

New Product Success among Small and Medium Enterprises (SMEs): An empirical study in Taiwan

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ABSTRACT

This paper investigates critical factors affecting the likelihood of new product success and effective new product development (NPD) performance for Taiwanese small and medium enterprises (SMEs). The sample included 357 SMEs from consumer manufacturing. Empirical results suggest that new product success dimension in measure customer acceptance measures, market acceptance measures, financial performance measure, and technical level measure. A discussion of the findings, managerial implications, and suggestions for future research are all presented.
Keywords: *New product development, SMEs, Innovation, R&D, Taiwan.*

INTRODUCTION

Rapid development of new product has quickly become a top priority in many organizations as competitors rush to commercialize emerging technologies and satisfy fragmenting customer needs. New product development (NPD) is a major driver of profitability, maintaining a competitive advantage and ensuring organizational survival (Ernst, 2002). Driven by intense international competition, rapidly changing customer need, technological innovation, shortened product cycles and high costs of R&D, managing NPD has become more critical and complex (Biemans,2003). Much of the early research on NPD focused on activities and their impact on new product success. Despite the profusion of studies that have focused on NPD processes and activities over the past three decades, there has not been a concomitant increase in NPD success rates (Griffin, 1997). However, such identification requires an understanding of new product success, as different definitions of “success” can produce different results (Craig and Hart, 1992).

Because new products are vital to long-term survival and viability, the process of developing them is a critical endeavor in today’s globally competitive environment. However, failures in NPD can cost hundreds of million of dollars, many firms have focused their resource and capability on NPD, in order to efficiently achieve effective NPD and reduce the risk of innovation. Therefore, measuring new product outcome from innovation is also crucial to our understanding of the organizational behaviors related to, and resource allocation provided to, new product development (Huang, et al., 2004). Although the importance of measuring new produce success is widely recognized, its treatment remains elusive, partly due to the multidimensional nature of such success, the different levels of analysis that can be examined (Griffin and Page,1993), and the multiple stakeholders who look for different things in the NPD process (Lipovestsky, et al.,1997). This has resulted in the use of a large number of measures in the assessment of new product performance. While several classification schemes have been suggested, there has been little effort to clarify the concept of new process or to synthesize and empirically test such classification schemes (Griffin and Page, 1993). In addition, as most new product measures have been developed from the study of larger firms, the question as to whether these measures can be applies to small businesses remain unanswered (Huang, et al.,2004).

Innovation and NPD are considered to be important to economic development and corporate growth and survival. Most studies of innovation and NPD, no matter whether they study large enterprises (LE) or SMEs, have been undertaken in the context of industrialized countries, such as the USA, the UK or Germany. Given the importance of the ‘contextual embeddedness’ of SMEs in developing countries, researchers (for example, Hadjimanolis, 2000; Siu,2001) advocate further research into the NPD process of SEMs in developing and newly developed economics (NIEs), including China, Taiwan and Hong Kong.

Taiwanese export promotion policy and its open economy have laid a solid foundation for the development of SMEs in Taiwan. However, in the 1990s the government of Taiwan set up a national system with a well-established, sophisticated infrastructure and with cheap land, labor and capital all designed to facilitate Taiwanese SMEs to carry out their own R&D (Hsu and Chiang, 2001; Shyu and Chiu, 2002). The system helps SMEs absorb uncertainties, reduce production and transaction cost, activate local technologies and facilitate technological learning (Mathews, 2002), to promote the NPD success. As show in Table 1, SMEs in Taiwan not only dominated the economics of their respective regions, but also contributed in larger measure to increased levels of business activity and employment there. Thus, NPD is one of the major marketing activities of Taiwanese SMEs. Against this background, this paper attempts to seek answers for the following questions:

1. Investigate the success measures used in Taiwan small businesses.
2. Examine empirically the structure of the success measures suggested by Griffin and Page (1993), in a small businesses environment, by look at the number of dimensions and their interrelationships.
3. Determine how each dimension contributes to perceptions of overall success.

