Determinants of reverse innovation in SMEs: findings from multivariate analysis in Japan.

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Abstract

Economic growth in emerging countries has exceeded that in developed countries over the last few decades. Given the background, reverse innovation is a topic that attracts considerable interest from academics and practitioners. However, much of the available literature on reverse innovation is case-based study or qualitative in nature. The present study extends our knowledge on reverse innovation by conducting quantitative data analysis. Using the unique survey data from 290 SMEs in Japan, the research explored how Japanese SMEs (i) develop new products, taking advantage of overseas knowledge and (ii) promote their "modified" new products in their home market, Japan. Multinomial logistic analysis found that new products with reversed innovation do not necessarily accompany reduction in price when the firms sell the products in Japan; product localisation tends to play a more important role leading to reverse innovation. Contrary to the conventional view on reverse innovation, such findings will serve as a basis for future studies.

1. Introduction

Japan's low birthrate and rapidly aging population have reduced its domestic market for many small and medium-sized enterprises (SMEs). They are often domestic subcontractors supporting Japan's manufacturing industry, as they observe their domestic market stalling or shrinking whilst their parent companies are expanding and operating businesses in foreign countries. An SME may follow its parent/major client company to foreign countries out of a necessity to continue a business relationship. However, it is not easy for SMEs to succeed in business operations abroad. Entry to the overseas, uncultivated market offers big opportunities, but the risks are still high, especially for SMEs whose resources are limited.

Despite the underlying challenges, some Japanese SMEs have started exploring opportunities abroad. Official aid packages from government agencies, such as the Japan International Cooperation Agency (JICA), and advances in information technology and distribution logistics make these SMEs to pursue overseas opportunities by themselves. They often benefit from the local market knowledge to facilitate much of the new product development. The new products developed, especially in emerging countries, are sometimes re-imported to Japan. The phenomena recently referred to as "reverse innovation" can be addressed in the context of innovation and internationalization of SMEs.

This study aims to explore empirically how Japanese SMEs can launch an innovation, taking advantage of overseas development. To this end, we surveyed to analyse sample data in which SMEs discover an innovation through overseas operation and feedback (reverse innovation) and bring the innovation to Japan.

2. Literature Review

The past decade has witnessed a significant increase in innovation that flows from emerging countries to developed countries. Such a process is often called "reverse innovation." As the emerging economies are becoming too big to ignore, Immelt et al, (2009) write "companies must learn reverse innovation: developing products in countries in China and India and then distributing the products globally (p.56)" in their pioneering paper.

The concept of reverse innovation is intuitively straightforward. However, the definition is often divided among scholars with different attributes of the innovation (Brem and Wolfram, 2014; von Janda, S.,et al, 2018). Some researchers focus on characteristics of new products in the innovation literature. Categorised as disruptive innovation (Christensen, 1997), innovation originated in emerging economies often results in good-enough products, taking

over the market-leading position in the product segment. In a similar vein, innovation from developing countries is frugal innovation in that innovative products are built with limited functions and a relatively low price tag, given the resource-constrained customers in emerging countries (Zeschky, et al. 2011). The other scholars define reverse innovation based on the innovation flow paradigm. Govindarajan and Ramamurti (2011) highlight the flow from a developing country to advanced countries, defining reverse innovation as "an innovation that is adopted first in a poor country before being adopted in rich countries" (p.191). More recently, Zedtwitz et al. (2015) decompose the adoption process into the market introduction stage, e.g., where to sell and the ideation-development stage, e.g., when and where they develop. Zedtwitz et al. (2015) are critical of the previous literature on reverse innovation, arguing real reverse innovation must have at least two phases of innovation project. In their conceptual model, there are 16 sub-categories based on a matrix of two locations (developing and advanced countries) by four projection phases (concept, development, primary market and secondary market).

The reason for various definitions of reverse innovation is that reverse innovation embodies a multitude of management literature on innovation and internalisation. Govindarajan and Ramamurti (2011) list the four strands of literature relevant to reverse innovation; innovation, internationalisation process, developed country multinational enterprise strategy & management, and FDI spill over. As for this empirical study, the literature on SMEs is essential to consider. Further theoretical discussion needs to be undertaken, but such a task is beyond the scope of this empirical paper.

