

Examining the Role of Partners in Improving Innovation Performance

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Abstract

The purpose of this paper is to study the innovation performance with regards to the input of collaborative partners in new product development processes leading to an innovation. A thoroughly-designed questionnaire was distributed to operations managers of 729 manufacturers. Data collected was subjected to regression analysis indicating significant comparative effect on innovation performance in favor of lead users.

Keywords: new product development, external collaboration, innovation performance, Australia, lead users

1. Literature Review

Innovation in products and services is the main driver of economic development in developed countries. A company with an innovative edge will be a market leader, and will enjoy all the benefits of being the first to provide a product or service, including the ability to charge high prices and to be free from competition: that is, for at least a time, the company will enjoy a monopoly. An innovative company will be able to introduce new products that are attractive to the market, and to operate with lower production costs or improved production processes (Abdallah et al., 2016). Continual innovation is therefore pivotal for any company seeking to be a market leader (Heidenreich and Kraemer, 2016; Wowak et al., 2016), and identification of effective sources of innovation is thus a focus of academics and practitioners alike.

Innovation may be derived from within a company, from activities such as research and development (R&D) and market research or from parties external to the company (Sánchez-González & Herrera, 2008). The latter, termed innovation sourcing, is now widely held to be essential for effective innovation (Chesbrough, 2003; Schmelzle, and Tate, 2017).

While it was initially assumed that innovation process was best performed and overseen by the company itself, with a repeating cycle of R&D, intellectual property protection and revenue generation (Elmqvist et al., 2009), competitive market demands render it very challenging for companies to innovate sufficiently rapidly on their own (Rosell & Lakemond, 2012). As a result, there has been a paradigm shift towards innovation sourcing (Kostopoulos et al., 2011), with studies finding that half of all innovation spending focusses on external partners rather than internal R&D, in both Europe (Gassmann, 2006) and the United States (Slowinski et al., 2009).

Innovation has been a fertile research field for many scholars over the course of the past few years. The general premise of innovation suggests that there is a plethora of ideas outside an organization's boundaries that are likely to lead to better and more commercially successful products for two main reasons. The first is that customers, suppliers, and other supply chain partners constitute a large network of sources that have the ability to exponentially increase the number of ideas which could be converted into marketable products (Chesbrough, 2003). The second is that within these three entities, there are smaller, innovative sub-groups that use their own technical skills to address new and unique problems. Consumers who adapt to new and innovative products are referred to as "lead users" (von Hippel, 1986).

As a result of this premise, there have been several research studies that aimed to explore the processes by means of various external sources leading to better products (Lilien et al., 2002). The literature concerning the process between innovation and external sources is found in both supply chain research and research on stakeholders' influences innovative performance. Literature regarding supply chains and external sources often explores how integration with external parties can improve the new product development process (Koufteros *et al.*, 2005). Literature on the relation between stakeholders and innovation explores the characteristics of the various

stakeholders that can improve the innovative performance of the organization (Lau et al., 2010). In this project, we aim to expand upon this stream of research by comparing the relative contribution of two key external parties, suppliers and lead users, and their effects on the innovative performance of an organization. The focus on these two external parties arises from previous research and anecdotal evidence that has shown that they can have a profound impact on the ability of an organization to develop both new and commercially successful products (Tsinopoulos & Al Zu'bi, 2012). However, contrary to previous research that focused on measuring various new product development metrics, in this study we define and measure an organization's innovative performance in terms of six new metrics focusing on a more wholesome picture of the innovation process itself and the impact it has in order to understand how to improve the performance for each of the collaborators.

In this study, companies' innovation performance was measured using six main dimensions: futures focus; market impact; capabilities and image; process; and sustainability and overall effectiveness. This work will highlight the relative contribution of collaboration with suppliers and lead users on innovation performance, with an aim of providing consumer products manufacturers with a sustainable competitive advantage by enabling them to introduce new and demanded products to the market more successfully than their rivals.

2. Theoretical Framework

Innovation is now understood to be crucial to the successful growth of entities, and identification of effective means of increasing innovation performance is now a focus not only of companies, but of entire nations (Calof, 2018). Innovation involves many stages, with various activities and partners involved in each stage (Scott & Bruce, 1994). The practices of innovation have evolved significantly from a time when it was largely the realm of a small number of innovation practitioners, primarily in high-tech industries: now, innovation is the aim of companies across the spectrum of industries (Elmqvist et al., 2009). Concerted research efforts have led to a deep knowledge of innovation (Dahlander & Gann, 2010), with a specific focus on external innovation.

