Capabilities and Implementation of Inbound Open Innovation: Evidence from LMT Firms in Technologically Less Advanced Countries

MMDR Deegahawature

School of Management, Huazhong University of Science and Technology, 103, Luoyu Road, Wuhan 430074, P.R. China

E-mail of the corresponding author: prasannadee@yahoo.com

Abstract

This study examines the applicability of inbound open innovation, and the effect of capabilities on implementation of inbound open innovation in low-and medium-low technology (LMT) firms in technologically less advanced countries. Based on the resource based view, this study postulates positive causation form capabilities and implementation of inbound open innovation. Particularly, the effect of customer and competitor orientation is assessed. Also, the uncertainty in the business environment changes the firms' strategies thus; a moderating effect of technology turbulence is posited. The proposed hypotheses are tested empirically using cross-sectional survey data collected from 272 LMT firms in Sri Lanka. The results suggest that LMT firms implement inbound open innovation at a moderate level. The results from the hierarchical regression models indicate positive and significant effect from the customer and competitor orientation. Also, the results partially confirm the moderating effect. The effect of competitor orientation is higher in a technologically turbulent environment but, there is no moderating effect on customer orientation. Accordingly, this study empirically confirms the validity of open innovation across the firms and countries irrespective of their technology, and research and development intensity. Further, findings suggest that LMT firms that adapt inbound open innovation should be cautious on capabilities and environment turbulence. Finally, this study provides implication for the managers and suggestions for future research.

Keywords: Inbound open innovation, Capability, Customer orientation, Competitor orientation, Technology turbulence, LMT firms, Technologically less advanced countries

1. Introduction

Innovation has become an integral part of firms in present competitive and global market place. Innovation is studied at different levels such as national, firm, group and individual level. At firm level, it is widely recognized as the key driver to the competitiveness and survival of firms (Edwards et al. 2005; Smith et al. 2008; Essmann & Preez 2009) and finally, to the success of firms in the present challenging business environment (Bigliardi et al. 2012) by delivering value to the stakeholders (Kolk & Püümann 2008). With the technological innovation, firms can abreast with new ideas, and circumvent entry barriers (Tseng 2009). Also, innovative firms sustain and advance their current businesses and start up new businesses (Chesbrough 2006a)

Innovation endeavors of firms are four types which include bringing novelty to product, process, marketing method and organizational method (OECD 2005). In past, the firms adapted a closed approached to management of innovation. It believed that whole innovation process should be kept under the strict control of the firm, thus it was based on internal research and development (R&D) activities (Chesbrough 2006b). However, due to the later changes in the innovation land scape, firms gradually rely on multiple channels of innovation which caused to emerge a new approach to management of innovation which is called open innovation (Chesbrough 2006b). Open innovation encourages innovation through extensive link with outside firms over more porous organizational boundaries. Out of three archetypes of open innovation, inbound open innovation refers to the use of external knowledge in different steps of innovation process. Accordingly, inbound open innovation uses purposive inflow of knowledge/ technology to enable firms to acquire new knowledge and competencies. Thus, inbound open innovation uses external sources of knowledge to enhance the internal competency and innovation process. This explains the extent of use of external knowledge by dealing with outside knowledge sources. It determines the extent of a firm's openness in external technology exploration strategy.

Among the plethora of literature on open innovation, studies on low-and medium-low technology (LMT) firms are scare (Hirsch-Kreinsen et al. 2005; Heidenreich 2009; Vrande et al. 2009; Santamaría et al. 2009). Also, present studies generally focus on technologically developed countries (Karo & Kattel 2010) and there is a criticism that open innovation has studied largely on American enterprises (Vrande et al. 2009). Nevertheless,

open innovation may applicable in the firms other than those belong to high-tech industries, and also outside the technologically advanced countries. There are evidences for the importance and validity of open innovation across many firms and contexts (Huizingh 2011).

Performance of firms depends on not only opportunities but also resources of firms. Resources of firms are two types: assets and capabilities. According to the resource based view, possession of distinctive capabilities by a firm is essential to achieve competitive advantages (Barney 1991; Zhou et al. 2005). Zhou et al. (2005) insist the value of resource based view in explaining the usefulness of capabilities as a determinant of innovation. One important strategic capability of a firm is market orientation which includes customer orientation, competitor orientation and inter-functional coordination (Narver & Slater 1990). There are research based evidences that the market orientation influence the innovation performance (i.e. Zhou et al. 2005).