Up to now, much of the research has been descriptive in nature, and empirical research on the subject has been mostly restricted to case-based studies. Following Immelt et. al (2009), Winter and Govindarajan (2015) analysed product specifications when Western companies develop new products in and for emerging markets. Other authors conducted interview-based studies in different settings. Hadengue et al. (2017) reported challenges that Essilor, a French ophthalmic lenses manufacturer, dealt with when they expanded into Asian emerging markets. Dellermann (2017) studied one of the German SMEs in the health care industry. Xu and Xu (2016) undertook interview-based analysis to identify several attributes among the engineering and technical services firms in China. Their approach differs from that of Hadengue et al. (2017) and Dellermann (2017) because their sample firms are based in China. In their paper, the term "reverse innovation" has been applied to situations where firms in emerging countries as the latecomers have increased their product market shares in advanced countries.

It is clear that empirical research on the subject has been mostly restricted to qualitative

analysis. One advantage is that interviews help reveal the process of reverse innovation, rather than outcomes, e.g., sales or product attributes of reverse innovation. However, the preceding studies are based on a few cases, so it is not easy to generalise their findings to other situations, e.g., different regions and industries.

Our research contributes to existing knowledge on reverse innovation by providing statistical data analysis and addressing the following two questions: (i) what attributes reverse innovation that Japanese SMEs possess, and (ii) which attributes of reverse innovation lead to good sales in the home market, i.e., Japan.

3. Empirical Analysis and findings

We conducted the questionnaire survey of 400 Japanese SMEs with support from one of the regional SME associations in Japan. 110 firms were excluded because their responses were unclear whether they engaged in product innovation. The remaining 290 firms were used as sample firms, and they were further classified into the three sub-groups based on the location(s) where the product development/design phase takes place. Firms engaging the innovative /product design activity only in Japan or outside Japan are categorized into Group X and Z, respectively. Firms engaging the innovative/product design activity both in Japan and overseas are sorted into Group Y. According to the claim by Zedtwitz et al. (2015), this classification is vital in the context of reverse innovation.

Table1 provides the summary of the sample firms by the number of employees (panel A-1), the type of overseas facility (panel A-2), industry (panel B), and years in business (panel C). The interesting finding from Table 1 is that most of the firms examined here (217 of 290) maintain involvement in innovative activities at home and in foreign countries. This implies that it is hard to define where innovation takes place. Hence, this finding calls into the question the way to divide the home-versus-overseas location as fertile ground for innovation.

[Table 1]

Table 2 reports type of innovation and product modification the firms have during the pre- and post-entry period into overseas markets. There are four categories: Completely New Development designed for overseas markets, Product Localisation, Basic Model with Price Reduction, and Advanced Model with Price Increase. Panels in Table 2 indicate these innovative activities took place before (in panel A) and after (panel B) entering foreign markets, respectively.

[Table 2]

As for the first research question, one particularly interesting result emerges at this point. Regardless of the pre-entry phase or post-entry phase, the most common innovative activity is to localise the existing products to fit the condition of target overseas markets.

The next task is to identify what attributes are important in selling the innovative or modified products in their home market, i.e., Japan. To this end, a 4x4 Chi-Square test was carried out to reveal whether a significant relationship exists between innovation attributes and sales plan/outcome in Japan. The innovation attributes are sorted into four groups similar to those used in Table 2. The sales plan/outcome is also divided into four categories: no sales plan, perspective sales, low volume of sales, and high volume of sales in their home market. The relationship between the innovation attributes developed in the pre-entry phase is presented in Table 3. The comparable relationship between the attributes developed in the post-entry phase is shown in Table 4.

[Table 3 and Table 4]

Cramér's V was calculated to examine if there is an association preference among four variables. The value was found to be statistically significant for all attribution-sales outcome association. The only exception is that the relationship between the product localisation-sales outcome is not found for the pre-entry phase.

Building on the preceding Chi-Square test, the next analysis serves as a robustness check using a logistic regression method. The objective is to explore the strength of influence a product's attributes and its sales outcomes in overseas markets has upon the sales outcome in the SME's home market, Japan. This analysis reveals possible determinants regarding the sales of reversed engineered/innovative products.

For analysis, multinomial logistic regression is used with a categorical dependent variable with four categories. The dependent variable, the sales of reversed innovative products in Japan, has the following four sub-categories: no intention for sales, prospective sales, low volume of sales, and high volume of sales. One value, "no intention for sales" of the dependent variable, is designated as the reference category. The probability of sales in Japan in other categories is compared to the probability of non-sales intention in the reference category. The independent variables include the new product's attributes used in the preceding analysis and the volume of the new product sales in overseas markets. The latter variable is based on categorical responses, i.e., selling very well, selling moderately well, selling only little, and selling very little.