Table 1: The profile of Taiwanese SMEs: 2008

Items	Numerical
Total number of SMEs	1.275 million
% of total establishment	98.10%
Number of employees	5.914 million
% of total employment	69.85%
Sales value	NT\$10.35 trillion
% of total sales value	30.60%
Sales value (inside market)	NT\$8.03 trillion
% of total sales value	35.82%
Sales value (outside market)	NT\$2.67 trillion
% of total sales value	16.91%

Source: White paper on small- and medium enterprises in Taiwan (2008)

LITERATURE REVIEW

NPD research has often measured new product success opportunistically. A fundamental problem when NPD success is the meaning of such success, as it has not been well defined. The interpretation of success is affected by the interest group involved in NPD, such as R&D, marketing, and production (Huang et al. 2004), therefore, success can be a value measure concept. Moreover, the existence of different levels of indicators, for example project, program and company, and multiple types of indicators or determinants has complicated the use of success measures. On the other hand, the time perspective of new product success also increases the difficulty of selecting relevant and meaningful measures (Maidique and Zirger, 1984). That is, some researchers have operationalized success based on the availability of data. This has resulted in a number of suggested success measures (Cooper and Kleinschmidt, 1993b).

In addition, most suggested measures are non-cumulative and a theoretical, market comparisons difficult or impossible. This may be because a new product's impact on an organization can be multilevel and multi-dimensional (Cooper and Kleinschmidt, 1987), complex and dynamic (Hart, 1993), Subtle and, sometimes, only perceivable in the long term (Maidique and Zirger, 1984). Several studies have used a "what there" approach to derive new product success terms and dimensions, either conceptually or empirically. For instance, Cooper and Kleinschmidt (1987) showed there new product performance aspects: financial performance, market impact, and opportunity window. These three dimensions are project level factors that describe the financial success of a new product, the impact of a product in marketplaces, and the extent to which a new product presented new opportunities. Hart (1993) identified three project level success dimensions, which she termed "beating the competition technologically," "beating the competition to market," and "providing a technological breakthrough." On the other word, both financial and non-financial success measures can be used, as direct and indirect measures. Hauschildt (1991) suggested that success

could be measured from both technical and economic perspectives and that multiple criteria were needed if a correct assessment was to be made.

Many researchers have argued that new product success should be measured using multiple criteria and that success can be gauged at different levels. However, a crucial question remains as to the measures that should be used to capture the various criteria. A special task force was set up by Griffin and Page (1993). While the research force identified 75 different measures, 16 common measures were found and these were considered to be core success measure. The frequencies with which the 16 PDMA (Product Development Management Association) criteria were used are show in Table 2. The 16 measures were grouped into four dimensions: three at a project level and one at an organization level. In Table 2, the first 15 questions measure new product success at a project level, which the last item is an organizational level measure. Huang et al. (2004) suggested the four dimensions were “customer acceptance measure,” “financial performance measure,” “product or technical-level measure,” and “organization-level measure.” This paper, we identify that the most frequently used project-level criteria are four dimensions “customer acceptance measures,” “market acceptance measures,” “financial performance measure,” and “technical or product level measure,” in the third column in Table 2. We use to examine several conceptual issues underlining the measurement of new product success and the measurement practice adopted in Taiwanese SMEs. The next section outlines the research approach undertake to answers the question about previous present.

Table 2: Frequency of new product success measures used in SMEs.

Measures	Percentage of responses	Suggest dimension	Source
1. Customer acceptance	73%	Customer acceptance	Griffin and Page (1993).
2. Customer satisfaction	65%	measures	
3. Meet revenue goal	58%	Market acceptance	Cooper and
4. Revenue growth	46%	measures	Kleinschmidt, (1987);
5. Meet market share goal	48%		Hart (1993).
6. Meet unit share goal	39%		
7. Break-even time	40%	Financial performance	Cooper and
8. Attain profitability goal	52%	measure	Kleinschmidt, (1987);
9. Attain margin goal	41%		Griffin and Page
10. Attain return on investment goal	48%		(1993).
11. Development cost	51%	Technical or product level	Griffin and Page
12. Launched on time	55%	measure	(1993); Hauschildt
13. Achieve product performance goal	61%		(1991); Hart (1993).
14. Meet quality guideline	61%		
15. Speed to market	50%		
16. Percentage of sales by new product	43%	Organization level measure	Huang et al. (2004)

