The Role of Customer Leverage in Process Innovation: Moderating Effect from Market Dynamics

Hung Nguyen (Hung.nguyen@rmit.edu.vn)
School of Business and Management, RMIT University, Vietnam

Norma Harrison (Norma.harrison@mgsm.edu.au)
Macquarie Graduate School of Management, FBE, Macquarie University, Australia

Abstract
With the current unpredictable and turbulent business environment, manufacturers are leveraging customer knowledge as the source of innovation and competitive advantage. Drawing upon the knowledge-based view, this study argues that customer leverage is the source of firms' process innovation. The empirical results from 650 manufacturers showed a strong association between a manufacturing firm's customer leverage and its process innovation and performance. Process innovation acts as a mediating role in absorbing and transforming customer knowledge in improving costs and financial outcomes. In a more dynamic market, customer leverage strengthens the positive impact on process innovation. These findings are important for managers who have to stretch their needs to accommodate resources for sustainable innovation strategies.

Keywords: Customer leverage, process innovation, market dynamics

Introduction
Recent literature re-emphasized the importance of process innovation, especially in combination with internal and external sources to yield superior results (Krishnan and Jha 2011). However, literature concluded that knowledge acquisition and knowledge sharing are the most frequently studied processes, and that more research is needed to elaborate the usage and application of customer knowledge and the impact on processes and performance. This current study addresses the above by defining the concept of customer leverage (CL) below, and examining its relationship with process innovation and performance (financial and cost measures). This study investigates the following questions:

- To what extent does customer leverage affect customer-firm innovation processes?
- How do these value dimensions of customer leverage impact costs and financial outcomes?
- How is the relationship between customer leverage and process innovation influenced by the dynamics of the markets?

It is intended that findings of this empirical study would provide a deeper understanding of the performance outcomes associated with process innovation, allowing organisations, especially small manufacturing firms, to better decide when, how much, and where to invest resources to enhance performances. Furthermore, the current study contributes to the existing literature by investigating the proposed relationships in a more global context with 10 countries, representing different stages of economic development.

This paper is set out as follows. The first section provides theoretical background from process innovation and customer-buyer relationship literature. Next, the study provides the development of the research model and hypotheses. The study design section describes methods and findings. The last section offers interpretations, contributions and limitations.

Theoretical background and research hypotheses

Customer Leverage (CL) and performance

There exist three streams of research that examine customer knowledge. The first stream focuses on the importance of acquisition (Drechsler and Natter 2012; West and Bogers 2014). The second line of research into CL highlights the importance of in sharing knowledge (Peng Wong and Yew Wong 2011; Wong et al. 2013) and the third area of research offers opportunity for improvement (Wagner and Bode 2014; Wang et al. 2016). Taking the tenets from three streams, this study defines a firm's customer leveraging capability as the extent of the focal firms' usage of their obtained knowledge from customers in developing new products and services, and in improving processes (Thakur and Workman 2016). Furthermore, firms can combine customer knowledge and leverage process innovations as a strategic resource, thereby increasing entry barriers for competitors and protecting the firms' market advantage (Smagalla 2004). Learning and applying knowledge from customers in response to market changes and technological innovation can reduce uncertainty and opportunism in the ongoing partnerships with customers, thus lowering transaction costs. Thus, this study argues that:

Hypothesis 1. A manufacturer's customer leveraging capability exerts a direct positive effect on cost efficiency.

Furthermore, customer knowledge could facilitate the process of sensing the new innovation from their position as customers and end users. The latter would know most about the market, thus enlarging market share and creating new engines for growth. This social capital can directly influence the performance such as market share and cost reduction. Collectively, these capabilities suggest that the newly obtained customer knowledge provides opportunities for creating innovative processes that result in operations efficiency and future market share. Accordingly, this study proposes that:

Hypothesis 2. A manufacturer's customer leveraging capability exerts a direct positive effect on financial performance.

