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The antecedents and consequences of product variety in new ventures: An empirical study

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ABSTRACT

Despite the known benefits of greater product variety for large firms, less is known about how new ventures pursue product variety. Liabilities of newness and smallness could possibly impede the ability of new ventures to develop the product design capabilities needed to increase product variety. Drawing on the design principles of product modularity, we posit that new ventures with modular product designs tend to have higher product variety. The benefits of product variety, however, are not monotonic, and at higher levels of product variety, increasing internal operational costs lead to an inverted-U type relationship between product variety and operational performance. We posit that process modularity, a systems-level capability, and manufacturing flexibility, an operations capability, enhance the benefits from product variety and mitigate the costs that arise from increasing product variety further. Based on a sample of 141 new ventures and using latent moderated structural model (LMS), we find support for the proposed model. The findings are robust against alternate model specifications. Academic and managerial implications from the findings are discussed.

1. Introduction

In the past two decades, the manufacturing base in the US has declined. The contribution of manufacturing to US GDP declined from 17.5% in 1986 to 12.1% in 2006.[2] Yet, small manufacturing firms remain a vibrant and growing part of the US economy. The Kauffman Foundation reported (Fairlie, 2011) that the number of manufacturing startups increased by 65% between 2000 and 2006. This number is particularly significant given that 70% of all US manufacturers have fewer than 20 employees. Furthermore, according to the US Census Bureau,[1] sales of small manufacturing firms grew by 20% between 2002 and 2006. While large manufacturers have focused on cost cutting, downsizing, and outsourcing, smaller manufacturers are relying increasingly on innovation and customization to revitalize the US manufacturing base.

Although the academic literature assumes that small firms lack economies of scale and scope to compete against larger firms high-growth manufacturing ventures in the Inc. 5000 list[3] increasingly provide greater product variety, with faster turnaround times, higher quality, and a smaller employee base. For example, with its 40 employees, Packrite provides a wide range of packaging and design solutions to consumer goods companies. Lumitec, a 15-employee firm with $3.4 million in sales, manufactures marine lights for recreational and law enforcement boats. Evolve Manufacturing, a manufacturer of electrochemical assemblies and systems for industries ranging from robotics and semiconductors to medical equipment, had 57 employees in 2012 and a revenue base of $41.4 million. Valley Rubber, with 105 employees, manufactures molded products used in industries ranging from marine and offshore drilling to railroads and bridges. All of these examples point to a common question: How do small and new ventures manage a diverse product portfolio with a small employee and resource base?

Given the increasing role that small and young manufacturing ventures play in the US economy, we explore the important issue of how new ventures manage increasing product variety. Product variety is defined as "the breadth of products that a firm offers at a given time" (Fisher et al., 1999: 297). Whereas larger and more established firms can manage product variety effectively, for new ventures, product variety can be a double-edged sword. On the one hand, product variety allows new ventures to increase product differentiation, efficiency, and product quality (Closs et al., 2008; Kekre and Srinivasan, 1990; Swaminathan and Tayur, 1998). On the other hand, lower product variety renders new ventures less competitive (Li and Atuahene-Gima, 2001). Also, new ventures face the liabilities of both newness and smallness (Aldrich and Fiol, 1994) and therefore have limited resources and capabilities to expand

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[3] http://www.inc.com/inc5000/list/2012/industry/manufacturing.

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their product offerings or manage increases in design, inventory, rework, and overhead costs. Ramdas (2003) indirectly confirmed by finding mixed effects of product variety on performance. It is likely that increased product variety could very quickly lead to declining returns in some ventures. For example, adding three products would be less burdensome for a large firm, whereas for a new venture to add the same level of three products could require significant investments and realignments that could lead to a significant decline in performance and even failure.

This begs the question of how small manufacturing firms can sustain growth and increasingly contribute to the US economy by offering greater product variety, when adding such variety could lower operational performance. To explain this paradox, we propose that *product modularity* can increase product variety in new ventures, whereas *process modularity* and manufacturing flexibility mitigates the inverted-U type relationship between product variety and operational performance. Operational performance refers to outcomes related to operational costs, product quality, and inventory management and delivery. Modularity in products or processes refer to "a continuum describing the degree to which . . . components can be separated and recombined, and it refers both to the tightness of coupling between components and the degree to which the 'rules' of the system architecture enable (or prohibit) the mixing and matching of components" (Schilling, 2000: 312). Product modularity enhances product variety by increasing possible reconfigurations to yield new product combinations. Product modularity helps increase internal variety to manage external variety.