[Table 5 and Table 6]

The results of the multinomial logit analysis are presented in Table 5 and 6 for the pre-entry and post-entry stages of new product development. Table 5 shows the variable of completely new development for overseas markets is found negative and statistically significant in Panel A. This indicates the completely new products originally designed for overseas are unlikely to be promoted in Japan. In Table 6, the variable of advanced model with price increase is found negative and statistically significant in Panel D, E, and F. These results indicate new and high-end products developed in overseas markets are unlikely to be promoted and sold well in Japan. In a similar vein, the attribute variable of "basic model with price reduction" is found negative and statistically significant at 0.05 level in Panel D and E. This suggests the new and low-end products are unlikely to be promoted and sold marginally well in Japan. Instead, such new and low-end products are likely to be sold well in Japan in that the coefficient of the attribute is positive and statistically significant at 0.06 level. It is also noteworthy that the coefficient of the product localisation variable is positive in both Panel E and F. The statistically significant levels are less than 1% and 7%, respectively.

4. Conclusion

The present study explores possible determinants for reverse innovation that is developed overseas, especially in emerging countries and promoted in the home country. The questioner survey from the sample SMEs in Japan is analysed with Chi-Square test and multinomial logit regression. The results of our empirical analysis show reverse innovation products appeared to focus more on product localisation than price reduction. The findings contrast with the conventional claim that reverse innovation is deployment of low-cost products in emerging markets first, followed by expansion of the same product to the developed countries. Further work needs to be done to establish whether these findings are common to large multinational firms.

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Table 1: Summary of the sample firms

Panel A Size and Oversea Facility

		Employees		Oversea Site	
		21-300	over 301	Factory	Branch
Total	N = 290	142	148	154	136
		48.97%	51.03%	53.10%	46.90%
Group X	8	6	2	3	5
		2.07%	0.69%	1.03%	1.72%
Group Y	217	100	117	116	101
		34.48%	40.34%	40.00%	34.83%
Group Z	65	36	29	35	30
		12.41%	10.00%	12.07%	10.34%

Panel B Industry Sector

		Machinery Metal Product	Textiles	Plastics	Furniture Accessories	Wood Pulp, Paper	Food	Chemical Rubber	Ceramics Stone Clay	Other Manufacturing
Total	N = 290	111	9	11	1	3	7	33	3	112
		38.28%	3.10%	3.79%	0.34%	1.03%	2.41%	11.38%	1.03%	38.62%
Group X	8	2	0	1	0	2	0	0	0	3
		0.69%	0.00%	0.34%	0.00%	0.69%	0.00%	0.00%	0.00%	1.03%
Group Y	217	82	6	8	0	1	5	29	3	83
		28.28%	2.07%	2.76%	0.00%	0.34%	1.72%	10.00%	1.03%	28.62%
Group Z	65	27	3	2	1	0	2	4	0	26
		9.31%	1.03%	0.69%	0.34%	0.00%	0.69%	1.38%	0.00%	8.97%

Panle C Years in Business

		Less than 10 years	10-19 years	20-29 years	30-39 years	40-49 years	50-59 years	60-69 years	70-79 years	80-89 years	90-99 years	Over 100 years
Total	N = 290	4	13	18	22	27	41	39	27	36	18	45
		1.38%	4.48%	6.21%	7.59%	9.31%	14.14%	13.45%	9.31%	12.41%	6.21%	15.52%
Group X	8	0	1	0	2	1	2	0	0	0	0	2
		0.00%	0.34%	0.00%	0.69%	0.34%	0.69%	0.00%	0.00%	0.00%	0.00%	0.69%
Group Y	217	4	10	15	17	21	28	30	11	26	18	37
		1.38%	3.45%	5.17%	5.86%	7.24%	9.66%	10.34%	3.79%	8.97%	6.21%	12.76%
Group Z	65	0	2	3	3	5	11	9	16	10	0	6
		0.00%	0.69%	1.03%	1.03%	1.72%	3.79%	3.10%	5.52%	3.45%	0.00%	2.07%