Additionally, this study argues that the effect of customer knowledge on performance will be greater in organizations involved in process innovations. After having deployed customer leverage, a manufacturer seeks to earn the returns on its investment and is therefore interested in sustaining a long-term relationship with the corresponding customer firm. The process innovations could be a possible means to strengthen the relationship, because the buying firm benefits from process innovations such as quality improvements and cost reductions on the buying firm's side (Kim 2000). Collectively, the above supports the following hypothesis:

Hypothesis 3. Customer leverage has a positive relationship with process innovation.

Theoretically in the Resource-Based View (RBV), resources that are rare, valuable, difficult to substitute, and imperfectly imitable will contribute to sustainable performance and competitive advantage Most studies argue that customers possess unique knowledge about their preferences (Poetz and Schreier 2012), and therefore, it is reasonable to expect that their involvement increases success in terms of product–customer needs fit (Alam and Perry 2002), consequently in financial measures such as profit (Lau et al. 2010), or market share (Joshi and Sharma 2004). Thus, this study proposes that:

Hypothesis 4. Process innovation strategy has a positive relationship with costs, and Hypothesis 5. Process innovation strategy has a positive relationship with financial performance.

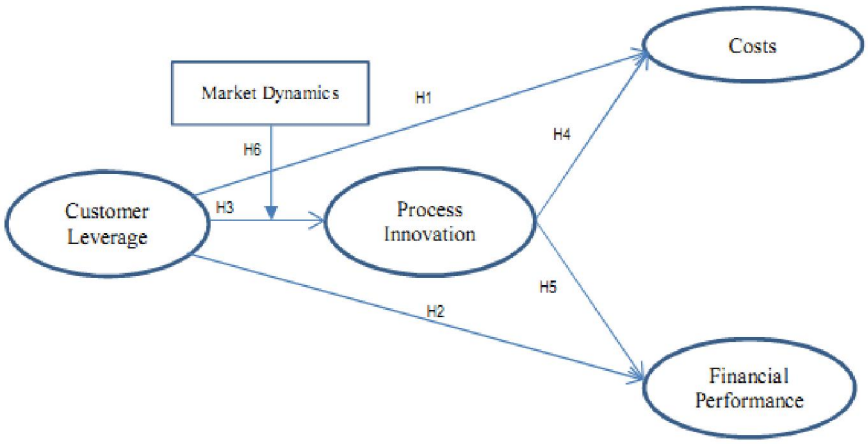

Figure 1. Research model

Firms with more stable markets might deploy the process incremental or exploitative innovation (Wang et al. 2015) whereas exploratory innovation is more speculative and focused on changing market dynamics. Economic theory lends empirical support that higher levels of market dynamics are associated with introducing new processes more frequently. This allows a manufacturer to align operations with changing customer requirements, develop unique capabilities that can reduce costs and lead times associated with customisation, and benefit from market dynamics (Liu et al. 2012). Thus, this study hypothesizes that:

Hypothesis H6: Market dynamics strengthens the positive relationship between customer leverage and process innovation

Research Design

Data collection was done via email using an interactive PDF questionnaire which targeted production and manufacturing managers as key respondents. This questionnaire was developed through the Global Manufacturing Research Group (GMRG) project conducted in 2014. The questionnaire distributed to the sample firms was developed in a rigorous process by key operations management scholars (Whybark et al. 2009).

Table 1 provides the company profiles in this study. The sample consists primarily of small and medium sized companies (74.6% of the sample). Included in the survey are more than twenty manufacturing industries. It can be seen that emerging industries in China, Korea and Taiwan have made relatively significant investments in new processes compared to other developing and developed countries.

