The Influence of Environmental Factors on Product Innovations in Emerging Markets: The Institutional Theory Perspective

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Abstract

This study addresses how environmental factors in emerging markets affect product innovation properties, categorized as frugality, sociality, and technological sophistication. A questionnaire survey among Japanese overseas subsidiaries in 13 emerging countries was conducted to collect data on environmental factors and new product innovation characteristics. Hierarchical OLS regression analysis was employed to estimate the influences. The results reveal that companies in emerging markets tend to adopt frugality, sociality, and technological sophistication innovation when consumers have low purchasing power, institutional voids exist, and resources are available, respectively. Traditional innovation literature has been built on the assumption of consumer affluence and resource abundance. However, the findings might not apply to the context of emerging markets owing to environmental constraints in these markets. This study is the first to empirically show the influence of environmental circumstances on firms' innovation strategies. The issue of generalizability may exist because of the limited number of samples collected from firms originating in one country (i.e., Japanese overseas subsidiaries). However, this study provides a framework to better understand how the innovation decisions of firms operating in emerging markets may vary depending on environmental factors. This study provides critical insights into how firms should adapt their innovation strategies to the market environment.

Keywords: consumer affordability, emerging market, frugality, innovation sophistication, institutional voids, resource availability, sociality

1. Introduction

Innovation research has traditionally focused on technological sophistication carried out by large firms operating in developed countries. This stream of research is based on the assumption that innovation resources and affluent consumers exist that enable firms to implement premium pricing and gain high returns on their investments (Prahalad & Mashelkar, 2010). However, this assumption may not be relevant to market environments in emerging countries, where formal institutions, physical infrastructure, and stable regulation are often inadequate or unavailable. In fact, many firms operating in these markets suffer from acute scarcity of resources, and consumers simply cannot afford to buy high-priced products (Prahalad, 2012). To cope with this issue, several studies have attempted to delineate new types of innovation that are expected to be more applicable to emerging markets (Mudambi, 2011). These include what are known as frugal innovation, resource-constrained innovation, Jugaad innovation, social innovation, and reverse innovation (Bhatti & Ventresca, 2013; Brem & Wolfram, 2014; Zeschky, Winterhalter, & Gassmann, 2014). Empirical evidence suggests that some of these innovations have successfully created consumer demand in emerging markets (Ernst et al., 2015; Bhatti, 2012).

Despite the growing interest in innovation strategies targeting consumers in emerging markets, the extant literature is still in its infancy. To date, we have little understanding of whether and how innovation strategies vary across countries. More specifically, it is currently unclear how the development of innovation is contingent upon several environmental characteristics that may be unique to a country. This study aims to fill this gap in the literature. In particular, we address how managers' decisions to develop an innovation are influenced by the environmental circumstances of the country in which they operate their businesses. Three innovation properties are proposed to characterize different innovation strategies: *frugality*, *sociality*, and *technological sophistication*. Frugality pertains to innovation development intended to provide no-frill products to fulfill the demand of consumers belonging to the bottom and lower middle classes. Sociality concerns new product development

intended to resolve various social problems typically arising in emerging markets owing to institutional voids (Mulgan et al., 2007; Bhatti, 2012). It is a property associated with the embodiment of creative and innovative solutions to social problems, social impact, and business interests. Technological sophistication is akin to product innovation traditionally practiced in developed markets but puts more emphasis on cost efficiency through processes such as design thinking, bricolage, creative improvisation, and lean innovation.

For environmental factors, we focus on the role of three variables: *resource availability*, *institutional voids*, and *consumer affordability*. Resource availability is critical for innovation development, as its process relies on the use of a variety of resources. Institutional voids represent the absence or underdevelopment of institutions that enable and support market activity (Khanna & Palepu, 1997). Unlike developed markets with well-prepared institutions, many emerging countries have poor institutional conditions, giving rise to severe social problems for consumers and firms operating in the local environment (Bhatti, 2012; Scott, 2007). Consumer affordability refers to the ability of consumers to purchase products from innovative firms. As the sale of new products is the ultimate goal of every innovation initiative, it should play a significant role in governing firms' strategies. Drawing on institutional theory (North, 1997; Peng, Wang, & Jiang, 2008), we build some hypotheses regarding the influence of environmental factors on the type of innovation adopted by firms. The hypothesized relationships are then examined empirically using survey data collected from managers of Japanese firms' overseas subsidiaries located in 13 countries.

The main contributions of this study are twofold. First, it deepens our understanding of how firms adapt their innovation strategies to local environments that appear to be different across markets. This understanding is critical to explaining why firms in different markets adopt different approaches to innovation. Second, our findings provide useful insights into the innovation strategy a firm should adopt when entering a market in an emerging country.

2. Literature Review and Hypothesis Development

2.1 Innovation in Emerging Markets

Traditional innovation research in developed economies has typically illustrated that innovation should be composed of entirely new technology and entails considerable financial and human capital resources that may not be readily available for firms in emerging markets. Two criteria are usually used to evaluate an innovation: either its process or outcome (Phills, Deiglmeier, & Miller, 2008). The former perspective suggests that, although not necessarily original, innovation must have some features that are new to its users. The latter implies that innovation should result in improvement by being either more effective or more efficient than the existing solutions that are to be replaced. Bhatti (2012) suggested that innovation involves not only sophisticated and capital-intensive research and development (R&D) by industrial organizations but also incremental improvements to existing technology (Bhatti, 2012). In other words, innovation does not necessarily have to be entirely new or require massive financial and human capital associated with high-tech R&D.

The notion that environmental conditions for innovation vary between firms in developed and emerging countries is widely acknowledged. Many scholars have attempted to explain this discrepancy from different perspectives. For instance, based on the theoretical lens of the *Diamond of Competitive Advantage*, Porter et al. (2001) argued that while emerging markets are attractive, as they offer low manufacturing costs and access to key markets, consumers in those markets have low purchasing power (Porter et al., 2001). Another critical limitation of these markets is the scarcity of skilled labor and materials required for the process of innovation (Shane & Venkatraman, 2000). Some scholars have pointed out that firms in emerging markets are typically copycats, beginning their businesses by imitating technologies that have already proven successful in advanced economies. Given the market conditions, many studies have focused on technological transfer from headquarters in advanced markets to emerging markets and the management of knowledge transfer instead of innovation. This line of research tends to neglect the capability of firms in emerging markets to engage in the development of innovative products. The growth of innovation initiatives in emerging countries has been viewed as merely knowledge spillover from headquarters in developed countries (Li, Zhang, & Lyles, 2013).

Nevertheless, the recent development of innovations in emerging markets has drawn increasing attention from both academia and practitioners in recent years. Some scholars have even argued that some innovations developed in emerging countries have been exported to advanced markets (Immelt, Govindarajan, & Trimble, 2019), indicating that firms in emerging markets are generating valuable innovation, despite severe market environments. It should be noted that innovation developed by firms in emerging markets is different from that in developed economies. Innovations developed by subsidiaries to serve emerging market consumers typically have properties that are different from those that target developed market consumers.