External innovation as a concept is not new: innovation has always relied on some level of external influence. For example, R&D departments have always depended on outside knowledge (Freeman, 1974), and organizations have always relied on new ideas, often taken from other industries or from the literature, for competitive advantage (Abdallah et al., 2016; Frishammer et al., 2010; Dahlander & Gann, 2010).

Since innovation performance is so essential to a company's success, it is important to identify which external innovation partners have the greatest impact on innovation performance. Von Hippel (1998) held that innovation was most strongly influenced by lead users, whose focus is on innovation that addresses real market needs. Other researchers, however, identify suppliers as a more significant contributor to innovation owing to their access to knowledge, resources and technology (Bidault & Butler, 1998; Dowlatshahi, 1997; Frohlich & Westbrook, 2001). Such opposing views mandate comparative studies.

3. Measuring Innovation Performance

A key challenge in understanding how to improve the innovation capacity of entities is the accurate measurement of innovation performance. Innovation performance has traditionally been quantified by adopting measures such as market share, numbers of patents or period of monopoly of the innovation, but each measure alone does not capture the complete picture. Recent research efforts have therefore attempted to identify appropriate measures that more accurately reflect the overall innovation performance of a company, with a recognition that there is a need to collect the right data, rather than collect overwhelming amounts of largely superfluous data (Neely, 2004). Determination of an appropriate set of measures for innovation performance is crucial not only to academic research, but for practitioners: self-evaluation of innovation practices is a key activity for companies seeking to improve their performance.

One of the greatest challenges in measuring innovation performance is the lack of a universally agreed-upon definition of innovation, compared to much more tangible activities such as new product development (Smith, 2005). There is also much debate about the processes that comprise innovation: for example, is research-based discovery a necessary first step of innovation? It has therefore been suggested that the measurement of innovation performance should be centered around factors that are critical for success in a particular business or sector (Birchall & Tovstiga, 2005b), and that innovation performance should compare the innovative activities of a firm to its success in the marketplace (Tidd et al., 2001). It has also been concluded by a number of researchers that the measurement of innovation performance must take into account the nature of the innovation: whether it is institutional, revolutionary or evolutionary (Mezias & Boyle, 2002).

There are numerous suggested frameworks for measuring innovation performance proposed in the literature. While some frameworks are designed to be applied at the level of the firm (Kerssens-van Drongelen &

Bilderbeek, 1999; Bremster & Barsky, 2004), others are intended to be used to compare innovation between firms (Birchall et al., 2011). There are frameworks that are built around measures of the innovation process (Cooper, 1999; Birchall & Tovstiga, 2005a), and those that measure the value of innovation outputs (Andriessen, 2004; Copeland & Antikarov, 2001).

Birchall et al. (2011) carried out a detailed investigation of innovation performance metrics, in an attempt to determine a set of metrics that were simple enough for application by stakeholders, did not require complex, difficult to access data, but that would still measure and cover the key aspects of innovation. They tested a range of measures and, using factor analysis, identified five measures that contribute to key factors that are essential for innovation success. The present study utilizes these measures as the dependent variable, for assessment of innovation performance.

4. Supplier Collaboration and Innovation Performance

There has been much prior literature highlighting the key roles of supplier collaboration in the new product development (NPD) process, and the various advantages of such partnerships (Bidault & Butler, 1998; Frohlich & Westbrook, 2001). The suppliers' technical expertise can provide a forum for the evaluation and improvement of ideas during both the initial stages of the innovation process, and later, during its testing phases. Suppliers with technical knowledge are well-placed to assist NPD teams advance existing products and ideas; and address technical questions more rapidly than internal R&D teams (Haeussler et al., 2012).

Suppliers are well-placed to support the incremental improvement of existing products, through providing technical expertise to increase modularity and therefore lead to a high number of products in a product family (Alford et al., 2000; Halman et al., 2003), as well as providing the technical autonomy to invest and develop subsystems that can then be used by a buyer during the final assembly stage (Kamath & Liker, 1995). However, qualified suppliers are also able to enhance innovativeness and performance of newly-developed products (Abdallah & Matsui, 2007; Al-Zu'bi et al., 2015).

The challenges of supplier collaboration in NPD include contradicting objectives of the two partners (Littler et al., 1995), and barriers to the open sharing of knowledge, particularly when it relates to core competencies. This can arise from a hesitancy of internal employees to working with external partners (Frishammer *et al.*, 2010).