Table 1. Respondent country profiles

Country	Frequency	Percent	Ave. GDP per capita	R&D Budget*	Investment New Process*	Training Staff*
Developed						
Australia	10	1.53	$65,600	0.51-0.75%	5-8%	1.1-1.5%
Korea	72	11.1	$45,091	0.76-1%	9-12%	1.6-2%
USA	83	12.8	$52,392	0.51-0.75%	5-8%	1.1-1.5%
Emerging						
Hungary	31	4.8	$13,403	0.26-0.50%	1-4%	0.51-1%
India	54	8.3	$1,548	0.51-0.75%	5-8%	1.1-1.5%
China	27	4.2	$6,626	0.76-1%	9-12%	1.6-2%
Poland	71	10.9	$13,760	0.26-0.50%	1-4%	0.51-1%
Taiwan	40	6.2	$31,900	0.51-0.75%	5-8%	1.1-1.5%
Developing						
Croatia	111	17.1	$13,490	0.26-0.50%	1-4%	0.51-1%
Vietnam	151	23.2	$1,868	0.51-0.75%	5-8%	1.1-1.5%
Total	650	100.0				

Notes: * as a percentage of total plant sales

Research constructs and reliability, validity and discriminant validity tests

The research model included a process innovation construct which focuses on firms' ability to learn more about new processes than their competitors; to be first within the industry in applying new processes; and to be updated with the latest processes (Malhotra et al. 2007; Menor et al. 2007). Customer leverage was assessed by the manufacturer's extent in obtaining, acquiring and applying new customer knowledge (Choi et al. 2002). Financial performance was measured objectively based on market share, revenue and profit increased relative to competitors (Choi et al. 2002).

Table 2 provides the construct's mean of measurement items, standard deviation, loading and p-values. First, the internal consistency reliability test revealed that Cronbach's alphas ranged from 0.701 (Process Innovation) to 0.882 (Financial performance), which exceeds 0.60, the threshold value (Hair et al. 2010). Second, the confirmatory factor analysis (CFA) measurement models confirmed the presence of five unique constructs, and their CFA details are presented in Table 3. The model fit indices were $\chi 2/df = 1.85$, which lies in the recommended range of 1 to 3. Further, the RMSEA value of 0.036 suggests a good model fit. The results in Table 3 showed that all of the average square root values (AVE) were higher than the correlations, again indicating acceptable discriminant validity. In addition, both MSV and ASV values are smaller than AVE (Hair et al. 2010).

Hypothesis testing

A structural equation model (SEM) was used to test the hypotheses. The fit indices indicate a good model fit as shown in Table 4. Table 4 displays the directions and significance of the hypothesized relationships among the constructs. The results supported H1, H3, H4 and H5, which confirmed the positive impacts of process innovation on both costs and financial measures; where customer leverage strongly support costs (H1) but not financial performance (H2). The results supported H1, confirming significant gains on process innovation from customer leverage.

Table 2. Constructs means and reliability measures

Research measurements	Estimate	Mean	SD
Costs (α= 0.823)			
Total product unit costs	0.71	4.39	1.20
Raw material unit costs	0.85	4.48	1.22
Product performance	0.69	4.46	1.14
Financial Performance (α= 0.848)			
Total sales	0.85	4.34	1.21
Profitability	0.88	4.28	1.02
Market share	0.71	4.32	1.13
Market Dynamics (α= 0.738)			
There are many substitutes in the market for your products	0.76	4.50	1.23
Demand for your products is difficult to predict	0.67	4.36	1.02
Suppliers of critical inputs have significant bargaining power	0.70	4.40	1.28
Your industry is subject to rapid technological change	0.68	4.20	1.31
Process Innovation (α= 0.701)			
We are learning more about the newest processes than our competitors	0.79	4.18	1.52
We are the first within the industry to deploy new processes	0.77	4.80	1.33
We keep up with the latest process developments	0.73	5.05	1.40
Process innovation is important to this plant	0.70	4.23	1.23
We frequently introduce processes that are radically different from	0.61	4.33	1.39
We have no difficulty in introducing processes that are radically different from existing processes in the industry	0.71	4.23	1.26
Customer Leverage (α= 0.832)			
We are able to obtain a tremendous amount of technical knowhow from our customers	0.65	4.43	1.14
We rapidly respond to technological changes in our industry by applying what we know from our customer	0.72	4.63	1.26
As soon as we acquire new knowledge from our customer, we try to find applications for it	0.65	4.36	1.21
Our key customer's technological knowledge enriched the basic understanding of our innovation activities	0.88	4.51	1.02
Our key customer's technological knowledge reduced the uncertainty of our innovation activities	0.85	4.52	1.06
Our key customer's technological knowledge helps us to identify new aspects of innovation activities that would otherwise have gone	0.81	4.26	1.23