Unlike top-down sophisticated R&D-driven innovations, which are created under abundant resources, innovation in emerging markets is driven by limited consumer affordability and resource scarcity (Prahalad & Mashelkar, 2010). However, challenges stemming from such environmental constraints could motivate managers to discover new solutions by recombining existing knowledge and resources in a novel way. Furthermore, innovation in emerging markets is often developed using bottom-up, human-centric, and cost-efficient approaches through processes such as design thinking, bricolage, creative improvisation, and lean and reverse innovation (Bhatti, 2012). These approaches have generated various types of innovation, including cost innovation, resource-constrained innovation, bottom-of-the-pyramid innovation, frugal innovation, affordable value innovation, reverse innovation, Gandhian innovation, and Jugaad innovation. For example, cost innovation refers to innovation created at a dramatically low cost by leveraging the cost advantage (Williamson, 2010). Resource-constrained innovation is developed in a market where affluent consumers, skilled labor, and investment resources are limited (Ray & Ray, 2009). Frugal innovation pertains to "good enough" affordable products that meet the needs of resource-constrained consumers (Zeschky, Winterhalter, S, & Gassmann, 2011). Weyrauch and Herstatt (2017) proposed three criteria for frugal innovation: substantial cost reduction, concentration on core functionalities, and optimized performance (Weyrauch & Herstatt 2017). Affordable value innovation is the development of new products that meet customers' low-price expectations while offering them value (Cai, Ying, & Wu, 2019). Reverse innovation is an innovation that is first adopted in developing countries before being exported to advanced economies. Gandhian innovation refers to a fast, creative, and improvised way of solving problems in a resource-constrained environment at a lower cost.

In terms of their objectives, innovations in an emerging market can be classified into those intended to satisfy the needs of low-income consumers (i.e., frugality), resolve various social problems (i.e., sociality), and introduce technologically sophisticated products (i.e., technological sophistication). Previous studies have indicated that the type of innovation adopted may vary among firms and countries. We anticipate that these differences can be explained, at least partially, by environmental conditions in the markets. In what follows, we elaborate on the properties of these innovations and describe how they are likely to be influenced by environmental factors.

2.1.1 Frugality Property of Innovation

Frugality is the most common innovation property in emerging markets. Most of the innovations previously discussed emphasize cost efficiency so that firms can provide consumers with affordable products. This is in line with Cai et al.'s (2019) finding that meeting the low-price expectation of emerging market consumers is critical for an innovation to be successful (Cai, Ying, & Wu, 2019). Weyrauch and Herstatt (2017) also suggested that frugal innovation can be attained through substantial cost reduction and performance improvement of a product's core functionalities (Weyrauch & Herstatt 2017). Some scholars have even suggested that frugal innovation typically does not have sophisticated technological features but meets customers' basic needs at a low cost with comparably high value (Zeschky et al., 2011; Brem & Wolfram, 2014; Ernst et al., 2015).

Some researchers have argued that developed economies are not the ground for frugal innovations because firms operating in these markets are typically committed to old industrial models and technologies (i.e., legacy systems) and top-down sophisticated R&D-led innovation approaches. They are deeply embedded in a context with better institutions, higher levels of human capital, and greater financial and technological resources (Prabhu, 2017). However, some frugal innovations originating in emerging markets have been adopted by consumers in developed markets (Govindarajan & Euchner, 2012). For example, low-priced apparel products made in China have gained acceptance from consumers in the United States.

2.1.2 Sociality Property Innovation

Social innovation can be defined as a novel solution to social problems that is more effective, efficient, and sustainable than existing ones, for which the value created accrues primarily to the whole society, rather than private individuals (Phills et al., 2008). Mair and Marti (2006) pointed out that, unlike business innovation, social innovation is designed to embody creative and innovative solutions to social problems and achieve social impact, rather than mere financial returns (Mair & Marti, 2006). However, in many cases, purely social innovation is difficult to sustain for firms in emerging markets owing to limited financial and human resources. Therefore, in addition to designing creative and innovative solutions to social problems and generating social impact, it is critical for firms to achieve financial returns to make innovation sustainable.

In the context of emerging markets, a variety of social problems exist because of institutional voids, that is, the absence of or inadequate social systems and institutions (Mulgan et al., 2007). This circumstance creates several unmet needs among consumers caused by the lack of institutional responses. In such conditions, products that satisfy unmet needs could create benefits, such as a higher standard of living, reduced income inequality,

employment generation, and overall well-being. Khanna and Palepu (2010) suggested that consumers in emerging markets may not adopt an innovation because of its low price unless the product helps them deal with a specific social issue (Khanna & Palepu, 2010). In other words, innovation that helps consumers cope with some issues caused by inadequate institutional conditions could create higher demand, even though it is somewhat expensive for consumers.

2.1.3 Technological Sophistication

Technological sophistication comprises the technological traits of innovation. Technological innovation can be divided into constructive and disruptive innovation (Schumpeter, 1934). Christensen et al. (2018) suggested that constructive innovation concerns new technology that has a lower cost and performance measured by traditional criteria but higher ancillary performance (Christensen et al., 2018). On the other hand, disruptive technologies enter and expand emerging market niches, improving with time and ultimately attacking established products in their traditional markets. Some scholars have attributed constructive technological innovation to large corporations because they have good access to resources. However, an increasing number of entrepreneurs engage in disruptive innovation (Shane & Venkatraman, 2000). Regardless of who innovates, there has been little debate in previous research on the need to access and control resources for innovation to occur. The procurement, control, and combination of labor, skills, and materials are crucial to the creation of new products and services (Hsu, 2008).

Most studies have suggested that innovations in emerging markets employ different approaches for resource exploitation, such as bottom-up, cost-efficient approaches through processes such as design thinking, bricolage, creative improvisation, and lean and reverse innovation (Bhatti, 2012). For example, frugal innovation attempts to create significantly more value while minimizing the use of resources (Radjou & Prabhu, 2015). Some researchers have found that while lacking in viable opportunities, legitimacy, or intellectual properties, many ventures stubbornly survive in penurious environments and are able to provide valuable products and services by relying on bricolage for resource mobilization (Baker & Nelson, 2005; Gundry et al., 2011). However, regardless of the approach being applied—traditional R&D lead innovation or innovation developed in emerging markets—innovation should always have the property of technological sophistication.

2.2 Environmental Factors in Emerging Markets

Emerging markets are often characterized by a lack of strong legal frameworks, proper infrastructure, and critical resources. These markets also have a large number of bottom-of-the-pyramid consumers (Prahalad, 2008). Previous research has shown that emerging markets differ from developed markets in several aspects, including resource availability, challenges and opportunities for dealing with institutional voids, and the need to address the needs of the base of the pyramid consumers (Bhatti, 2012). In this research, we focus on the influence of consumer affordability, institutional voids, and resource availability on the development of innovations by firms operating in emerging markets.