Previous studies have demonstrated that supplier collaboration has a positive effect on NPD in terms of product variety (Al-Zu'bi & Tsinopoulos, 2012), product development time (Tsinopoulos & Al-Zu'bi, 2012) and NPD cost (Tsinopoulos & Al-Zu'bi, 2014). While these studies highlight the importance of supplier collaboration on NPD, they do not provide a complete picture of the effect of this partnership on innovation performance. No study has provided an understanding of the effect of supplier input on innovation performance. It is clear, however, that suppliers have the deep knowledge of the market and consumer needs, as well as the technological capability to contribute positively to innovation performance. This leads to the first hypothesis:

H1: Supplier collaboration in NPD will be positively and significantly related to innovation performance.

5. Lead User Collaboration and Innovation Performance

Lead users have been defined as a unique group of consumers who possess specific needs that are unknown to the wider public, and benefit from helping to find a solution to those needs (von Hippel, 1986). Lead users also possess knowledge that is relevant to an organization's products and product development (Morrison *et al.*, 2000), and are therefore seen as an essential source of information regarding market needs and expectations. This knowledge of the market can enable companies to overcome competitors by the development of innovative new products (Luthje & Herstatt, 2004).

Lead users have long been regarded as a key source of innovation (Lilien et al., 2002), and there has therefore been a focus on identifying ways in which they can be most effectively engaged in the NPD process. The demonstrated benefits of lead user collaboration in NPD include decreased cycle and product development times, lower costs, and greater product quality (Lonsdale & Newell, 1996; Hamann, 1999; Al-Zu'bi & Tsinopoulos, 2012; Tsinopoulos & Al-Zu'bi, 2014).

Potential drawbacks of collaboration with lead users include disruption of internal processes (Abdalla & Phan, 2007), and the risks of leaking internal knowledge and of achieving only incremental innovation (Frishammer et al., 2010; Dahlander & Gann, 2010). Furthermore, it has been noted that, as with suppliers, collaboration with lead users can be hindered if the two parties have different objectives (Eliashberg et al., 1997). Regardless of these potential challenges, it is generally agreed that lead users are likely to benefit a company's new product development process, but no study has directly investigated the effect of lead user collaboration on innovation behavior. We therefore propose the following hypothesis:

H2: Lead user collaboration in NPD will be positively and significantly related to innovation performance.

6. Methodology

6.1 Data Collection

Data for this study was collected by means of a survey, in which respondents were asked to answer questions using a five-point Likert scale, in which 5 signifies strong agreement and 1 signifies strong disagreement. The constructs for partner collaboration in NPD were adapted from Al-Zu'bi, Z.M.F. (2016), and the constructs for innovation performance from Birchall et al. (2011). Following pilot-testing of constructs were pilot-tested by three professors of business management, and subsequent revisions, the survey was administered to 1200 manufacturing companies in Australia, encompassing both local and multinational companies. The questionnaire was sent to the NPD manager, operations manager or plant manager of each company. In total, 840 questionnaires were returned, with 111 excluded from further analysis due to missing data. The 729 usable questionnaires corresponded to a response rate of 60.75%, which is regarded a high response rate for studies in the field of operations management (Frohlich & Westbrook, 2001)

6.2 Measurement Analysis

Construct validity was tested using exploratory factor analysis (EFA) using the Varimax rotation method (Hair et al., 2010), with the criteria that all items for a construct had factor loadings of greater than 0.4 and an eigenvalue greater than 1. Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity were carried out to confirm that the data was appropriate for further analysis. The construct reliability was tested using the Cronbach's α -coefficient, with all coefficients above the threshold of 0.70, confirming sufficient reliability and internal consistency (Table 1).

Table 1. Means, standard deviations, and Cronbach's α -coefficient

Variable	Mean	Standard deviation	Cronbach's α -coefficient	Final number of question items
1. Supplier collaboration in NPD	3.77	0.444	0.799	8
2. Lead user collaboration in NPD	3.33	0.499	0.777	8
3. Innovation performance	3.90	0.511	0.801	6

Exploratory factor analysis results are shown in Table 2. Eight question items measured supplier collaboration in NPD, Eight items measured lead user collaboration in NPD which is in line with Al-Zu'bi, Z.M.F. (2016) and Six question items measured innovation performance which is different result than that of Birchall *et al* (2011) by which the results divided the last measurement of sustainability and overall effectiveness into two separate loadings; which does not affect the study's dependent variable as much it shows uniqueness in response and measurement.