Note: $\chi2 = 205.8$; df = 111; $\chi2/df = 1.85$; CFI = 0.985; NFI = 0.973; RMSEA = 0.036

Notes: SD: Standard Deviation; RMSEA=Root Mean Square Error of Approximation, GFI=Goodness-of-fit Index, CFI=Comparative Fit Index. The scale format for each of these measures was 1=strongly disagree to 7=strongly agree.

Table 3. Correlation matrix and construct validity measures

Research Constructs	CR	MSV	ASV	AVE	[1]	[2]	[3]	[4]	[5]
[1] Costs	0.796	0.114	0.071	0.568	**0.754**				
[2] Process Innovation	0.837	0.200	0.101	0.508	0.263**	**0.713**			
[3] Customer Leverage	0.892	0.200	0.102	0.582	0.256**	0.447**	**0.763**		
[4] Market Dynamics	0.675	0.107	0.052	0.506	0.185*	0.261**	0.327**	**0.716**	
[5] Financial Performance	0.853	0.114	0.054	0.662	0.337**	0.258**	0.186**	0.025	**0.814**

Note: Diagonal elements in (bold-underlined) are the square root of the average variance extracted (AVE) between the constructs and their measures. Off diagonal elements are correlations between constructs. MSV – Max shared variance and ASV – Average shared variance. For discriminate validity, AVE should be greater than off-diagonal elements. ** Correlation is significant at 0.001.

Table 4. Results of the hypothesis testing

Research constructs and impacts			Estimate	S.E.	C.R.	P	Hypotheses
Costs	<---	Customer Leverage	0.150	0.040	2.717	0.007	H1-Suppported
Financial	<---	Customer Leverage	0.013	0.063	0.269	0.788	H2-Not supported
Costs	<---	Process Inno	0.294	0.046	4.932	***	H2-Suppported
Process Inno	<---	Customer Leverage	0.477	0.048	9.465	***	H3-Supported
Financial	<---	Process Inno	0.350	0.071	6.532	***	H5-Suppported

$\chi2 = 300.251$; df = 158; $\chi2/df = 1.900$; CFI = 0.986; NFI = 0.957; RFI = 0.941; RMSEA = 0.031. Note: S.E = Standard Errors; P = *** Correlation is significant at 0.001.

Moderating effects by Market Dynamics (H6)

Hypothesis H6 suggested that process innovation will be pursued with different emphases based on the degree of market dynamics. A moderated regression analysis was run to test the hypotheses. This procedure provides further refining results supporting the structural models (see Table 4). Table 5 confirms that customer leverage strongly supports process innovation ($\beta = 0.47$ at $p < 0.001$). The moderating effects were tested by creating the product terms between these variables using their standardized scores. The dependent variable, Process Innovation, is jointly determined by the interaction of the predictors (Market dynamics x Customer leverage). The findings show that market dynamics strengthens the positive relationship between customer leverage and process innovation

($\beta = 0.12$ at $p < 0.05$). Therefore, H6 is supported. The interaction and the mixed impacts on process innovation are presented in Figure 2.

Table 5 Moderating effects from market dynamics

	Process Innovation	
	Model 1	Model 2
Size	0.22 ***	0.22***
Customer Leverage	0.46 ***	0.47***
Market Dynamics		0.30***
Customer Leverage x Market Dynamics		0.12*
R	0.541	0.654
Adjusted R^2	0.290	0.420
F Change	88.97***	59.15***