2.2.1 Consumer Affordability

Consumer affordability pertains to resource scarcity in the value chain downstream. Relative to their counterparts in developed markets, most consumers in emerging markets belong to the low or middle classes with modest incomes and limited access to mainstream goods and services (Schilling & Shankar, 2019). Over four billion people living in developing countries have very low affordability because they earn an income of less than USD 2 per day (Prahalad, 2012). This large segment poses a challenge for multinational corporations, entrepreneurs, and governments alike to provide affordable solutions that help mitigate poverty and its consequences. As most innovations in emerging markets target these consumer segments, their properties are expected to be influenced by consumers' buying power.

2.2.2. Institutional Voids

Institutional voids represent the absence or underdevelopment of institutions that enable and support market activity (Khanna & Palepu, 1997). Institutions can be formal, as in the case of formal rules, laws, and constitutions, or informal, as in the case of behavioral norms, conventions, and codes of conduct (North, 1997). Institutions that are consistent, integrated, and reliable allow entrepreneurs to form expectations about the future, such as whether to invest in innovation, by removing some uncertainty regarding whether they will be able to gain a return on their investments (Baumol, 2002). In other words, well-developed institutions would guarantee that firms are doing business in a fair context.

In emerging markets, basic social infrastructures such as transportation systems or hospitals are underdeveloped, and institutions such as laws and regulations are yet to be prepared. Hoskisson et al. (2000) suggested that

challenges are likely to arise in emerging economies because of weak institutional infrastructure and the existence of different institutional voids (Hoskisson et al., 2000). This would result in higher costs for procuring materials, capital, information, skills, and new ideas, subsequently reducing the likelihood of efficient outcomes for companies targeting these markets. Furthermore, this situation can make it difficult for firms to meet consumer needs. Khanna and Palepu (2010) suggested that institutional voids could cause dysfunction of markets, opportunism, and excessive rents for a few actors, as well as market power concentration (Khanna & Palepu, 2010). This would eventually lead to various social problems for all actors in the market (Bhatti, 2012; Scott, 2007). Therefore, providing new solutions or innovations for such social problems can help firms secure their position and legitimacy in the environment.

2.2.3 Resource Availability

Resource availability refers to the extent to which resources such as skilled labor, capital, materials, components, and funds are accessible for firms (Shane & Venkatraman, 2000). To run their businesses, entrepreneurs and firms require access to three types of resources: (1) inputs such as labor, capital, and raw materials; (2) process-related knowledge, including technology and operational know-how; and (3) markets, including distribution channels and contracts with foreign and domestic customers (Markides & Williamson, 1996). It is widely acknowledged that for countries that rely on primary industries, establishing heavy industries would be unlikely, not only because vital components are rarely available, but also because equipment for producing such components, along with skilled labor to assemble them, are extremely limited. Unlike those operating in developed markets, firms in emerging markets do not enjoy the freedom of resources due to a lack of infrastructural development, technological advancement, an affluent customer base, and financial resources.

2.3 Theory and Hypothesis Development

Traditional innovation research is based on the assumptions of consumer affluence and resource abundance (Prahalad & Mashelkar, 2010). However, extant theories or findings derived from studies in developed economies may not be relevant to market conditions in an emerging economy (Peng & Luo, 2000). In fact, innovations that have taken place in emerging markets indicate a paradox between the traditional innovation theories and the actual market situation (Young, Peng, Ahlstrom, & Bruton, 2002). In this study, we draw on institutional theory to explain how environmental factors affect firms' innovation decisions in emerging markets. Institutional theory illustrates how various groups and organizations behave to secure their positions and legitimacy by conforming to the rules and norms of the environment (Meyer & Rowan, 2006; Scott, 2007). According to this theory, institutional systems surrounding organizations affect organizational processes and decision-making. Further, North (1997) suggested that institutions provide the rules of the game that govern human interactions in societies and that organizations are the players bound by formal and informal rules (North, 1997). In the business field, firms would behave properly to secure their positions and legitimacy in their external environment and adapt their processes to the unique challenges and demands of the environment (Peng et al., 2008).

As previously outlined, consumer affordability in emerging markets is low. Furthermore, consumers in such markets typically have limited access to various financial services, resulting in a reduction in their consumption choices (Banerjee & Duflo, 2007). From the perspective of institutional theory, we can regard low consumer affordability as resource scarcity at the downstream of the value chain. In other words, low consumer affordability is a sort of unique local environmental rule and norm that cannot be easily controlled by a firm. Therefore, although companies operating in such an environment may be motivated to change or improve the environment (Karnani, 2010), it would be more profitable to develop new product innovations that meet consumers' needs (i.e., products that are sold at low prices). Therefore, we anticipate that companies in emerging markets will provide affordable solutions to meet the needs of consumers with low purchasing power. Hence, we expect the following relationship to hold:

Hypothesis 1: Consumer affordability is negatively associated with the frugality property of innovation in emerging markets.

Further, well-prepared institutions that promote fair market transactions are still rare in emerging markets, which produces substantial institutional voids that could lead to various social problems. Institutional voids exist in emerging markets because the instrumental institutions in these markets are often unstable and underdeveloped (Bruton & Ahlstrom, 2010). At a more fundamental level, basic social infrastructure such as transportation systems, which are the basis for the operation of modern society, are outdated. In such circumstances, social problems frequently occur. For example, in a society with no patent protection systems, firms lack interest in investing too much in new product development.

Institutional theory suggests that firms behave properly to secure their positions and legitimacy by conforming to the rules and norms of the environment. In the environment of emerging markets, where people are desperately looking for solutions to different kinds of social problems, products or services that help solve such social problems or can be used to develop an institution would gain legitimacy from consumers (Bhatti, 2012; Scott, 2007; Prahalad, 2008). When this is the case, products that merely reduce the cost of existing products are likely to fail. In contrast, products that deal with such social issues will get better market responses and are more sustainable in the local market (Khanna & Palepu, 2010). Hence, we propose the following hypothesis:

Hypothesis 2: Institutional voids are positively associated with the sociality property of innovation in emerging markets.

Personal, raw materials, components, and financial resources play a critical role in the new product development process. In developed markets, it would be relatively easy to procure resources to develop new products. By contrast, firms in emerging markets struggle to secure the resources needed to make copycat products, let alone innovative products (Bhatti, 2012). However, the scarcity of resources may differ across countries. For firms operating in markets where innovation resources are relatively easier to procure, the development of technology-based innovations would be more feasible than for those operating in more severe market conditions. Although the quality of resources may not be as high as those in developed countries, firms would be able to use them to craft new products with new technological attributes. Hence, we anticipate the following relationship:

Hypothesis 3: Resource availability is positively associated with the technological sophistication property of innovation in emerging markets.