This paper has three objectives. First, it examines the validity and applicability of open innovation in LMT firms in technologically less advanced countries. Second, based on the resource based view, this study postulates that capabilities of firms determine the adaption of inbound open innovation strategy. Particularly, this study attempts to investigate the effect of market orientation (customer and competitor) on firms' openness in external technology exploration strategy. Third, the uncertainty of environment stimulates and changes the firms' strategies (Ettlie 1983) thus, the moderating effect of technology turbulence on the relationship between market orientation and implementation of inbound open innovation strategy is also examined. This study is original and contributes to the present knowledge in various ways. First, it deepens our understanding about the applicability of open innovation across firms and countries, particularly firms with different level of technology intensity by examining LMT firms, and countries with different level of technology development by examining technologically less developed countries. Secondly, it helps understand the role of capabilities in implementing inbound open innovation by examining effect of customer and competitor orientation. Finally, its contribution widens our understanding on the effect of external environment conditions by examining the effect of the technology turbulence. The rest of the paper is structured as follows. The next section reviews the relevant literature on open innovation, market orientation and technology turbulence, and develops study hypotheses. The third section describes the research methodology adopted in this study. The fourth section reports and discusses the analysis and results of the empirical study, whereas final section outlines the discussion, conclusions, and directions for future studies.

2. Literature Review and Hypotheses

Innovation is the economic application of new ideas (Subrahmanya 2005). New ideas refer to those relate to the new or significantly improved product or process, new marketing methods and organizational methods in business practice, workplace organization or external relations (OECD 2005). Open innovation brings new ideas to organizational method of managing innovation process by creating a new business model. Open innovation insists the need of innovating innovation (Chesbrough 2006b). It highlights that the way, the firms generate and commercialize the new ideas, has been subjected to a fundamental change. Innovating innovation insists the necessity of experiment with novel business models (Chesbrough 2006b; Kolk & Püümann 2008) with other aspects of innovation such as product innovation, process innovation etc. Open innovation can be implemented by outside–in, inside–out or coupled processes (Gassmann & Enkel 2004). The outside–in process refers to the inbound open innovation strategy where external knowledge sources are used throughout the innovation process to enhance the internal competency and innovation process. Whereas, the inside–out process refers to the outbound open innovation strategy which uses purposive outflows of knowledge to commercialize the technology, enabling firms to seek out different paths to market. The coupled process simply integrates both inside–out and outside–in processes by working in alliance with complementary partners (Gassmann & Enkel 2004).

The outbound open innovation strategy involves searching and working with various external knowledge sources. Laursen & Salter (2006) categorize sources of knowledge into four categories: market, institutional, other and specialized. They include sources such as suppliers, clients, competitors, consultants, commercial laboratories/ R&D enterprises under the category of market, whereas institutional category includes universities and other higher educational institutions, government research centers, other public sector (i.e. business links, government offices), and private research institutes. According to them, other category includes professional conferences and meetings, trade association, technical/ trade press and computer data bases, fairs and exhibitions, whereas specialized category includes technical standards, health and safety standards and regulations, and environmental standards and regulations. Keupp & Gassmann (2009) also present a similar classification of sources of knowledge which includes three categories: other firms, institutions and consulting and specialized information. By introducing a concept of search breadth and depth to inbound open innovation, Laursen & Salter (2006)

present them as two components of the openness of external search strategies of a firm. The external search breadth refers to "the number of external sources or search channels that firms rely upon in their innovative activities", whereas the depth refers to "the extent to which firms draw deeply from the different external sources or search channels" (Laursen & Salter 2006, p. 134). Accordingly, the verity of sources or search channels, with which a firm engages in, determines the breadth. Whereas, the depth is determined by the intensity of using each source or search channel. Laursen & Salter (2006) use these two concepts to determine the extent to which the firms are open in term of inbound open innovation.