RESEARCH METHODOLOGY

The Questionnaire

Have 16 core PDMA measures developed by Griffin and Page (1993) were used in this survey as they were developed and validated SMEs environment. In Table 2, were included as part of a larger scale of survey of NPD in Taiwan SMEs. Respondents were asked to select their most recent new product and to indicate whether they had measured the success of that project. Following Huang et al. (2004) approach, respondents were asked about the success measures used mark such as assessment and how well they thought the new product had performed on the 16 core measures, using a five-point scale that ranged from “well below average” to well above average,” The last item (for example, percentage of sales by new product), this is a subjective measure, we asked the respondents to compare it with the average percentage of sales by other new products developed. In addition, respondents were also asked to measures the product’s overall success with reference to 5-point Likert scale items (ranging from 1= very unsuccessful to 5= very successful).

The Sample

In recent years, the Small and Medium Enterprise Administration (SMEA) and China Management Association (CMA) of Taiwan were commissioned to coordinate with university professors to published interview reports with entrepreneurs by Ministry of Economic Affairs. On this basis, the sampling frames for the study were consumers manufacturers listed in the SMEA and CMA. The data sources were reviewed, a sampling base was developed, the target survey list was screened, and multiple entries and entries with incomplete information were deleted from the list. Next, the firms to be surveyed were identified through a systematic sampling technique with every third firm in the database being selected fro the survey. The systematic sampling yielded 357 firms for the survey and the majority of firms are small and medium sized with less than 200 employees and an annual turnover of less than or equal to NT\$150 million (US\$4.05 million) were selected.

Data Collection

The questionnaires were mailed to 357 firms together with a self-addressed postage prepaid return envelope and a personalized covering letter outlining the objectives o the study and explaining that all information obtained would be treated as “confidential.” the covering letter explained that the study aimed to enable an understanding of issues in the industry as a whole and that responses would not be attributed to any individuals or firms.

Two weeks after mailing the questionnaires letters were mailed to all individuals. The remainder letter and thanked individuals who had completed and returned the questionnaires and requested those who had not returned a completed questionnaire to do so within the next two week. The survey generated 111 responses within six weeks. Seven questionnaires were eliminated because there were too many missing data and this made available 104 usable questionnaires. The response rate of 29.13 percent obtained in the survey is consistent with results obtained in mail surveys in other studies where the unit of analysis in the organizational innovation and performance (Bhaskaran, 2006). Of the 357 respondents, 87.4 percent identified themselves as managing directors, R&D, or marketing controllers. The remainder was senior functional managers. The median year industrial experience was 19 years.

ANALYSIS AND RESULTS

New Product Performance Measures

In the previous section, respondents were asked whether they measured NPD success. The frequencies with which the 16 PDMA criteria were used are show in Table 2. We obtained the most frequently used criteria were customer acceptance (0.71), customer satisfaction (0.67), the suggest dimension are “customer acceptance measures.” The frequencies with which the achieve product performance goal (0.63), meet quality guideline (0.59) and other items ranged from speed to market (0.48) to development cost (0.54) are “technical or product level measure,” according to Griffin and Page’s classification scheme.

Moreover, the frequently used items were meet revenue goal (0.55), revenue growth (0.49), meet market share goal (0.46), and meet unit share goal (0.36), which reflects a combination of the margin and sales volume of the new product developed. Because all of these four measures are related to sales volume (for example, market measure), therefore, the four are “market acceptance measures,” (Hart 1993). On the other hand, the frequently used “financial performance” item was attaining profitability goal (0.54), attaining return on investment goal (0.45), attaining margin goal (0.44), and Break-even time (0.38), supporting the result of Griffin and Page (1996), and Huang et al. (2004).