Table 2: The innovation attributes

Panel A: Pre Entry Stage

Completely New Development	N	Yes	Yes to some extent	No to some extent	No
Total	225	31	83	55	56
Firms with Pre Entry Only	8	2	5	1	0
Firms with Pre Entry and Post Entry	217	29	78	54	56
Product Localisation					
Total	225	41	131	27	26
Firms with Pre Entry Only	8	1	7	0	0
Firms with Pre Entry and Post Entry	217	40	124	27	26
Basic Model with Price Reduction					
Total	225	24	106	49	46
Firms with Pre Entry Only	8	1	3	4	0
Firms with Pre Entry and Post Entry	217	23	103	45	46
Advanced Model with Price Increase					
Total	225	31	92	57	45
Firms with Pre Entry Only	8	0	6	1	1
Firms with Pre Entry and Post Entry	217	31	86	56	44

Panel B: Post Entry Stage

Completely New Development	N	Yes	Yes to some extent	No to some extent	No
Total	282	32	105	75	70
Firms with Pre Entry and Post Entry	217	26	90	55	46
Firms with Post Entry Only	65	6	15	20	24
Product Localisation					
Total	282	40	152	42	48
Firms with Pre Entry and Post Entry	217	33	125	33	26
Firms with Post Entry Only	65	7	27	9	22
Basic Model with Price Reduction					
Total	282	40	123	54	65
Firms with Pre Entry and Post Entry	217	32	104	40	41
Firms with Post Entry Only	65	8	19	14	24
Advanced Model with Price Increase					
Total	282	36	124	67	55
Firms with Pre Entry and Post Entry	217	31	98	53	35
Firms with Post Entry Only	65	5	26	14	20

Table 3: The association between the innovation attributes (before the market entry development) and sales outcomes

Attribute (1) : Completely New Development

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	8	17	16	23	64
Perspective Sales	11	40	12	3	66
Low Volume of Sales	1	9	13	9	32
High Volume of Sales	11	17	14	21	63
Total=225	31	83	55	56	225

Cramer's V =	0.239
Significance	0

Attribute (2) : Product Localisation

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	11	39	5	9	64
Perspective Sales	16	41	7	2	66
Low Volume of Sales	4	18	7	3	32
High Volume of Sales	10	33	8	12	63
Total=225	41	131	27	26	225

Cramer's V =	0.145
Significance	0.118

Attribute (3) : Basic Model with Price Reduction

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	7	30	13	14	64
Perspective Sales	12	38	12	4	66
Low Volume of Sales	2	11	10	9	32
High Volume of Sales	3	27	14	19	63
Total=225	24	106	49	46	225

Cramer's V =	0.178
Significance	0.011

Attribute (4) : Advanced Model with Price Increase

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	6	24	15	19	64
Perspective Sales	13	34	15	4	66
Low Volume of Sales	1	10	14	7	32
High Volume of Sales	11	24	13	15	63
Total=225	31	92	57	45	225

Cramer's V =	0.187
Significance	0.005

Table 4: The association between the innovation attributes (after the market entry development) and sales outcomes

Attribute (1) : Completely New Development

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	11	22	22	30	85
Perspective Sales	10	41	20	5	76
Low Volume of Sales	1	19	13	9	42
High Volume of Sales	10	23	20	26	79
Total=282	32	105	75	70	282

Cramer's V =	0.191
Significance	0

Attribute (2) : Product Localisation

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	21	37	10	17	85
Perspective Sales	10	54	9	3	76
Low Volume of Sales	1	24	10	7	42
High Volume of Sales	8	37	13	21	79
Total=282	40	152	42	48	282

Cramer's V =	0.201
Significance	0

Attribute (3) : Basic Model with Price Reduction

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	13	31	20	21	85
Perspective Sales	14	47	9	6	76
Low Volume of Sales	7	19	9	7	42
High Volume of Sales	6	26	16	31	79
Total=282	40	123	54	65	282

Cramer's V =	0.198
Significance	0

Attribute (4) : Advanced Model with Price Increase

		to some extent			
	Yes	Yes	No	No	Total
No Sales Plan	8	26	25	26	85
Perspective Sales	13	47	12	4	76
Low Volume of Sales	3	18	14	7	42
High Volume of Sales	12	33	16	18	79
Total=282	36	124	67	55	282

Cramer's V =	0.193
Significance	0

Table 5: The results from multinomial logit regression on the association between the innovation attributes (product development before the market entry) and sales outcomes in Japan.