There are studies which focus on the relationship between strategic orientation and innovation (Bryan 1999; Matsuno & Mentzer 2000; Kumar et al. 2012). Strategic orientation is the set of principles that directs and influences the activities of a firm, and generates the behavior intended to ensure viability and performance (Hakala & Kohtamäki 2011; Hakala 2011). Hambrick (1983) defines strategic orientation as a pattern of responses to the operation environment of the firm so that it can achieve higher level of performance and competitive advantages. These patterns or principles are the philosophy of a firm that leads the way in which a firm conducts its business with deeply rooted values and beliefs that guides the firm's endeavors to achieve superior performance (Gatignon & Xuereb 1997). In other words, these patterns or principles can be used as the direction, guidance or motivation towards the activities of the firm (Hakala 2011). Based on the guidance given by those values and beliefs, the way of using resources and transcend capabilities, and unifying the resources and capabilities are decided. The strategic capabilities determine the firms' conduct and thereby, firms introduce novel organization methods of managing innovation. The resource based view also supports this argument. Thus, strategic orientation may influence the implementation of inbound open innovation.

Market orientation is prominent among strategic capabilities. It basically concentrates on creation of superior value to the customers in compared to competitors. Thus, it is defined as the "organization culture that most effectively and efficiently creates the necessary behavior for the creation of superior value for buyers and thus, continuous superior performance for the business" (Narver & Slater 1990, p. 21), and can be viewed as a 'customer pull' philosophy. Jaworski & Kohli (1996) insist that market orientation need to be incorporated as a source of innovation, and innovation is an outcome of market innovation. Market oriented firms are highly responsive to the changing needs of the customers thus, may be more innovative (Narver & Slater 1990). Also, based on the resource based view, market orientation can be viewed as one of important capability that determines firm's innovativeness.

Narver & Slater (1990) identify three sub-components of market orientation which are customer orientation, competitor orientation and inter-functional coordination. The confluence of these three components creates unique resources for achieving competitive advantages. These three components comprehend the activities related to acquisition and dissemination of market information, and finally comprehend collective creation and delivery of superior customer value (Narver & Slater 1990). This study explores the effect of the customer and competitor orientation on implementation of inbound open innovation strategy.

Customer orientation: The customer orientation refers to a firm' ability in understanding its target customers so that they can continuously create superior value to them (Narver & Slater 1990). The customer oriented firms understand the present value chain of the customer and its future changes so that they can create value to the customers. Superior customer value can be delivered to the customers by two ways: by increasing the benefits to the customers compared to his/her cost, and by decreasing the cost of the customers compared to his/her benefits. Customer orientation helps firms understand the present and future potential customers, their present and future needs, and what they perceive as their present and future satisfiers of wants (Narver & Slater 1990). The customers potential needs may not be expressed by themselves since such needs are beyond the present customer experience (Grinstein 2008). Thus, the firms' own knowledge becomes a key in recognizing the potential future needs of the customers and developing the product and services that fulfill such needs. Competitive advantages can be achieved not only by serving the present needs of the customers but also by meeting the potential latent needs of them (Narver & Slater 1990). Also, customer orientation helps firm understand the market and its behavior such as segments, importance and growth (Gatignon & Xuereb 1997). Sufficient understanding of the target market including the present and potential needs of the customers makes it possible to meet and exceed customer expectations. With the aim of meeting and exceeding the customer expectations and delivering a superior value to them, firms need to acquire technological know-how. It can be developed internally by internal R&D. Since LMT firms are weak in R&D capacity (firm categorized into LMT due to lower R&D), such firms may acquire technology/ knowledge externally, thereby engage in external technology exploration activities. Therefore, the following hypothesis is postulated.

H_1: The customer orientation has a positive effect on implementing inbound open innovation.

Competitor orientation: The competitor orientation provides with knowledge and understanding on present and potential key rivals' strengths and weaknesses in short term and capabilities and strategies in long term (Narver & Slater 1990). This provides firms with the ability and willingness to identify, analyze and respond to the competitors' actions (Gatignon & Xuereb 1997). The firms can capitalize this knowledge to understand the roadmap of industry and technological change, and it helps firms demarcate the technological changes in the industry landscape. This insists the need and importance of assessing the entire technological capabilities of present and potential competitors which could be used to satisfy customers in the market. This knowledge can also be used to create differentiated product and services that are innovative and attractive than the competitors' products and services. Stressing on the innovation output Gatignon & Xuereb (1997) state that the competitor orientation has a positive effect when it is blended with some sort of customer orientation. Based on this insight, firms may understand the level of needed knowledge to be competitive, and thereby understand the missing knowledge within them. Due to the weak position of LMT firm in creating internal knowledge by extensive R&D, such firms may rely on external sources of knowledge. Accordingly, competitor oriented firms likely engage in knowledge exploration activities. Thus, the following hypothesis is posited.