Figure 1 depicts the conceptual model used in this study. The above hypotheses are represented by arrows from environmental factors to innovation properties. Note that we control for the effects of product type, competition, and firm capability.

3. Methodology

3.1 Sample and Procedures

Data were collected through a questionnaire survey conducted between January and September 2017. We selected overseas subsidiaries of Japanese manufacturing companies located in emerging markets as our sample. In this study's context, we focus on a new product development project in each subsidiary targeting local market consumers. Following Ernst et al. (2015), we adopted a two-stage sampling procedure to measure the development process of the project and its consequences separately to avoid the issue of common method variance (Podsakoff et al., 2003; Ernst et al., 2015). We created two sets of questionnaires: one was sent to project managers in charge of new product development, and the other was sent to senior managers who assessed the consequences of the new product.
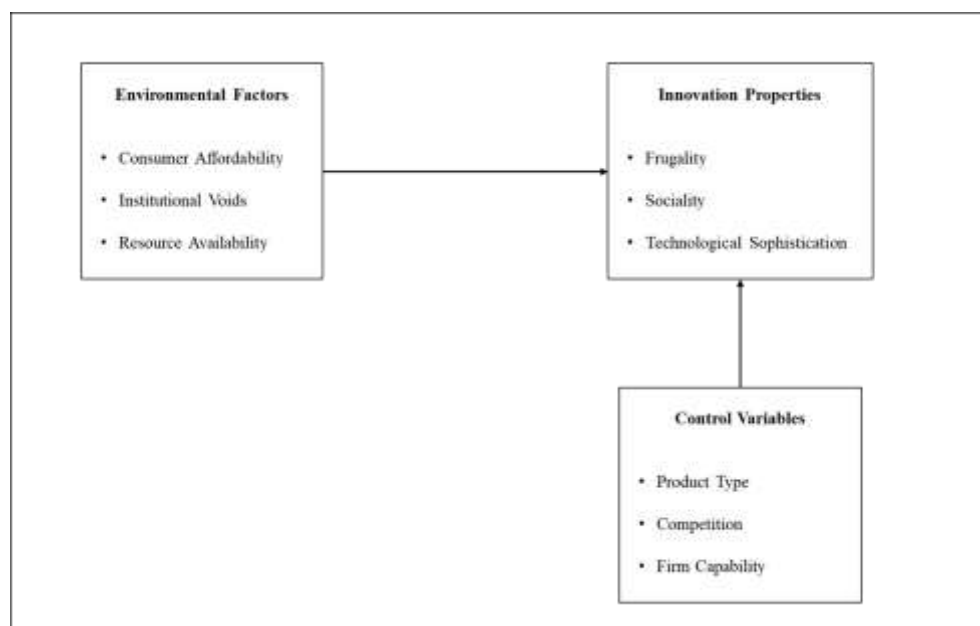

Figure 1. Conceptual model

We conducted random sampling using the Toyo Keizai Overseas Japanese Company Database (Toyo Keizai, 2016), which served as the sampling frame. The database has been frequently used to sample Japanese companies in previous studies (Delios & Henisz, 2000). We focused on the manufacturing sector because some of our questions, such as production cost and the degree of technological sophistication, were only relevant to the context of physical product development (Eppinger & Ulrich, 2015). To ensure sufficient variance among the variables in question, various manufacturing industries, ranging from materials to consumer goods located in different geographical areas, were included in the sample. As the criteria for emerging markets, we used the list of emerging markets defined by the International Monetary Fund (2016). We excluded subsidiaries established within the last five years to minimize any bias stemming from a firm's initial stage of business operation.

Questionnaires were sent to 1,159 subsidiaries of Japanese companies in emerging markets. After sending several reminders, we received 167 responses (14.4%), of which 155 (13.3%) were valid. The net response rate of 13.3% is considered plausible when compared with the usual response rates, which range from 6% to 16% in international surveys (Harzing, 1997). Among the available 155 responses, 52 companies answered that they had conducted at least one new product project in the past five years. Therefore, we used these 52 responses as the final sample in our analysis. The descriptive statistics of the sample are shown in Table 1.

Table 1. Overview of the sample (n = 52)

Company profile						Project profile	
Country		Industry		Established year		Project duration (months)	
Thailand	10	Chemical	13	1960s	1	1–6	17
China	7	Electronics	13	1970s	7	7–12	15
Indonesia	6	Machinery	10	1980s	5	13–18	4
Vietnam	6	Automotive	8	1990s	25	19–24	10
Brazil	5	Metal	4	2000s	14	25–36	5
Taiwan	5	Daily consumer goods	4			37–48	1
Malaysia	4			Employees		Project full-time participants	
India	2			30–99	9	1–4	17
Mexico	2			100–299	14	5–9	12
Phillipine	2			300–499	9	10–19	15
Czech	1			500–999	13	20–49	5
Hungary	1			1000–1999	5	50–200	3
Pakistan	1			2000–4000	2		

3.2 Measurement

3.2.1 Dependent Variables

As discussed above, we describe the nature of innovation in emerging markets in terms of three dimensions: frugality, sociality, and technological sophistication (Bhatti, 2012; Brem & Wolfram, 2014; Immelt et al., 2009). As there is no established scale for these constructs, we developed some scales based on extant conceptual and qualitative studies. We asked project managers to rate the project's objectives through six questions, using a seven-point Likert scale ranging from "1 = strongly disagree" to "7 = strongly agree": (i) to reduce manufacturing cost, (ii) to develop a low-priced product relative to the competitor's product, (iii) to solve local social problems, (iv) to respond to local societal needs, (v) to introduce sophisticated technology, and (vi) to improve technical product specifications. The first two questions were intended to measure frugality. The third and fourth questions pertained to the degree of *sociality*. Drawing on the conceptual works of Brem and Wolfram (2014) and Bhatti (2012), project managers were asked to specify the extent to which their project targeted local societal problems or specific needs. Finally, the fifth and sixth questions concerned the degree of *technological sophistication*, as it represents the development of technology-based solutions (Bhatti, 2012; Ernst et al., 2015). We used the average of the corresponding items as the scores of frugality, sociality, and technological sophistication.

To check the discriminant validity of the constructs, we performed a confirmatory factor analysis (CFA) for all six items of the project objective questions. As a result, we obtained a satisfactory model fit: $\chi2/d.f. = 7.613/6$ (p. = 0.268), RMSEA = 0.072, and CFI = 0.974. Furthermore, as for internal consistency, the values of Cronbach's

alpha were 0.68 for frugality, 0.75 for sociality, and 0.71 for technology. Thus, we confirmed that our measures properly captured the three dimensions of the innovation properties.