New Product Development Dimension

The four suggested dimensions by Huang et al. (2004) used a five-factor structure of new product success, was not included as it is organizational level outcome. The principle components analysis showed four factors with eigenvalues greater than one that explained 0.74 of the variance in the data, with all communalities above 0.60, (except development cost). In Table 3 showed the varimax rotated factor loading, suggested that these four factors provided a very well explanation of the original 15 items measure (for example, Huang et al., 2004).

According to Griffin and Page's (1993) terms, we obtained the similar results of factor loadings. Factor 1 was related with financial performance as the four financial items had high and similar loadings on this factor (above 0.81). Oppositely, Factor 2 were less frequently used than financially based measures, as these four items are revenue or market share oriented, we call market acceptance measure or financial performance measure (Huang et al., 2004). The five "technical or product level measures," loaded on Factor 3, with loadings from 0.52 to 0.86, that all can make a contribution to technical measure in new product success. In addition, Factor 4 was related to two items about customer acceptance and customer satisfaction that are the measure of customer orientation (or non-financial performance measure).

Table 3: Rotate factor loading for four structural factors

Measures	Factor loading				Commonality	Factor (Eigenvalue)
	F1	F2	F3	F4		
Break-even time	0.853				0.86	Financial performance (3.703)
Attain profitability goal	0.914				0.93	
Attain margin goal	0.864				0.92	
Attain return on investment goal	0.812				0.84	
Meet revenue goal		0.601			0.62	Market acceptance (2.674)
Revenue growth		0.743			0.71	
Meet market share goal		0.709			0.79	
Meet unit share goal		0.853			0.82	
Development cost			0.523		0.42	Technical level measure (2.554)
Launched on time			0.874		0.78	
Achieve product performance goal			0.628		0.63	
Meet quality guideline			0.659		0.70	
Speed to market			0.794		0.65	Customer acceptance (2.213)
Customer acceptance				0.878	0.83	
Customer satisfaction				0.896	0.85	

The Dimension and Contribution to New Product Success

The descriptive statistics in Table 4 show basic information on each factor, coefficient alpha, and correlations among these factors. The alpha reliabilities varied from 0.76 to 0.94, suggesting the four measures were reliable and can be used with confidence in this study. In addition, Table 4 shows the overall product performance in the sample. Corresponding to the frequencies of the success measures used by the respondents, customer acceptance measure (for example, non-financial performance) has scored highest among all other factor, this result suggests that the SEMs not only use the factor to measure NPD, but they have also done well in customer's demand. Similarly, technical level measures that are frequently used by SEMs have a relatively high score compared with customer acceptance and financial performance.

Table 4 show the corrections between the four project level success dimensions, the organization level item, and the overall success score. From these factors that describing important aspects of new product success in SMEs. Firstly, we have the correlated dimensions, which were expected because of the nature of the measurement. However, the explanatory power ranged from 8% to 45%, proposing the measures tap different aspects of success and emphasizing the importance of adopting multiple measures to get an overall picture of new product performance. Furthermore, the organization level success measure is correlated with the four project level success dimensions. In other word, if selected properly the project level measure can be used as the organization level substitute.

In assessing the overall success relationship between the four project level measures, we used a regression analysis to examine the impact on four factors. The results shown in Table 5, suggest that the four dimensions all influence the overall success of NPD, as their regression coefficients were statistically significant well beyond the 0.05 level. Reported in Table 5 the customer acceptance had the greatest impact on overall success. Some prior research found that customer acceptance and satisfaction were the most important criteria in assessing NPD performance (for example, Griffin and Page, 1996; Huang et al., 2004). Thus, this study suggests that this is also true for SMEs.

Table 4: Correlation coefficients between factor scores and overall success

Factor	Mean	S.D.	Correlation coefficients						
			1	2	3	4	5	6	
1. Financial performance	3.61	0.87	(0.97)						
2. Market acceptance	3.78	0.86	0.69	(0.88)					
3. Technical level measure	3.97	0.79	0.39	0.40	(0.79)				
4. Customer acceptance	4.47	0.74	0.34	0.49	0.39	(0.91)			
5. Organization level measure	3.55	0.96	0.59	0.61	0.48	0.26	(n.a.)		
6. Overall success	3.73	1.02	0.56	0.55	0.59	0.45	0.57	(n.a.)	

n.a.: not applicable, (): coefficient alpha.