H_2: The competitor orientation has a positive effect on implementing inbound open innovation.

Technology turbulence: The present technological environment undergoes a rapid change, and this refers to the technology turbulence. Technology turbulence refers to the speed of change and unpredictability of technology in an industry (Jaworski & Kohli 1993). The changing technological environment creates opportunities and challenges to firms, and opportunities includes introduction of new products, upgrade products, enhance customer bases, etc. So long as firms can utilize opportunities and face challenges, they can remain and sustain in the market (Li & Calantone 1998). Also, these opportunities and challenges stimulate changes in current strategies of the firm (Ettlie 1983) thus; it may affect the strategies related to the customer and competitor orientation. Accordingly, the turbulent environment may influence the relationship of both customer orientation and competitor orientation with inbound open innovation strategy. More turbulent environment create more opportunities thus, a positive influence can be posited. Therefore, the following hypotheses are proposed.

H_3: Technological turbulence positively moderates the relationship between customer orientation and implementing inbound open innovation.

H_4: Technological turbulence positively moderates the relationship between competitor orientation and implementing inbound open innovation.

3. Methodology

3.1 Sample and Data Collection

This study investigates the extent of implementation of inbound open innovation strategy by LMT firms in technologically less advanced countries, the effect of both customer and competitor orientation on inbound open innovation strategies and moderating effect of technology turbulence. The empirical research for testing the hypotheses adopted a questionnaire based cross-sectional survey approach and was conducted in a technologically less advanced country[1]. The study selected five industries in LMT category as per the industry categorization of OECD sector (Hatzichronoglou 1997; Hirsch-Kreinsen 2008). Selected industries included Rubber and plastics products, Basic metals and fabricated metal products, Wood, pulp, paper, paper products, printing and publishing, Food products, beverages and tobacco, Textiles, textile products, leather and footwear. Other industries were dropped due to lower number of firms. The sample consisted with 660 firms employing 25 or more employees, of which the population was 2,496 firms. The research planned to gather 330 responses after allowing 50 per cent for non-response and rejection rate. However, only 312 firms responded for the questionnaire, yielding 47.27 per cent response rate. Out of these responses, 40 responses were discarded due to incompletion. Finally, 272 responses were retained for the analysis, yielding 41.21 per cent net response rate. The age of the firms in the sample ranged from 1 to 60 years. The majority of the firms (27 firms) were 12 years old. 25% of the firms were below 11 years old while 25% of the firms were over 22 years old. Out of the total sample, 50% was below 15 years old. The firm size was measured in term of number of employees in the firms. The sample consisted with firms employing 25 to 6000 employees. On an average, firms employed 107 employees. 25% of the firms in the sample were having below 42 employees while 25% of the firms employed over 95 employees. Out of the total sample, 50% was having below 63 employees.

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[1] Technologically less advanced countries are the Scientifically Lagging Nations as of "RAND's Science and Technology Capacity Index". The country selected is Sri Lanka.

3.1 Variables and Measures

This study used the instrument of Narver & Slater (1990) to operationalize both customer orientation and competitor orientation, and they were operationalized as first order latent variables. These instruments have been widely used in different studies (Gray et al. 1998; Gao et al. 2007; Zhou et al. 2008). Also, several studies used and validated these instruments in the context of innovation (Gatignon & Xuereb 1997; Lukas & Ferrell 2000; Zhou et al. 2005; Hult et al. 2005). Thus, these instruments were appropriate to be used in this study. The customer orientation and competitor orientation were measured by using six and four scale items respectively by asking respondents to rate their firms by comparing two competitors during last two years, over a seven point likert scale (1 = "strongly disagree", 7 = "strongly agree"). This research also used an instrument based on Jaworski & Kohil (1993) to measure technology turbulence. This instrument was appropriate since the same has been used in open innovation studies such as Lichtenthaler (2009). To operationalize the technology turbulence, this research adapted four scale items of Zhou & Wu (2010), and used similar seven point likert scale. Also, the extent of using inbound open innovation was measured by the procedure used by Laursen & Salter (2006). Contrast to their procedure, this study converted it to a 10-point index where zero indicates 'use of no inbound open innovation strategy' while ten indicates 'use of inbound open innovation strategy at a highest degree'.