3.2.2 Independent Variables

For the independent variables, we measured local resource availability by asking the subsidiaries' presidents about the availability of three human resources in that country, using questions on a seven-point Likert scale: 1) qualified technical personnel, 2) qualified marketing personnel, and 3) qualified management personnel (Shane & Venkatraman, 2000; Khanna & Palepu, 2010). We included some inverted items to avert the risk of common method variance. The average of the values was operationalized as local resource availability, as the Cronbach's alpha of these measures was 0.94. Regarding institutional voids, we asked the presidents about the condition of infrastructure for business operations in the country. Based on Khanna and Palepu (2013), we employed the following statements: 1) Law, policy, or other public rules are sufficiently prepared for our local business. 2) Financial institutions such as banks are adequately prepared for our local business. 3) We have difficulty obtaining good parts and materials in the local institutional environment (Khanna and Palepu, 2013). The first and second statements were reverted to minimize common method variance bias. Cronbach's alpha for the items was 0.74. Thus, after reverting the first and second items, we calculated the average value of all items and used it as the institutional voids' variable. The measurement of consumer affordability was based on several conceptual and qualitative studies. In particular, we asked the respondents how they evaluated the income condition of the target customers (Bhatti, 2012; Brem & Wolfram, 2014; Govindarajan & Trimble, 2013). Specifically, the respondents were asked whether they agreed with the following statements: 1) Our customers suffer from a shortage of money, 2) customer income is quite low, and 3) customers' price reduction requests are severe. We operationalized the average as consumer affordability. The Cronbach's alpha was 0.67.

3.2.3 Control Variables

The type of innovation may vary depending on the characteristics of the industry, firm capabilities, and local business environment. Therefore, we introduced three control variables: industry, company capability, and local business environment. First, we included a dummy for firms in the consumer goods industry. Past studies have indicated that firms operating in the industry adapt to local market conditions more sensitively than those in other industries. Next, we introduced a firm capability index. We assumed that a company is more likely to obtain commercial success from new products when they have more functions, which would affect their orientation toward innovation activities. Following the conceptual framework proposed by Rugman, Verbeke, and Yuan (2011), we measured this variable by asking a corporate president whether their company possessed the following corporate functions (multiple answers): 1) formal new product development organization, 2) manufacturing facilities, 3) formal marketing department, and 4) its own distribution system (Rugman, Verbeke, & Yuan, 2011). We then operationalized the variable (i.e., company capability) by summing the number of functions chosen by the respondents. We found that the variable was highly correlated with indicators such as the number of employees, company age, and capital size. Specifically, the older the firm, the larger the number of employees, and the larger the amount of capital a company possesses, the more functions they were likely to possess. Therefore, we did not include these indicators because of multicollinearity issues.

For local environmental differences, we introduced the degree of *competitive severity* in our models. We anticipated that competitive severity could influence firms' decisions regarding the development of a new product; firms facing more severe competitive environments would experience more pressure from their competitors to develop more superior products. Following Jaworski and Kohli (1993) and Birkinshaw, Hood, and Jonsson (1998), we measured the variable by asking respondents about the following three items on a seven-point Likert scale (1=absolutely disagree, 7=absolutely agree): 1) the competition within the local market is very serious, 2) the change in market needs is very quick, and 3) the change in product features and technology is extremely difficult. One item was inverted to avoid the risk of common method variance. Cronbach's alpha was 0.62, and the average value of the items was used to represent the degree of competitive severity (Jaworski & Kohli, 1993; Birkinshaw, Hood, & Jonsson,1998). Table 2 presents the correlations among the variables discussed above.

Table 2. Mean, standard deviation, and correlations of variables

	mean	s.d.	1)	2)	3)	4)	5)	6)	7)	8)	9)
1) Frugality	4.686	1.252	1.000								
2) Sociality	4.312	1.352	0.043	1.000							
3) Technological sophistication	5.234	1.190	-0.235	0.454	1.000						
4) Consumer affordability	3.744	0.872	-0.361	-0.113	0.159	1.000					
5) Institutional voids	4.520	1.658	0.122	0.201	-0.074	-0.040	1.000				
6) Local resource availability	4.387	1.385	0.210	-0.177	-0.410	-0.037	-0.335	1.000			
7) Consumer goods	0.061	0.242	-0.141	-0.144	-0.195	0.026	-0.081	0.021	1.000		
8) Competitive severity	4.904	0.866	-0.422	0.206	0.403	-0.028	0.311	-0.492	-0.104	1.000	
9) Firm capability	0.780	0.231	-0.065	0.157	-0.027	-0.076	0.276	-0.184	0.151	0.049	1.000

Note: The consumer goods variable is operationalized as a dummy variable

4. Results

We tested our hypotheses using hierarchical OLS regressions. Tables 3, 4, and 5 show the estimation results for models with frugality, sociality, and technological sophistication serving as dependent variables, respectively. For each dependent variable, we tested the effects of the control variables in Model 1 and subsequently introduced each independent variable in Models 2, 3, and 4. Finally, we incorporated all independent variables in Model 5. As shown in Table 3, competitive severity appears to be the only control variable that affected the frugality property of innovation ($\beta = -0.69, p < 0.01$). The negative sign of its coefficient implies that companies are less likely to engage in frugal innovation when competition in the local market is fierce. We conjecture that this might be because companies consider it difficult to generate profits from the low-income market in highly turbulent circumstances, as competitors tend to reduce prices, which leads to price competition. In other words, moderate competition induces companies to engage in frugal innovation.

The coefficient of consumer affordability is significant, with a negative sign ($\beta = -0.54, p < 0.01$), providing support for H1. That is, when many consumers in the local market earn a low income, local subsidiaries are likely to develop frugal or low-priced products. By contrast, the effect of resource availability and institutional completeness on frugality did not appear to be significant. Therefore, we concluded that consumer affordability is the most influential environmental factor of the frugality property of innovation.

For sociality, the results revealed that none of the effects of the control variables were significant (see Table 4). Institutional voids appear to be the only variable that significantly affected the sociality property of innovation ($\beta = 0.33, p < 0.05$). The results suggest that social innovation is more likely to be realized in emerging markets with more serious institutional voids. Thus, H2 was supported.

Lastly, looking at Model 5 for *technological sophistication*, we found that under highly *competitive severity*, companies tend to develop a product that has high *technological sophistication* in emerging markets ($\beta = 0.38, p < 0.05$). We assumed that companies would consider technological sophistication to be one of the sources of competitive advantage in serious competition. For the dependent variables, only resource availability had a positive influence on technological sophistication ($\beta = 0.27, p < 0.05$). That is, companies were likely to develop technologically sophisticated products when local resources were more accessible, providing support for H3.