Table 5: The overall success against four factors

Factor	Organization level measure ^a (Standardized β)	Overall success (Standardized β) ^b
1. Financial performance	0.176*	0.198*
2. Market acceptance	0.357***	0.186**
3. Technical level measure	0.306***	0.174**
4. Customer acceptance	-0.044	0.343***

^a $R = .68$, $R^2 = .45$, adjusted $R^2 = .42$.

^b $R = .71$, $R^2 = .49$, adjusted $R^2 = .47$.

* $P < .1$, ** $P < .05$, *** $P < .01$.

DISCUSSIONS

The purpose of this paper is to examine the structure of new product success in the Taiwanese SMEs. We investigate critical factors affecting the likelihood of new product success for Taiwanese consumer manufacturing firms. Several conclusions can be drawn based on the findings presented in the previous section. First, using a multiple dimension, we have described and classified the new product success performance used by Taiwanese SMEs. The results demonstrate that successful dimensions were financial performance, marketing acceptance, technical level measure, and customer acceptance.

In contrast with previous research (Griffin and Page 1996; Huang et al. 2004), while these dimensions were correlated, our findings suggest that the factors measure different aspect of success. In addition, we suggest several managerial implications in new product success measure. First, a successful product may need to perform well on all dimensions of criteria, thus, firms should use multiple criteria when measuring new product performance. The measures that represent various aspects of success seem to be customer satisfaction, profitability, revenue, and product performance. Second, these dimensions are correlated. The implication of the correlation coefficients suggest that the most distinguished components are financial measure (financial performance and market acceptance) and non-financial (technical level measure and customer acceptance). Management needs to be aware of the relationships between the factors and to select success measures of the new product project at the start.

Moreover, these measures are non-financial such as customer acceptance, customer satisfaction, achieving product performance goal, and meet a quality goal are the most frequently used success criteria used by Taiwanese SMEs. This suggests Taiwanese SMEs consider the quality and performance of a new product and its market acceptance to be primary measures of new product success, and financial measures seem to be of secondary concern. Anecdotal evidence suggests that many of the new products developed by SMEs perform well technologically, but not so well financially (Huang et al. 2004). The success measures used by SMEs may explain this phenomenon. The challenge for SMEs is to set financial and non-financial goal for their new products, to measure these goals and to allocate appropriate resources to strategically strengthen their NPD capabilities.

Traditionally, keep up a close to customers has been competitive advantage for SMEs and the present research suggests this is still felt to be true. In other words, the managers ought to believe that customer acceptance and customer satisfaction contributed most to the overall success of a new product, although the other three factors also contributed to success. Therefore, good market research may be needed when developing new products, as such

research can offer needed information about customers' demand, thereby improving new product performance. Further, SMEs will need to be especially careful about the degree of customer acceptance in this dynamic marketplace.

Finally, our conclusions of the present study, it is important to be mindful of some limitations. First, we collected data from the sample of consumer manufacturing SMEs; thus, the generalizability of the model is limited. Future research should include the other type organizations or larger organizations would enable a comparison of new product success measurement across these two types' organizations. Second, the individual project selected might not represent the set of new products launched by the organization or the measures used to determine their success. Future research that examine a set of new product launches in a smaller number of organizations would help to determine if such measures changes between launches and, if so, what causes such change. Third, the present study used a key informant approach to obtain the data, which may impact on the reliability and validity of the data. Fourth, each new product success factor may have a different set of determinants and moderating variables, future researchers may concentrate on specific hypotheses that link determinants and success measures. Finally, the data were obtained from Taiwanese firms, future research across a number of other countries would help to determine if the success dimensions and their relationships with new product success are general; for example, the SMEs in China and Hong Kong.

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