Construct Validity: This study adapted the two-step approach recommended by Anderson & Gerbing (1988) to refine and assess the measures for construct validity. Firstly, all multi-item scales (customer orientation, competitor orientation and technology turbulence) were assessed by exploratory factor analysis. Communalities for all items were well above the threshold point of 0.50 (Hair et al. 2009), and factor loadings exceeded the theoretically expected valve for all items (over 0.70). Thus, no items were deleted. Secondly, confirmatory factor analysis was run for all focal variables. After dropping three items due to higher cross loading, the measurement model achieved a satisfactory fit to the data (χ^2 [49]= 167.28, $p < .001$; goodness-of-fit index [GFI] = 0.93, root mean square error of approximation [RMSEA] = 0.08, root mean square residual [RMR] = 0.06; incremental fit index [IFI] = 0.96, normed fit index [NFI] = 0.94, comparative fit index [CFI] = 0.96). All factor loadings were highly significant ($p < .001$), and composite reliabilities of each constructs (over 0.97) exceeded the minimum threshold point of 0.60 (Bagozzi & Yi 1988). Also, average variance extracted (AVE) of all constructs (0.55 – 0.85) exceeded the minimum cut-off-point of 0.50 (Hair et al. 2009). Therefore, adequate convergent validity and reliability of construct exist (Fornell & Larcker 1981). The discriminant validity of the measures was tested by calculating the shared variance between all possible pairs of construct, and then comparing them with AVE to determine whether they were lower than the AVE of the individual constructs (Fornell & Larcker 1981). All AVE values (0.55 – 0.85) were adequately higher than the shared variance with the other construct (0.23 – 0.52), in support of discriminant validity. These results confirm that the measures of the study possess adequate reliability and validity.

Also, the study considered several control variables identifying the characteristics of the firms (age and size of the firm). Age of the firm was measured by the number of years, the firm has been doing business. Size of the firm was determined by the number of employees. This study adapted a component-wise analysis of market orientation.

4. Analysis and Results

The table 1 summarizes basic descriptive statistics and correlations of the focal variables. The results show that LMT firms adapts inbound open innovation strategy at a moderate level ($M = 5.69$, $SD = 1.80$). Both customer orientation ($M = 5.22$, $SD = .86$) and competitor orientation ($M = 5.33$, $SD = .93$) of LMT firms are at moderate level. The environment demonstrates average level of technology turbulence ($M = 4.52$, $SD = 1.14$). The results show that 12 correlations out of 15 are statistically significant. Also, it shows that both customer orientation and market orientation are significantly and positively correlated ($p < .001$) with implementation of inbound open innovation, supporting the postulated relationship. Though the size of the firm has no association, the age has a positive and significant association on inbound open innovation.

Table 1. Basic descriptive statistics and correlations

Variable	Mean	SD	1	2	3	4	5	6
1. Inbound open innovation	5.69	1.80	1					
2. Customer orientation	5.22	0.86	.49***	1				
3. Competitor orientation	5.33	0.93	.43***	.68***	1			
4. Technology turbulence	4.52	1.14	.50***	.45***	.65***	1		
5. Age of the firm	17	9	.14**	.01	.14*	.13*	1	
6. Size of the firm	107	365	.10	.05	.19***	.17**	.20***	1

Notes: $N = 272$; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

This study used hierarchical regression method to test hypothesis and to assess the explanatory power of each set of variables (Aiken & West 1991). This method can explain whether or not interaction terms have significant effects over and above the direct effect of the independent variables, and thereby the existence of interaction effect (Wiklund & Shepherd, 2003). The scales used to construct the interaction effect were mean-centered with the aim of alleviating the potential threat of multicollinearity and explaining the effect of interaction terms (Aiken & West 1991). The issue of multicollinearity was examined by variance inflation factor (VIF) for each construct in each regression equation. The maximum VIF value within the models (2.72) is far below the cut off value of 10 (Neter et al. 1990), alleviating the concern of multicollinearity. The results of regression analysis are presented in the Table 2.