*** Correlation is significant at 0.001; * significant at 0.05

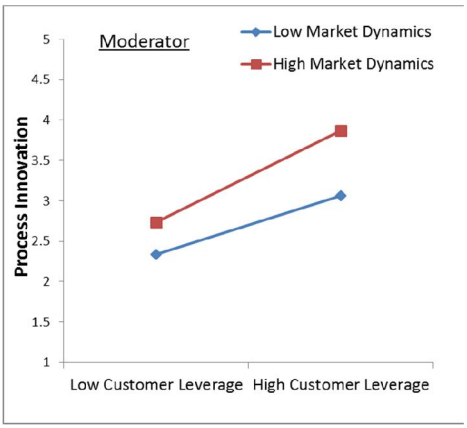

Figure 2. Moderating effects from market dynamics on process innovation

Discussion and implications

This study examined the linkages between a marketing concept, customer leverage and manufacturing performance via process innovation, which in turn affect cost efficiency and the firm's financial performance. Drawing upon the knowledge-based view, this study confirmed that customer leverage has a strong influence on process innovation, where co-created knowledge between customers and manufacturers is able to reconfigure the existing processes to respond rapidly to the unpredictable and turbulent market. Where demand is unpredictable and customer and technological factors change frequently, the effect of perceived customer perception and its accumulative knowledge on process innovation can vary significantly. Process innovation, on the other hand, exerts a mediating effect between customer leverage and performance, including both cost efficiency and financial measures, grounded in transaction cost economics. Collectively, the results shown above provide support to the argument of the importance of leveraging customer knowledge in enhancing process innovation and performance.

From a theoretical perspective, these results extend the existing research in the global manufacturing context that customer knowledge forms an effective source for increasing innovative processes and enhancing the ability of manufacturing companies to adapt in new and different markets. These results are consistent with previous studies (Anne Jalkala 2010; Liao and Barnes 2015) that customer knowledge is a source for innovation strategies. This finding asserts that, in the manufacturing context, customer knowledge is an essential factor to enhance process innovation. This study defines a firm's customer leveraging as the extent the focal firms depend on customers in developing new product, services and improving processes. The findings confirm that the speed and frequency of applying the acquired knowledge from customers will potentially decrease competitive uncertainty and thus lead to improved process innovation. In essence, customer leverage plays a significant role as "business intelligence" in closing the gaps in traditional marketing and initiates process changes through organizational boundaries.

The higher the market turbulence, the stronger the pressures for customer leverage demanded by process innovation. The results of moderating effects from market dynamics on the relationship between customer leverage and process innovation (as in Table 5 and Figure 2) have shown that in dynamic markets (characterized by many

substitutes, fluctuating demand and rapid technological change), investments through customer leverage could help push process innovation to adapt to market changes. These findings enhance the understanding of the important role of knowledge management in supply chain management, especially when the market is fluctuating (Abrell 2016; Revilla and Villena 2012). The results in Table 6 confirm the view that process innovation plays a mediating role in absorbing and transforming customer knowledge in improving costs and financial measures. This is an important result that highlights the mechanism by which customer knowledge can influence a firm's bottom line.

Limitations and future research

The results of this study are subject to some limitations which could be dealt with in future research. First, this study was conducted for manufacturing organizations across different industries, thereby potentially resulting in a greater source of variance, as particular manufacturing industries could exhibit different characteristics and customer responses to process innovation and operate within different market dynamics. Second, the data points were collected from single sources from each firm in the sample (i.e., CEOs or supply chain managers). Although they were considered to be the more relevant informants, the more desirable data collection procedure would have used a design of multiple respondents. Future researchers may replicate this study in industrial sectors other than manufacturing and/or extend this study across the value chain, taking into account manufacturing and service components of networked organizations.

Acknowledgement

The work described in this paper was fully supported by a research grant from the RMIT University, Vietnam.

References

Abrell, T. (2016). "The Role of Users and Customers in Digital Innovation: Insights from B2B Manufacturing Firms." *Information & Management*, 53.

Alam, I., and Perry, C. (2002). "A customer-oriented new service development process." *Journal of services Marketing*, 16(6), 515-534.

Anne Jalkala, R. T. S. (2010). "Practices and functions of customer reference marketing — Leveraging customer references as marketing assets." *Industrial Marketing Management*, 39.

