



## Alliance diversity, environmental context and the value of manufacturing capabilities among new high technology ventures

Siri Terjesen<sup>a,\*</sup>, Pankaj C. Patel<sup>b,1</sup>, Jeffrey G. Covin<sup>a,2</sup>

<sup>a</sup> Department of Management and Entrepreneurship, Kelley School of Business, Indiana University, 1309 E. 10th Street, Bloomington, IN 47405, United States

<sup>b</sup> Department of Marketing and Management, Miller College of Business, Ball State University, Muncie, IN 47306, United States

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### ABSTRACT

Manufacturing capabilities have often been shown to predict various indicators of firm performance. However, the association between manufacturing capabilities and firm performance has seldom been studied in the context of high technology new ventures. Using a sample of 167 UK-based, high technology manufacturing ventures, the current study examines the relationship between manufacturing capabilities (in particular, those contributing to low operating costs and product quality) and venture performance. Additionally, the moderating effects of the ventures' alliance portfolios and environmental contexts on the capability–performance relationships are explored. Results indicate that venture performance (as reflected in sales growth, return on sales (ROS), and return on assets (ROA)) is significantly predicted by manufacturing capabilities that promote low operating costs and product quality. Further, the data generally support the hypothesized moderating effects of two alliance diversity variables (alliance partner diversity and alliance geographic diversity) and two environmental context variables (environmental dynamism and environmental munificence) on the capability–performance relationships. Overall, the study supports the premise that the value of manufacturing capabilities (i.e., the strength of the capability–performance relationship) among high technology ventures is contingent upon the alliance and environmental contexts within which those ventures operate. Specifically, alliance partner diversity, alliance geographic diversity, and environmental munificence enhance the value of manufacturing capabilities that promote low operating costs. Alliance partner diversity, environmental munificence, and environmental stability enhance the value of manufacturing capabilities that promote product quality. The study's theoretical and practical implications are discussed.

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### 1. Introduction

Manufacturing capabilities are fundamental proficiencies in manufacturing that enable firms to achieve production-related goals involving such matters as consistent product quality that conforms to specifications, cost control, time/throughput speed, volume and product flexibility, and delivery dependability (Boyer and Lewis, 2002; Swink and Hegarty, 1998). Superior manufacturing capabilities have long been recognized as a source of competitive advantage and high firm performance (e.g., Skinner, 1969; Vickery et al., 1993). Nonetheless, the possession of superior manufacturing capabilities is a relative rarity among younger

firms/new ventures (Lu, 2000; Ernkvist, 2008; Fan, 2009). This is because manufacturing capabilities are often based on complex resource interactions and organizational routines that can take years to develop (Cleveland et al., 1989; Hayes et al., 1988). Additionally, young firms are often resource poor (Stinchcombe, 1965), which can preclude their acquisition of expensive process technologies and other tangible assets on which manufacturing capabilities are sometimes built (Bowen et al., 1994).

Given the value of manufacturing capabilities and their rarity among younger firms, significant challenges to manufacturing venture managers include the identification of means by which their firms' manufacturing capabilities can be developed as well as the identification of factors that can enhance the value of the manufacturing capabilities they already possess. A fair amount of research has explored the matter of how ventures can build capabilities in particular areas, including manufacturing capabilities (e.g., Lowengart and Vekstein, 2000; Sheather, 2002; Hanna, 2007). Relatively less is known about how the value of manufacturing capabilities can be enhanced such that the linkage between

\* Corresponding author. Tel.: +1 812 855 2769; fax: +1 812 855 4246.

E-mail addresses: [terjesen@indiana.edu](mailto:terjesen@indiana.edu) (S. Terjesen), [pcpatel@bsu.edu](mailto:pcpatel@bsu.edu) (P.C. Patel), [covin@indiana.edu](mailto:covin@indiana.edu) (J.G. Covin).

<sup>1</sup> Tel.: +1 765 285 3194; fax: +1 765 285 9003.

<sup>2</sup> Tel.: +1 812 855 2715; fax: +1 812 855 4246.

manufacturing capabilities and venture performance outcomes is strengthened. This knowledge gap provides the impetus for the current research.

Two contextual factors are proposed for examination as possible moderators of the relationship between a venture's manufacturing capabilities and its performance—the venture's alliance portfolio (defined in terms of alliance partner diversity and alliance geographic diversity) and environmental conditions (defined in terms of the dynamism and munificence dimensions). Alliances and the environment are herein examined because both contextual factors may influence ventures' abilities to extract value from their manufacturing-based resources. Based on a survey of 167 high technology manufacturing ventures, we explore the following two research questions: (1) What are the relationships between manufacturing capabilities contributing to (a) low operating costs and (b) product quality and venture performance? (2) Do alliance diversity (alliance partner diversity and alliance geographic diversity) and environmental context (environmental dynamism and environmental munificence) moderate these relationships?