Table 2. Results of Hierarchical Regression Analysis

Variables	Model 1		Model 2		Model 3	
	b (s.e)[a]	β	b (s.e)[a]	β	b (s.e)[a]	β
Capability						
Customer orientation	.75 (.15)	.36***	.79 (.14)	.38***	.95 (.15)	.45***
Competitor orientation	.36 (.14)	.19**	.17 (.08)	.09**	.22 (.11)	.11*
Control variables						
Age of the firm			.02 (.01)	.10*	.02 (.01)	.10*
Size of the firms			5.05E-5 (.00)	.01	2.74E-5 (.00)	-.01
Technology turbulence			.60 (.10)	.38***	.55 (.11)	.35***
Moderating effects						
Customer orientation × Technology turbulence					.04 (.14)	.02
Competitor orientation × Technology turbulence					.28 (.14)	.15*
R	.50		.59		.61	
R^2	.26		.35		.37	
ΔR^2	.26		.09		.02	
R^2 (adj)	.25		.34		.36	
F	45.92***		28.75***		22.50***	

Note: Dependent variable: Implementation of Inbound Open Innovation

$N = 272$; *** $p<.001$, ** $p<.01$, * $p<.05$

[a]Unstandardized coefficients with standard errors in the parentheses and standardized coefficients are reported

The model 1 includes capabilities, and explains statistically significant amount of the variance in implantation of inbound open innovation strategy ($R^2 = 0.26$, $p <.001$). Results shows that both customer orientation (β = 0.36, $p < .001$) and competitor orientation (β = 0.19, $p < .01$) are positively and significantly related to implementation

of inbound open innovation strategy. This finding supports the postulated relationships in hypothesis 1 that the customer orientation has a positive effect on implementing inbound open innovation; and hypothesis 2 that competitor orientation has a positive effect on implementing inbound open innovation strategy. In model 2, control variables were included and this set of variables explains a significant amount of additional variance in implementation of inbound open innovation ($R^2 = 0.35$, $\Delta R^2 = 0.09$, $p < .001$). This confirms the effect of control variables in assessing the relationship between capabilities and implementation of inbound open innovation, and insists the need of controlling possible variables. Even after introducing the control variables, main variables remain significant. Finally in model 3, interaction effect of technology turbulence was considered. The interactions accounts for a significant amount of variance in implementation of inbound open innovation ($R^2 = 0.37$, $\Delta R^2 = 0.02$, $p < .001$). Firstly, the interaction term of customer orientation $\times$ technology turbulence has positive but insignificant effect ($\beta = 0.02$, $p = .75$). This does not support the hypothesis 3 which proposed a positive moderation effect from technological turbulence on the relationship between customer orientation and implementing inbound open innovation. Secondly, the interaction term of competitor orientation $\times$ technology turbulence has positive and significant moderating effect ($\beta = 0.15$, $p < .05$). This finding supports the postulated effect in hypothesis 4 which proposed that the technological turbulence positively moderates the relationship between competitor orientation and implementation of inbound open innovation strategy. Also, adjusted R^2 increases gradually from model 1 to 3.

5. Discussion and Conclusions

Among the plethora of open innovation literature, LMT firms and technologically less advanced countries are largely unexplored. Also, the effect of capabilities on implementation of inbound open innovation strategies is less researched. Thus, this study attempted to fill this gap by exploring the causal link between capabilities and implementation of open innovation. Particularly, the extent of implementation of inbound open innovation strategy, and the effect of customer and competitor orientation on implementation of inbound open innovation strategy by LMT firms in technologically less advanced countries were examined.