Table 3. Results of the hierarchical OLS regression analysis for frugality

	Dependent Variable: *Frugality*									
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Beta	s.e.	Beta	s.e.	Beta	s.e.	Beta	s.e.	Beta	s.e.
Intercept	8.012***	1.048	5.870***	1.173	7.856***	1.604	7.957***	1.389	6.262***	1.759
Independent variables										
Consumer affordability			−0.529**	0.166					−0.541**	0.179
Resource availability					−0.017	0132			0.030	0136
Institutional voids							−0.003	0.111	−0.023	0.105
Control variables										
Consumer goods	−0.872	0.593	−0.919†	0.544	−0.872	0.599	−0.951	0.707	−0.868	0.657
Firm capability	−0.196	0.683	−0.330	0.627	−0.174	0.711	−0.087	0.765	−0.321	0.719
Competitive severity	−0.631**	0.186	−0.634***	0.170	−0.619**	0.212	−0.639**	0.204	−0.685**	0.217
Model statistics										
Adjusted R^2	0.161		0.295		0.144		0.141		0.260	
Δ Adjusted R^2 from Model F-1			0.134		−0.017		−0.020		0.099	
P. of F-statistic	0.009		0.000		0.022		0.029		0.004	

n = 52. All two-tailed tests. *p<0.05, **p<0.01, ***p<0.001.

Table 4. Results of the hierarchical OLS regression analysis for sociality

	Dependent Variable: *Sociality*									
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Beta	s.e.	Beta	s.e.	Beta	s.e.	Beta	s.e.	Beta	s.e.
Intercept	2.434†	1.268	1.507	1.546	2.859	1.939	−0.208		1.505	0.586
Independent variables										
Consumer affordability			0.229	0.219					−0.112	
Resource availability					0.046	0.160			0.152	
Institutional voids							0.312*		0.120	0.329*
Control variables										
Consumer goods	−0.522	0.717	−0.542	0.717	−0.522	0.724	−1.044		0.767	−1.045
Firm capability	0.916	0.826	0.858	0.827	0.856	0.859	1.615†		0.829	1.468†
Competitive severity	0.248	0.225	0.247	0.224	0.214	0.256	0.455*		0.221	0.344
Model statistics										
Adjusted R^2	0.002		0.004		0.016		0.135		0.118	
Δ Adjusted R^2 from Model F-1			0.002		0.014		0.133		0.116	
P. of F-statistic	0.382		0.388		0.538		0.033		0.076	

n = 52. All two-tailed tests. *p<0.05, **p<0.01, ***p<0.001.

Table 5. Results of the hierarchical OLS regression analysis for technological sophistication

	Dependent Variable: *Technological sophistication*									
	Model 1		Model 2		Model 3		Model 4		Model 5	
	Beta	s.e.	Beta	s.e.	Beta	s.e.	Beta	s.e.	Beta	s.e.
Intercept	2.836**	1.019	3.653**	1.239	4.803**	1.512	2.404†	1.339	5.301**	1.750
Independent variables										
Consumer affordability			0.202	0.175					0.222	0.178
Resource availability					0.216*	0.125			0.267*	0.133
Institutional voids							0.045	0.107	0.093	0.104
Control variables										
Consumer goods	−0.813	0.576	−0.796	0.575	−0.814	0.565	−0.773	0.682	−0.841	0.654
Firm capability	−0.195	0.664	−0.143	0.663	−0.473	0.670	−0.027	0.737	−0.118	0.716
Competitive severity	0.532**	0.180	0.533**	0.180	0.372*	0.200	0.558**	0.197	0.381*	0.210
Model statistics										
Adjusted R^2	0.154		0.159		0.188		0.116		0.188	
Δ Adjusted R^2 from Model F-1			0.005		0.034		−0.038		0.034	
P. of F-statistic	0.011		0.015		0.007		0.051		0.020	

n = 52. All two-tailed tests. *p<0.05, **p<0.01, ***p<0.001.

To check the robustness of the results, we conducted regressions using randomly selected subsamples (90% of the original sample). We found that the empirical results regarding hypothetical relationships were the same as those obtained from the full sample, although the level of significance decreased by approximately 10%.

5. Discussion and Contributions

In this study, we examined how local environmental factors affect the innovation activities of firms targeting local emerging markets. Our empirical analysis using a questionnaire survey among subsidiaries in emerging countries of Japanese multinational companies revealed that environmental factors had a significant impact on innovation properties. As proposed by Prahalad (2008), different approaches are needed for emerging markets owing to a large number of bottom-of-the-pyramid consumers (Prahalad, 2008). A growing amount of research has been conducted to investigate the features and mechanisms of innovation in emerging markets and the difference between innovation in emerging markets and developed markets. Most scholars have attempted to identify unique innovation types in emerging markets, such as frugal innovation, resource-constrained innovation, Jugaad innovation, and institutional innovation. At the same time, attention is being paid to how these different types of innovation are developed: in other words, how the mechanism of innovation differs from R&D-led innovation. For example, Prahalad and Mashelkar (2010) suggested that instead of premium pricing and resource abundance, innovation in emerging markets is driven by environmental factors such as affordability and sustainability (Prahalad & Mashelkar, 2010). However, empirical investigations addressing these relationships are scarce.

Based on Bhatti's (2012) model of frugal innovation, we suggest that innovation development in emerging markets has three main properties: frugality, sociality, and technological sophistication (Bhatti,2012). Subsequently, we empirically verified the relationships between these properties and their driving factors, including consumer affordability, institutional voids, and local resource availability. The results indicate that customer affordability positively affects the frugality of new product development. In other words, low consumer affordability in emerging markets prompts companies to develop frugal solutions or innovations with high frugality to meet consumer needs. In traditional research, premium pricing and resource abundance play a critical role in driving innovation. By contrast, our results suggest that a different approach to new product innovation can be applied to target consumers with low affordability in emerging markets.

Furthermore, our examination showed that institutional voids could stimulate innovation in social solutions. Several scholars have proposed that institutional voids and market failures offer fertile ground and new spaces for business activities (Khanna & Palepu, 2010; Bhatti, 2012). In line with previous studies, we suggest that

institutional voids can cause different types of social problems, and companies targeting local markets will try to provide solutions for these social problems to secure their positions and legitimacy. In turn, legitimacy benefits firms targeting local markets.

Finally, our research found that local resource availability has a positive influence on the technological sophistication of product innovation activities. In other words, firms tend to invest in product technological sophistication when the local environment provides adequate resources. One may argue that this proposal is contrary to the concept of innovation in emerging markets that typically employ different approaches, such as design thinking, bricolage, and creative improvisation (Bhatti, 2012). However, our research suggests that innovations in emerging markets are not necessarily frugal. With respect to the technological sophistication of new product innovations, resources such as skilled personnel would be more significant. Moreover, frugality or sociality of innovation is not a special phenomenon in certain markets but a phenomenon in certain economic development phases. For example, we can conclude that in the 1950s or 1960s, frugal innovation should have happened in Japan as well, but scholars paid little attention to such innovations.

6. Conclusion and Limitations

Our research provides a new view of innovation in emerging markets. It shows three innovation properties (i.e., frugality, technological sophistication, and sociality) that characterize a new product development in those markets and delineate how these properties are influenced by environmental factors. Furthermore, it provides evidence that innovation in emerging markets is more likely driven by environmental factors such as affordability, sociality, and sustainability, rather than premium pricing and abundance. Practically, this study indicates that by targeting emerging markets, adapting to the local environment, and providing suitable new product innovations, companies will find it easier to achieve a sustainable competitive advantage in local markets.