		Coef.	Std. Err	Z	P>z	[95% Conf	Interval]
Panel A: Perspective Sales in Japan	Attribute (1) : Completely New Development for Oversea Markets	-0.63	0.23	-2.80	0.01	-1.08	-0.19
	Attribute (2) : Product Localisation	0.08	0.29	0.26	0.80	-0.50	0.65
	Attribute (3) : Basic Model with Price Reduction	-0.19	0.27	-0.73	0.47	-0.72	0.33
	Attribute (4) : Advanced Model with Price Increase	-0.42	0.24	-1.75	0.08	-0.89	0.05
	Sales Overseas	0.21	0.35	0.59	0.56	-0.49	0.90
	constant	2.48	0.93	2.67	0.01	0.66	4.29
Panel B: Low Volume of Sales	Attribute (1) : Completely New Development for Oversea Markets	0.00	0.26	-0.02	0.99	-0.52	0.51
	Attribute (2) : Product Localisation	-0.12	0.30	-0.40	0.69	-0.71	0.47
	Attribute (3) : Basic Model with Price Reduction	0.39	0.30	1.30	0.20	-0.20	0.99
	Attribute (4) : Advanced Model with Price Increase	-0.05	0.27	-0.17	0.86	-0.59	0.49
	Sales Overseas	0.30	0.37	0.82	0.41	-0.42	1.02
	constant	-1.97	1.05	-1.87	0.06	-4.03	0.09
Panel C: High Volume of Sales	Attribute (1) : Completely New Development for Oversea Markets	-0.18	0.22	-0.82	0.41	-0.60	0.25
	Attribute (2) : Product Localisation	0.18	0.26	0.69	0.49	-0.33	0.68
	Attribute (3) : Basic Model with Price Reduction	0.43	0.25	1.70	0.09	-0.07	0.92
	Attribute (4) : Advanced Model with Price Increase	-0.38	0.23	-1.66	0.10	-0.82	0.07
	Sales Overseas	-0.15	0.33	-0.46	0.64	-0.81	0.50
	constant	0.24	0.88	0.27	0.79	-1.48	1.95

Table 6: The results from multinomial logit regression on the association between the innovation attributes (product development after the market entry) and sales outcomes in Japan.

		Coef.	Std. Err	Z	P>z	[95% Conf	Interval]
Panel D: Perspective Sales in Japan	Attribute (1) : Completely New Development for Oversea Markets	-0.36	0.22	-1.65	0.10	-0.79	0.07
	Attribute (2) : Product Localisation	0.46	0.28	1.64	0.10	-0.09	1.00
	Attribute (3) : Basic Model with Price Reduction	-0.54	0.25	-2.12	0.03	-1.03	-0.04
	Attribute (4) : Advanced Model with Price Increase	-0.97	0.25	-3.89	0.00	-1.46	-0.48
	Sales Overseas	1.62	0.39	4.13	0.00	0.85	2.39
	constant	0.13	0.83	0.16	0.87	-1.50	1.76
Panel E: Low Volume of Sales	Attribute (1) : Completely New Development for Oversea Markets	-0.18	0.25	-0.70	0.49	-0.67	0.32
	Attribute (2) : Product Localisation	0.95	0.31	3.09	0.00	0.35	1.55
	Attribute (3) : Basic Model with Price Reduction	-0.72	0.28	-2.60	0.01	-1.26	-0.18
	Attribute (4) : Advanced Model with Price Increase	-0.56	0.27	-2.04	0.04	-1.09	-0.02
	Sales Overseas	1.75	0.43	4.12	0.00	0.92	2.59
	constant	-2.89	1.00	-2.90	0.00	-4.85	-0.94
Panel F: High Volume of Sales	Attribute (1) : Completely New Development for Oversea Markets	-0.06	0.18	-0.32	0.75	-0.42	0.30
	Attribute (2) : Product Localisation	0.40	0.22	1.81	0.07	-0.03	0.84
	Attribute (3) : Basic Model with Price Reduction	0.42	0.23	1.88	0.06	-0.02	0.87
	Attribute (4) : Advanced Model with Price Increase	-0.75	0.22	-3.40	0.00	-1.17	-0.32
	Sales Overseas	0.34	0.38	0.89	0.37	-0.40	1.07
	constant	-0.72	0.83	-0.87	0.39	-2.34	0.90