This study contributes to the present body of open innovation literature in several ways. Using 272 LMT firms covering five industries in Sri Lanka, this study found that LMT firms adapt outbound open innovation strategy ($M = 5.69$ over 10-point index). This finding suggests that open innovation is not limited to high-tech firms or to certain countries including technologically advanced countries and emerging economies, also it is applicable to LMT firms in technologically less advanced countries. Thus, at present, it has become a global trend (Hung & Chiang 2010). Further, this empirically confirms the speculation of scholars that open innovation is valid across the firms with asymmetrical technology intensity (Chesbrough & Crowther 2006; Santamaría et al. 2009). Although various antecedents and their effect on implementation of open innovation have been studied, the effect of capabilities was unclear. Particularly, this study focused on two capabilities – customer and competitor orientation – and results indicate significant positive effect of both capabilities on implementation of inbound open innovation. Thus, this study found that those capabilities play an important role as determinants of open innovation implementation. Accordingly, this study contributes to open innovation literature by stressing the importance of capabilities, and insisting the applicability of capability perspective in implanting open innovation. The firms, which strive to create superior value to the customers by identifying their current and latent needs, are more open in inbound open innovation than those who do not. Also, the higher knowledge about competitors enhances the openness of firms in inbound open innovation. On the other hand this suggests that the firms, which need to implement inbound open innovation, need to be cautious on the capabilities of firms such as customer and competitor orientation. The results indicate that the technology turbulence positively moderates the relationship between competitor orientation and implementation of inbound open innovation. This suggests the effect of external environment factors in implanting inbound open innovation. In an environment where the technology changes at a rapid rate, firm will be benefited largely by having better knowledge about competitors. However, contrary to the theoretical speculation that posited positive effect of technology turbulence on the relationship between customer orientation and implementation of open innovation, the result found positive but insignificant relationship, indicating no effect of technology turbulence. This may be explained as the shift of focus of firms in a highly turbulent environment. Rather than concentrating on bringing superior customer value by identifying and fulfilling the customer present and latent needs, firms in turbulent environment may focus on generating products and services with superior technology.

The outcome of this study has several implications to managers. The results of this study indicate that LMT firms in technologically less developed countries adapt open innovation providing empirical evidence and alleviating the criticism that open innovation is limited to high-tech firms in certain countries. LMT firms also

should acquire external knowledge from various sources to complement with internal knowledge. Thus, LMT firms should strive to implement inbound open innovation strategy and get benefited out of it including competitive advantages and sustainability. Also, this study found that capabilities such as customer and competitor orientation affect the implementation of inbound open innovation strategy. Thus, firms expecting to implement such strategies should closely work with and enhance the capabilities. Finally, the study found that the technology turbulence intensify the effect of competitor orientation on implementation of inbound open innovation by LMT firms while there is no effect on customer orientation. It provides an insight to LMT firms to be selective in developing capabilities to support open innovation implementation endeavors taking the environmental condition into consideration.

This research focuses on new area of study, investigating the effect of capabilities on implementation of inbound open innovation strategy. Apart from the merits, contributions of this study should be considered with the appropriate understanding of limitations which open opportunities for future studies. Firstly, this research was based on five industries out of nine LMT industries. This limits the generalizability of the outcome to the LMT firms opening an opportunity for a research on entire LMT category. Secondly, this study did not consider the possible differences among industries and between low and medium-low categories of industries. However, it would be interesting to inquire how different industries differ in implementation, and in their effect of capabilities on implementing inbound open innovation. Thirdly, this study did choose only two capabilities, opening further investigation opportunities to consider other capabilities. Also, though this study used component-wise analysis, studies considering composite analysis are sought. Fourthly, this study considers only one external factor, technology turbulence. However, it indicated that the external environment factors condition the relationship between capabilities and open innovation implementation, requiring further scientific investigations. Finally, this study postulated a causation mechanism from the capabilities to the implementation of inbound open innovation. Though the appropriate research design is longitudinal design for the studies in this nature, this study adopted cross sectional approach, opening an opportunity for further investigation by longitudinal research design.

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MMDR Deegahawature (Mohotti Mudiyanselage Dharsana Rathnayake Deegahawature) is a doctoral candidate at School of Management, Huazhong University of Science and Technology, Wuhan, P.R. China under Chinese Government Scholarship Program. He received his master's degree in business administration (management of technology) from Asian Institute of Technology, Bangkok, Thailand in 2006. Also, he received master's degree in business administration from University of Colombo, Colombo, Sri Lanka in 2003. His bachelors' degree in business administration was received from University of Sri Jayewardenepura, Nugegods, Sri Lanka in 1999. He is a Senior Lecturer at Department of Industrial Management, Faculty of Applied Sciences, Wayamba University of Sri Lanka, Sri Lanka. His areas of research interest include technology management and innovation management.