Nevertheless, this study has several limitations. First, the sample size of the data used in our analysis was relatively small. We sent more than 1,500 questionnaires to foreign subsidiaries in emerging markets and collected more than 200 responses. Only a quarter of these subsidiaries conduct new product innovation projects targeting the local environment; hence, only 52 responses were useful for this study. Second, this study only surveyed Japanese subsidiaries in emerging markets, and the results may contain a cultural bias. Finally, although we tried to assess how different types of innovation affect firm performance in local markets, because of the short-term performance measurement, we did not obtain meaningful results.

Qualitative research is necessary for future studies of this issue, as the process of innovation activities in emerging markets remains unexplored. There is a need to clarify how companies perceive the local environment and develop innovation activities that emphasize frugality, sociality, and technological sophistication. This would be very helpful in explaining why some companies conduct certain innovation projects for local markets while others do not. Furthermore, an empirical study is needed to address how these innovations targeting emerging markets benefit multinational companies.

References

Baker, T., & Nelson, R. (2005). Creating something from nothing: resource construction through entrepreneurial bricolage. *Administrative Science Quarterly*, *50*(3), 329-366. https://doi.org/10.2189/asqu.2005.50.3.329

Banerjee, A. V., & Duflo, E. (2007). The economic lives of the poor. *Journal of Economic Perspectives*, *21*(1), 141-168. https://doi.org/10.1257/jep.21.1.141

Baumol, W. J. (2002). Entrepreneurship, innovation and growth: The David-Goliath symbiosis. *Journal of Entrepreneurial Finance*, *7*(2), 1-10. Retrieved from http://hdl.handle.net/10419/55986

Bhatti, Y. (2012). What is Frugal, What is Innovation? Towards a Theory of Frugal Innovation. *Said Business School, Working Paper, Oxford, UK*. https://doi.org/10.2139/ssrn.2005910

Bhatti, Y. A., & Ventresca, M. (2013). How can 'frugal innovation' be conceptualized? *Said Business School Working Paper Series, Oxford*. https://doi.org/10.2139/ssrn.2203552

Birkinshaw, J., Hood, N., & Jonsson, S. (1998). Building firm‐specific advantages in multinational corporations: the role of subsidiary initiative. *Strategic Management Journal*, *19*(3), 221-242. https://doi.org/10.1002/(SICI)1097-0266(199803)19:3<221::AID-SMJ948>3.0.CO;2-P

Brem, A., & Wolfram, P. (2014). Research and development from the bottom up-introduction of terminologies for new product development in emerging markets. *Journal of Innovation and Entrepreneurship, 3*(1), 1-22. https://doi.org/10.1186/2192-5372-3-9

Bruton, G. D., Ahlstrom, D., & Li, H. L. (2010). Institutional theory and entrepreneurship: where are we now and where do we need to move in the future?. *Entrepreneurship theory and practice*, *34*(3), 421-440. https://doi.org/10.1111/j.1540-6520.2010.00390.x

Cai, Q., Ying, Y., & Wu, W. (2019). Innovating with limited resources: The antecedents and consequences of frugal innovation. *Sustainability, 11*(20), 5789. https://doi.org/10.3390/su11205789

Christensen, C. M., McDonald, R., Altman, E. J., & Palmer, J. E. (2018). Disruptive innovation: An intellectual history and directions for future research. *Journal of Management Studies*, *55*(7), 1043-1078. https://doi.org/10.1111/joms.12349

Delios, A., & Henisz, W. I. (2000). Japanese firms' investment strategies in emerging economies. *Academy of Management Journal*, *43*(3), 305-323. https://doi.org/10.5465/1556397

Eppinger, S., & K. Ulrich. (2015). Product design and development. *NY: McGraw-Hill Higher Education*.

Ernst, H., H. N. Kahle, A. Dubiel, J. Prabhu, & M. Subramaniam. (2015). The antecedents and consequences of affordable value innovations for emerging markets. *Journal of Product Innovation Management, 32*(1), 65-79. https://doi.org/10.1111/jpim.12171

Govindarajan, V., & C. Trimble. (2013). Reverse innovation: Create far from home, win everywhere. *Boston: Harvard Business School Press.*

Govindarajan, V., & Euchner, J. (2012). Reverse innovation. *Research-Technology Management*, *55*(6), 13-17. https://doi.org/10.5437/08956308X5506003

Gundry, L. K., Kickul, J. R., Griffiths, M. D., & Bacq, S. C. (2011). Creating social change out of nothing: The role of entrepreneurial bricolage in social entrepreneurs' catalytic innovations. In *Social and Sustainable Entrepreneurship*. Emerald Group Publishing Limited. https://doi.org/10.1108/S1074-7540(2011)0000013005

Harzing, A. W. (1997). Response rates in international mail surveys: Results of a 22-country study. *International business review*, *6*(6), 641-665. https://doi.org/10.1016/S0969-5931(97)00040-1

Hoskisson, R. E., Eden, L., Lau, C. M., & Wright, M. (2000). Strategy in emerging economies. *Academy of Management Journal*, *43*(3), 249-267. https://doi.org/10.5465/1556394

Hsu, I. C. (2008). Knowledge sharing practices as a facilitating factor for improving organizational performance through human capital: A preliminary test. *Expert Systems with Applications*, *35*(3), 1316-1326. https://doi.org/10.1016/j.eswa.2007.08.012

Immelt, J. R., Govindarajan, V., & Trimble, C. (2009). How GE is disrupting itself. *Harvard business review*, *87*(10), 56-65.

International Monetary Fund. (2016). Glossary of Selected Financial Terms. Terms and Definitions. Retrieved on 2017/10/17.

Jaworski, B. J., & Kohli, A. K. (1993). Market orientation: antecedents and consequences. *Journal of Marketing*, *57*(3), 53-70. https://doi.org/10.1177/002224299305700304

Karnani, A. (2010). The case against corporate social responsibility. *Wall Street Journal*, *23*(14), 1-5.

Khanna, T., & Palepu, K. (1997). Why Focused Strategies. *Harvard Business Review*, *75*(4), 41-51.

Khanna, T., & Palepu, K. G. (2010). Winning in emerging markets: A road map for strategy and execution. *Boston: Harvard Business Press*. https://doi.org/10.1177/0974173920100316

Li, H., Zhang, Y. A., & Lyles, M. (2013). Knowledge spillovers, search, and creation in China's emerging market. *Management and Organization Review*, *9*(3), 395-412. https://doi.org/10.1111/more.12036

Mair, J., & Marti, I. (2006). Social entrepreneurship research: A source of explanation, prediction, and delight. *Journal of World Business*, *41*(1), 36-44. https://doi.org/10.1016/j.jwb.2005.09.002

Markides, C. C., & Williamson, P. J. (1996). Corporate diversification and organizational structure: A resource-based view. *Academy of Management Journal*, *39*(2), 340-367. https://doi.org/10.5465/256783

Meyer, H. D., & Rowan, B. (2006). Institutional analysis and the study of education. *The New Institutionalism in Education*, 1-13.