Briefly, alliances are "access relationships" that enable partners to share knowledge flows (Kogut, 1988), legitimacy and status (Baum and Oliver, 1991), and other resources (Dyer and Singh, 1998; Gulati, 1998; Koka and Prescott, 2008). Firms may enter alliances with customers, suppliers, firms in the industry, and other partners, resulting in research collaborations, joint marketing, and other activities (Mishra and Shah, 2009). An efficient alliance portfolio enables access to "diverse information and capabilities," providing "desired benefits with minimum costs of redundancy, conflict and complexity" (Baum et al., 2000: 270). Alliances can be considered a hybrid form of organization (Williamson, 1991) and are commonly employed (Bleeke and Ernst, 1994), including by entrepreneurial firms as means to complement or otherwise augment their resource bases (Alvarez et al., 2006; Marino et al., 2002). Environmental conditions are also explored within this research because the value of resources varies across environments (Miller and Shamsie, 1996; Priem and Butler, 2001). Therefore, the value of manufacturing capabilities – more specifically, their link with venture performance – may be affected by the environmental contexts within which those capabilities are employed.

The salience of the alliance portfolio and the environmental context of high technology new ventures as factors which influence the effectiveness of their manufacturing capabilities is demonstrated through the case of Better Energy Systems (BES). Founded in London in 2001, BES produces innovative technology-based products such as Solio, a solar-powered recharger for portable electronic devices. BES competes largely on the basis of outstanding product quality, a situation enabled by the venture's strong capabilities in manufacturing. As a venture in the sustainable energy field, the environment in which BES operates is growing and resource rich, reflecting a generally high level of munificence. This munificence has enabled some firms to remain viable despite the fact that the long-term demand for their technologies and products remains uncertain. With monies generally available for any venture that demonstrates a glimmer of market potential, the sustainable energy industry is currently flooded with weak incumbent firms. Within this context, BES's products have received tremendous market validation for their recognized superiority over other firms' offerings. In short, the munificent environment in which BES operates enables the venture to easily and effectively differentiate itself on the basis of its manufacturing capabilities that promote high product quality.

Over the years, BES has formed a number of alliances with other players in or associated with the sustainable energy industry. For example, Solio partnered with modern explorer Robert Swan to learn from the use of Solio during his 2005 Mission Antarctica III expedition. Brand alliance partners include Quiksilver (Japan mar-

ket) and Vodafone (UK market). BES also allied with Apple for global distribution. BES offers an open alliance program for interested parties to become affiliates, selling BES products through webpages. Overall, BES's alliance portfolio is quite diverse, both in terms of the types of firms with which BES partners and the geographic locations of those partners. This diversity is recognized within BES as having helped the venture to better leverage its manufacturing capabilities pertaining to product quality. This has occurred because, for example, partners have been instrumental in identifying market segments where BES's high quality products would be particularly well received.

In short, the BES vignette demonstrates that high technology new ventures can benefit from the presence of deep manufacturing capabilities in particular areas. Moreover, the BES case demonstrates that the success associated with the possession of particular manufacturing capabilities can be impacted by factors related to the alliance and environmental contexts within which the venture operates.

Consistent with the identified focus on the value of manufacturing capabilities as a determinant of venture performance, the current research adopts a resource-based perspective for theory development and hypothesis framing purposes. The resource-based view of the firm (RBV) describes how resources (e.g., tangible and intangible assets and organizational capabilities) shape firm outcomes (Barney, 1991; Wernerfelt, 1984). Resources that are valuable, rare, and inimitable can lead to competitive advantage (Barney, 1991) when strategically selected and deployed (Makadok, 2001). RBV has been extensively adopted in operations management literature (Amundson, 1998), including in research on manufacturing firms (e.g., Bates and Flynn, 1995; Mishra and Shah, 2009). RBV is also a commonly used framework for studying alliances (Wassmer, 2010) and the value of firm resources in differing environments (Heeley et al., 2006).

This research makes three principle contributions to the literature on manufacturing capabilities in the context of new ventures. First, extant research does not consider how the value of manufacturing capabilities is shaped by forces in the ventures' environments. This research investigates the possibility that manufacturing capabilities variously contribute to venture performance under conditions of high versus low dynamism and high versus low munificence. Second, the present study investigates the indirect effects alliance portfolios have on new venture performance, specifically the role of alliance diversity as a moderator of the manufacturing capability–venture performance relationship. In so doing, we answer calls for research on how alliance synergies affect performance outcomes (Wassmer, 2010) and investigate the oft-neglected role of alliance partner geographic location as a portfolio variable (Lavie and Miller, 2008). Finally, this research investigates the effects on venture performance of manufacturing capabilities that are of recognized importance to established manufacturers, yet remain relatively unexplored within the context of high technology new ventures. Specifically, the present study's focus on manufacturing capabilities that contribute to low operating costs and product quality can confirm the importance of these capabilities among high technology ventures, thereby challenging the common assumption that manufacturing ventures' performance is largely determined by speed-based and/or flexibility-based manufacturing capabilities (e.g., Dodgson, 1987; Nor et al., 2007).

This paper proceeds as follows. Next, we develop theory with respect to (a) the relationship between manufacturing capabilities and venture performance and (b) the effects of alliance diversity and environment on this relationship. We then outline our sample, measures, and analytical techniques. The research results are reported, followed by a discussion of the implications of our study for theory and practice. We conclude with a discussion of the study's limitations and suggested directions for future research.

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