Table 2. Exploratory factor analysis

Supplier collaboration in NPD	We consult suppliers early in the design efforts for new products.	0.801
	We partner with suppliers for the design of new products.	0.777
	Suppliers are frequently consulted about the design of the new products.	0.703
	Suppliers are involved in the new product project only after the design is completed.	0.755
	Suppliers are an integral part of the design effort for the new products.	0.899
	Suppliers are involved in specifying product specifications for the new products.	0.733

	Suppliers are consulted in setting general new product definition.	0.722
	Suppliers are involved in the new product process from the start to the finish.	0.862
	We consult lead users early in the design efforts for new products.	0.799
	We partner with lead users for the design of new products.	0.705
	Lead users are frequently consulted about the design of the new products.	0.905
Lead users collaboration in NPD	Lead users are involved in the new product project only after the design is completed.	0.743
	Lead users are involved in specifying product specifications for the new products.	0.855
	Lead users are an integral part of the design effort for the new products.	0.783
	Lead users are consulted in setting general new product definition.	0.699
	Lead users are involved in the new product process from the start to the finish.	0.900
	Our innovations have higher market impact than others'	0.833
	Our innovation process is more future focussed than others'	0.801
	Our innovation process invests more in capability development than others'	0.843
Innovation performance	Our innovation process utilizes better internal project management than others'	0.905
	Our innovation process caters for sustainability better than others'	0.791
	Our innovation process is more effective than others'	0.865

Extraction method: Principal component analysis

Rotation method: Varimax with Kaiser Normalisation

7. Results and Analysis

The hypotheses of this study were tested using regression analysis. The skewness measured by normality tests, of between -0.112 and 0.132, were consistent with normally-distributed data (Hair et al., 2010). The variance inflation factors (VIF) for the independent variables were below 1.3, confirming that analysis was not compromised by multicollinearity, despite any correlations between the independent variables. (Hair et al., 2010).

The first step of multiple regression analysis involved entering control variables into the hierarchical regression model, with the results showing that the control variables did not significantly affect innovation performance (Adj. $R^2 = 0.018$ Table 3). This was followed by inputting of the independent variables into the regression model, which revealed that the independent variables did have significant contribution to innovation performance (Adj. $R^2 = 0.018$; Table 3). Both supplier collaboration ($\beta = 0.345$) and lead user collaboration ($\beta = 0.489$) had significant effects on innovation performance. Based on these results, both hypotheses H1 and H2 are accepted.

Table 3. Hierarchical Regression Model: Company's Innovation Performance

	Unstdized Coeffs		Stdized Coeffs	t	Sig.
	B	Std. Error	Beta		
Step 1					
(Constant)	7.543	.324		10.001	.000
Company size (number of employees)	-.071	.023	-.033	-.444	.965
Sector of Industry	.055	.015	.022	.634	.833
Length of relationship	.043	.064	.092	1.654	.222
r	.150				
R ²	.0225				
Adjusted R ²	.018				
Regression F-value	5.006				
Step 2					
(Constant)	4.554	.421		9.111	.000
Company size (number of employees)	-.030	.029	-.019	-.408	.785
Sector of Industry	.046	.011	.013	.543	.722
Length of relationship	.009	.052	.063	1.064	.204
Supplier Collaboration in NPD	.401*	.256	.345*	3.336	.000
Lead Users Collaboration in NPD	.556*	.019	.489*	4.551	.000
r	.822				
R ²	.675				
Adjusted R ²	.601				
R ² Change	.6525				
Regression F-value	8.434				

Note: * p<0.001

8. Conclusion

This study investigated the effects of supplier and lead user collaboration in NPD on innovation performance of manufacturing companies in Australia. The analysis revealed a strong positive relationship between collaboration with both lead users and suppliers and innovation performance, although the relationship is stronger for lead user collaboration. The results emphasize the importance of external collaboration on innovation performance. New ideas with high quality are not restricted to internal R&D, but the innovation process can be accelerated and enhanced by involving suppliers and lead users. In today's highly competitive environment, organizations can enhance their competitive advantage by focusing on external alliances and collaboration in NPD. External alliances enable manufacturers to increase and maintain competitive advantages despite declining R&D budgets.

The study highlights the essential role of lead user collaboration in innovation. It is not surprising that lead user collaboration showed higher impact on innovation performance than supplier collaboration. Lead users are invaluable sources of new innovative ideas that represent the future needs of the markets. Companies missing lead user collaboration may not be able to catch up with competitors in the era of globalization and high environmental uncertainty. Overall, this study demonstrates that external alliances have a significant impact on innovation performance with regards to the six metrics used.

The limitation of this paper is that only two external collaborators were investigated: it is possible that there are other external collaborators who also favorably influence the innovation performance. Further in-depth research is needed to investigate how suppliers and lead user collaboration influence different innovation models in services and manufacturing sectors.

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