Mudambi, R. (2011). Hierarchy, coordination, and innovation in the multinational enterprise. *Global Strategy Journal*, *1*(3−4), 317-323. https://doi.org/10.1002/gsj.32

Mulgan, G., Tucker, S., Ali, R., & Sanders, B. (2007). *Social Innovation: what it is, why it matters, how it can be accelerated.* London: University of Oxford, Young Foundation.

North, D. (1997). The Contribution of the New Institutional Economics to an Understanding of the Transition Problem. *WIDER Annual Lectures*, March 1997. https://doi.org/10.1057/9780230501850_1

OECD. (2005). Oslo Manual: Proposed Guidelines for Collecting and Interpreting Technological Innovation Data. Paris.

Peng, M. W., & Luo, Y. (2000). Managerial ties and firm performance in a transition economy: The nature of a micro-macro link. *Academy of Management Journal*, *43*(3), 486-501. https://doi.org/10.5465/1556406

Peng, M. W., Wang, D. Y., & Jiang, Y. (2008). An institution-based view of international business strategy: A focus on emerging economies. *Journal of International Business Studies*, *39*(5), 920-936. https://doi.org/10.1057/palgrave.jibs.8400377

Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering social innovation. *Stanford Social Innovation Review*, *6*(4), 34-43.

Podsakoff, P. M., S. B. MacKenzie, J. Y. Lee, & N. P. Podsakoff. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903. https://doi.org/10.1037/0021-9010.88.5.879

Porter, M., & Stern, S. (2001). Innovation: Location Matters. *MIT Sloan Management Review Summer*, 28-36.

Prabhu, J. (2017). Frugal innovation: doing more with less for more. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *375*(2095), 20160372. https://doi.org/10.1098/rsta.2016.0372

Prahalad, C. K. (2008). The fortune at the bottom of the pyramid: Eradicating poverty through profits. *McKinsey Briefing Notes Series*, *36*(3), 52-74.

Prahalad, C. K. (2012). Bottom of the Pyramid as a Source of Breakthrough Innovations. *Journal of Product Innovation Management*, *29*(1), 6-12. https://doi.org/10.1111/j.1540-5885.2011.00874.x

Prahalad, C. K., & Mashelkar, R. A. (2010). Innovation's holy grail. *Harvard Business Review*, *88*(7-8), 132-141.

Radjou, N., & Prabhu, J. (2015). *Frugal Innovation: How to do more with less*. The Economist.

Ray, P. K., & Ray, S. (2009). Resource-constrained innovation for emerging economies: The case of the Indian telecommunications industry. *IEEE Transactions on Engineering Management*, *57*(1), 144-156. http://doi.org/10.1109/TEM.2009.2033044

Rugman, A., Verbeke, A., & Yuan, W. (2011). Re‐conceptualizing Bartlett and Ghoshal's classification of national subsidiary roles in the multinational enterprise. *Journal of Management Studies*, *48*(2), 253-277. https://doi.org/10.1111/j.1467-6486.2010.00969.x

Schilling, M. A., & Shankar, R. (2019). *Strategic management of technological innovation*. McGraw-Hill Education.

Schumpeter, J. A., & Nichol, A. J. (1934). Robinson's economics of imperfect competition. *Journal of political economy*, *42*(2), 249-259. https://doi.org/10.1086/254595

Scott, W.R. (2007). Institutions and organizations: Ideas and interests. *Thousand Oaks, CA: Sage Publications.*

Shane, S., & Venkatraman, S. (2000). The promise of entrepreneurship as a field of research. *Academy of Management Review*, *25*, 217-226. https://doi.org/10.5465/amr.2000.2791611

Toyo Keizai. (2016). Kaigai Shinshutsu Kigyo Soran. *Tokyo: Toyo Keizai, in Japanese.*

Weyrauch, T., & Herstatt, C. (2017). What is frugal innovation? Three defining criteria. *Journal of Frugal Innovation*, *2*(1), 1-17. https://doi.org/10.1186/s40669-016-0005-y

Williamson, P. J. (2010). Cost innovation: preparing for a 'value-for-money'revolution. *Long Range Planning*, *43*(2-3), 343-353. https://doi.org/10.1016/j.lrp.2009.07.008

Young, M., Peng, M., Ahlstrom, D., & Bruton, G. D. (2002). Governing the corporation in emerging economies: A principal perspective. In *Academy of Management Proceedings* (Vol. 2002, No. 1, pp. E1-E6). Briarcliff Manor, NY. https://doi.org/10.5465/apbpp.2002.7516497

Zeschky, M., Widenmayer, B., & Gassmann, O. (2011). Frugal innovation in emerging markets: the case of Mettler Toledo. *Research-Technology Management, 54*(4), 38-45.

https://doi.org/10.5437/08956308X5404007

Zeschky, M., Winterhalter, S., & Gassmann, O. (2014). From cost to frugal and reverse innovation: mapping the field and implications for global competitiveness. *Research-Technology Management, 57*(4), 20-27.

Appendix 1. Measures for innovation properties

Frugality of innovation in emerging markets	Mean	SD
1. Our new product project for the local market targets a reduction in manufacturing costs.	4.734	1.804
2. Our new product project for the local market targets a reduction in product price compared to the competitor's product.	4.469	1.213
Sociality of innovation in emerging markets		
3. Our new product project for the local market targets the resolution of local social problems.	3.591	1.771
4. Our new product project for the local market targets the response to local societal needs.	4.469	1.715
Technological sophistication of innovation in emerging markets		
5. Our new product project for the local market targets the introduction of sophisticated technology.	4.673	1.595
6. Our new product project for the local market targets the improvement of product technical specifications.	5.795	1.413

Appendix 2. Measures for environmental factors

Consumer affordability	Mean	SD
1. Our customers suffer from a shortage of money.	2.714	1.355
2. Our customers' income is quite low.	2.571	1.414
3. Our customers' price reduction requests are severe.	2.981	1.393
Institutional voids		
4. Law, policy, or other public rules are sufficiently prepared for our local business.	4.510	1.751
5. Financial institutions such as banks are adequately prepared for our local business.	4.733	1.396
6. We have difficulty obtaining good parts and materials in the local institutional environment.	3.959	1.851
Resource availability		
7. We have difficulty obtaining qualified technical personnel in the local environment.	3.183	1.380
8. We have difficulty obtaining qualified marketing personnel in the local environment.	3.173	1.125
9. We have difficulty obtaining qualified management personnel in the local environment.	3.061	1.361