According to Tu and colleagues (2004: 151) process modularity refers to "standardizing manufacturing process modules. . .so that they can be resequenced easily or new modules can be added quickly" to manufacture a variety of products. It includes process standardization, or standard subprocesses; process resequencing, or ability to reorder processes; and process postponement, or delayed differentiation (Feitzinger and Lee, 1997). Process standardization reduces internal variety of tasks, tools, and processes; process resequencing allows reconfiguration of manufacturing processes to reduce retooling, setup, and reordering costs; and process postponement allows moving manufacturing processes closest to their most pertinent point in the value chain. For example, Xtreme Power, a startup with 231 employees and $22.2 million in sales in 2011, designs, engineers, manufactures, and operates energy storage and power management systems for wind and solar power producers, transmission firms, and end users. Through highly standardized manufacturing processes, the company is able to use standard processes to make both wind and solar energy storage systems to lower costs. Because it caters to producers, transmitters, and end users, it leverages postponement by customizing the installation and operations of equipment and systems at various points along the value chain.

Manufacturing flexibility, an operations-level capability, helps new ventures cope with fluctuating customer demands through increased range-number and range-heterogeneity of manufacturing components (Nemetz and Fry, 1988). Whereas process modularity provides the broad design rules for manufacturing processes, manufacturing flexibility strategies deal with the detailed operational-level decisions that should comply with broad design rules. For example, range-mobility strategies reduce transition losses in manufacturing a wide variety of products, and a range-uniformity strategy ensures consistent product quality. Megan Summerville of SewSister is an apparel manufacturer that provides fast turnaround for small orders from designers and manufacturers. Her firm completes a vast range of apparel jobs on machines such as single- and double needle, serger, zigzag, and labeling devices that provide a fast turnaround of three to four weeks for quantities of 100 or fewer pieces of clothing. Manufacturing flexibility enhances the benefits of increasing product variety and mitigates costs that typically increase at higher levels of product variety. Overall, we propose that new ventures can increase product variety by using more modular product designs and can manage decreasing returns from product variety by using process modularity and manufacturing flexibility strategies.

2. Theoretical development and hypotheses

Product variety not only includes the number of unique product classes in a firm's product portfolio but also the number of unique product varieties within each product class[4] (Fisher et al., 1999). Organization theory discusses the generalist–specialist tradeoff (Aldrich and Fiol, 1994). Generalist new ventures increase their chance of survival by meeting the needs of a variety of customers. However, generalist ventures lack the experience and resources of a large firm and therefore exacerbate risk of failure by offering broader product variety. Conversely, specialist new ventures face higher risks as they occupy narrow market niches and cannot adapt to changing customer demands. Product variety in new ventures is therefore a double-edged sword. By expanding product offerings, new ventures increase the horizontal scope or "the set commercialization efforts. Focusing on a smaller assortment of products could increase competitive response (Chatain and Zemsky, 2007: 550). The ability to provide product variety comparable to levels competitors could increase the legitimacy of the venture and ensure a steady inflow of resources to undertake future stability in the short run, but render ventures less competitive in the long run. Investors react positively to product launches by smaller firms (Lee and Chen, 2009). Greater product variety increases legitimacy among stakeholders, increases the flow of resources, and hedges the fledgling technical core of a venture against environment changes. Product variety spreads the loci of commercialization as a coping mechanism against changing market demands.

On the other hand, due to the liabilities of newness (younger firms face a higher risk of mortality) and smallness (smaller firms face a higher risk of mortality), small firms may not realize the full benefits of product variety and could realize lower performance and ultimately failure. The liability of newness refers to age dependence; that is, younger firms face a higher risk of mortality (Freeman et al., 1983). Younger ventures require scale and scope economies to mitigate costs under greater product variety (Shelton, 2005). Not only do limited resources hinder commercialization efforts, but limited organizational cognitive capabilities reduce comprehensive decision-making and the ability to seek and combine the knowledge needed to increase product variety. Internal learning curves are less able to cope with changing needs. Furthermore, gains from product variety could be realized to a lesser extent because of limited economies of scope and scale. A lower ability to recoup expenses for R&D, operations, and marketing due to lower scale efficiencies further constrains new product commercialization. Ventures must judiciously manage the tradeoffs between competitive gains from differentiating through greater product variety and increasing costs from higher product variety.

2.1. Product modularity and product variety

Both conceptual (Krishnan and Ulrich, 2001) and normative (e.g. Chen and Hausman, 2000) research highlights the

[4] Product variety, traditionally measured as the number of stock keeping units (SKUs), differs from product portfolio breadth, defined as the number of unique product classes in which a firm offers products.