Choi, T. Y., Wu, Z., Ellram, L., and Koka, B. R. (2002). "Supplier-supplier relationships and their implications for buyer-supplier relationships." *IEEE transactions on engineering management*, 49(2), 119-130.

Drechsler, W., and Natter, M. (2012). "Understanding a firm's openness decisions in innovation." *Journal of Business Research*, 65(3), 438-445.

Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2010). "Multivariate data analysis: A global perspective."

Joshi, A. W., and Sharma, S. (2004). "Customer knowledge development: antecedents and impact on new product performance." *Journal of marketing*, 68(4), 47-59.

Kim, B. (2000). "Coordinating an innovation in supply chain management." *European Journal of Operational Research*, 123(3), 568-584.

Krishnan, R. T., and Jha, S. K. (2011). "Innovation strategies in emerging markets: what can we learn from Indian market leaders." *ASCI Journal of Management*, 41(1), 21-45.

Lau, A. K., Tang, E., and Yam, R. (2010). "Effects of supplier and customer integration on product innovation and performance: Empirical evidence in Hong Kong manufacturers." *Journal of Product Innovation Management*, 27(5), 761-777.

Liao, Y., and Barnes, J. (2015). "Knowledge acquisition and product innovation flexibility in SMEs." *Business Process Management Journal*, 21(6), 1257-1278.

Liu, G., Shah, R., and Babakus, E. (2012). "When to Mass Customize: The Impact of Environmental Uncertainty*." *Decision Sciences*, 43(5), 851-887.

Malhotra, A., Gosain, S., and El Sawy, O. A. (2007). "Leveraging standard electronic business interfaces to enable adaptive supply chain partnerships." *Information Systems Research*, 18(3), 260-279.

Menor, L. J., Kristal, M. M., and Rosenzweig, E. D. (2007). "Examining the influence of operational intellectual capital on capabilities and performance." *Manufacturing & Service Operations Management*, 9(4), 559-578.

Peng Wong, W., and Yew Wong, K. (2011). "Supply chain management, knowledge management capability, and their linkages towards firm performance." *Business Process Management Journal*, 17(6), 940-964.

Poetz, M. K., and Schreier, M. (2012). "The value of crowdsourcing: can users really compete with professionals in generating new product ideas?" *Journal of Product Innovation Management*, 29(2), 245-256.

Revilla, E., and Villena, V. H. (2012). "Knowledge integration taxonomy in buyer–supplier relationships: Trade-offs between efficiency and innovation." *International Journal of Production Economics*, 140(2), 854-864.

Smagalla, D. (2004). "Supply-Chain Culture Clash". City: Magazine

Thakur, R., and Workman, L. (2016). "Customer portfolio management (CPM) for improved customer relationship management (CRM): Are your customers platinum, gold, silver, or bronze?" *Journal of Business Research*, 69(10), 4095-4102.

Wagner, S. M., and Bode, C. (2014). "Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing." *Journal of Operations Management*, 32(3), 65-78.

Wang, G., Dou, W., Zhu, W., and Zhou, N. (2015). "The effects of firm capabilities on external collaboration and performance: The moderating role of market turbulence." *Journal of Business Research*, 68(9), 1928-1936.

Wang, Z., Zhang, M., Sun, H., and Zhu, G. (2016). "Effects of standardization and innovation on mass customization: An empirical investigation." *Technovation*, 48-49, 79-86.

West, J., and Bogers, M. (2014). "Leveraging External Sources of Innovation: A Review of Research on Open Innovation." *Journal of Product Innovation Management*, 31(4), 814–831.

Whybark, C., Wacker, J., and Sheu, C. (2009). "The evolution of an international academic manufacturing survey." *Decision Line*, 40(3), 17-19.

Wong, C. W. Y., Wong, C. Y., and Boon-itt, S. (2013). "The combined effects of internal and external supply chain integration on product innovation." *International Journal of Production Economics*, 146(2), 566-574.