not a widely accepted definition for these enterprises (Oakey, Rothwell, Cooper, and Oakey, 1988). A broad definition is that these are businesses whose activities have a great dependence on innovation in science and technology (Medcof, 1999). In this study, based on the guidelines of the European Commission, instead of providing a very precise definition, we follow a rather broad conceptual approach. SMEs being the subject of this study are "highly innovative and/or R&D intensive companies and/or use