รายงานวิจัยฉบับสมบูรณ์

โครงการ การศึกษาการพัฒนาการบริการทางด้านการเงินใหม่ๆ สำหรับบริษัทผู้ส่งออกขนาดเล็กและขนาดกลาง (SMEs) ในประเทศไทย

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This research examines the relationship among new service development, new service performance, and small and medium exporters' orientation in the Thai banking industry. A model has been developed and tested as an output of this study. Prior to determining which companies to use in the samples, in-depth interviews were conducted with five experts from local banks, public banks, and foreign representative office, foreign bank, and insurance companies to determine criteria for identifying successful new service development in the banking industry. Step 1a: Qualitative analysis using in-depth interviews (as a result of the pilot study) with the selected banks and insurance companies who propose new services to SME exporters in Thailand. The semi-structured questions will be provided to interviewees prior to each interviewing period. Some population in this main study includes specific companies that are chosen based on good access to senior managers, who have great experience in financial services for SME exporters. The NSD process will be explored in detail focusing on the sources of information from customers. Step 1b: There will also be qualitative interviews with SMEs to make sure that the issues and items on the questionnaire are relevant to SMEs. HOW MANY, HOW TO CHOOSE? Based on the record of the customs department, Ministry of Finance in 2005, there are approximately 20,000 SMEs in Thailand. Step 2: Quantitative analysis using mail survey to test the model. Quantitative analysis using a mail survey which will be distributed to SMEs whose products are exported in order to learn customer views on their needs to compare what the financial service provides regarding their knowledge of SMEs needs. After several rounds of questionnaire development and testing, the questionnaire was sent and the survey obtained 134 responses from SMEs whose new banking service is being processed, representing a 67 percent response rate. Questionnaire response rate from local banks obtained 19% returned rate from the ones whose new service(s) have been proposed onto the market for the past two years. Study results indicate that the more comprehensive use of new service development is certainly the strongest reason for better new service performance. However, if local banks would like to be more successfully compete with other foreign representative offices, foreign banks or public banks, they need to consequently consider other factors like services encounter practices, type of sources of information, accessed approach of information, and SMEs' orientation in order to immensely improve new service performance. If local banks would like to develop new service for small and medium exporters (SMEs) more successfully, the focus on new services that fit SMEs' needs or beyond their needs for successful

international business operation should be considered as the primary factor. Such new ideas of service development may be obtained through information accessed by the rigid relationship between employees and SMEs. The development of advanced technological tools is designed and launched to fit those needs. Local banks should pay more attention to what SMEs' need prior to develop new services onto the market. To do that, better new service performance should be finally shown as a result.

Keywords: new service development, new service performance, small and medium exporters (SMEs), Thailand

Output จากโครงการวิจัยที่ได้รับทุนจาก สกว.

1 ผลงานที่กำลังจะตีพิมพ์ในวารสารวิชาการนานาชาติ

1.1 Ngamkroeckjoti, C., Speece, M.W., and Zimmermann, W., SMEs orientation and new service process development in Thailand banking industry, *International Journal of Bank Marketing* (on revision).

1.2 Ngamkroeckjoti, C., Speece, M.W., and Zimmermann, W., SMEs' orientation, new service development, new service performance in the Thai banking industry and small and medium exporters , *International Journal of Bank Marketing*, (on the process)

2 การนำผลงานวิจัยไปใช้ประโยชน์

2.1 เชิงพาณิชย์

2.2 เชิงนโยบาย – ธนาคารเอกชนสามารถนำข้อมูลที่ได้นำไปปรับปรุงนโยบายการออกแบบการพัฒนาการบริการทางการเงินใหม่ๆ ได้เพื่อการเข่งขันที่รุนแรงกับธนาคารหรือตัวแทนธนาคารต่างชาติ

2.3 เชิงสาธารณะ – สามารถสร้างเครือข่ายและความร่วมมือทั้งภาครัฐและภาคเอกชน ในกรณีภาคเอกชน ผู้วิจัยและทีมงานได้รับความร่วมมือจากผู้มีส่วนร่วมในการจัดงานนิทรรศการ และงานแสดงสินค้าต่างๆ โดยเฉพาะความร่วมมือในการกรอกแบบสอบถาม รวมทั้ง ธนาคารเอกชน เช่น ธนาคารกรุงเทพฯ จำกัด (มหาชน)ธนาคารกรุงศรีอยุธยา จำกัด (มหาชน) ธนาคารกสิกรไทย จำกัด (มหาชน) ธนาคารไทยพาณิชย์ จำกัด (มหาชน)ธนาคารยูโอบี จำกัด (มหาชน) เป็นต้น ในกรณีภาครัฐ ผู้วิจัยและทีมงานได้รับความร่วมมือจาก กระทรวงพาณิชย์ กรมส่งเสริมการส่งออก กรมส่งเสริมอุตสาหกรรม กรมสรรพากร กระทรวงพาณิชย์ กรมส่งเสริมการส่งออก กรมส่งเสริมอุตสาหกรรม ธนาคารพัฒนาวิสาหกิจขนาดกลางและขนาดย่อมแห่งประเทศไทย ธนาคารส่งเสริมการส่งออกและนำเข้าแห่งประเมศไทย เป็นต้น

2.4 เชิงวิชาการ – มีการนำผลที่ได้จากการศึกษาวิจัยชิ้นนี้ไปประกอบการสอนในวิชาการจัดการระหว่างประเทศ ซึ่งอยู่ในความรับผิดชอบของผู้วิจัย

3 การเสนอผลงานในที่ประชุมวิชาการ

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3.5 เชิงวิชาการ

4

Technology turbulence and Environmental Scanning in Thai Food New Product Development

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Technology Turbulence and Environmental Scanning in Thai Food New Product Development

Abstract

New product development (NPD) can be an important source of competitive advantage. Performance of the resulting products is often better when companies use external information in the NPD process. Technology trends are one aspect of useful information, and technological turbulence may cause companies to scan the environmental more extensively. Small and medium enterprises (SMEs) in the food processing industry are not generally known either for their extensive NPD activities nor for extensive environmental scanning, but both can help them be more competitive. We examine these issues in the context of the Thai food SMEs. Data from a survey of 124 Thai SMEs shows that more extensive acquisition of environmental scanning information does improve new product performance. In addition, managers who perceive more technological turbulence do use environmental scanning more extensively. The technology strategy of the company does not have much impact on the use of environmental scanning. The results indicate that even SMEs can benefit from environmental scanning, a practice more commonly carried out by larger companies. Some SMEs seem to recognize that more turbulent environments require more extensive scanning.

Introduction

Well organized, market-oriented new product development (NPD) can be a major source of competitive advantage (Hill and Jones 2004). This is the case in almost any industry, but NPD is especially important in rapidly changing markets, and the need to adapt rapidly is a driving force in the evolution of NPD practice (Rothwell 1994). Fast moving consumer goods, including food products is one such rapidly changing market. NPD can become a key component in fostering loyalty among modern consumers who like variety and may switch to another brand which has introduced something new and different (Adebanjo 2000; Nijssen 1999). Avermaete et al (2003), for example, discuss the need for smaller food companies to continuously introduce new products and develop new processes. However, although small and medium enterprises (SMEs) are often a major source of innovation, in the food industry they frequently do less NPD than large companies. This is unfortunate, since NPD could help food SMEs become more competitive if they do learn to use it well (e.g., Rudder et al 2001).

To be most effective, NPD should incorporate external information. One sort of useful information, of course, is about customer needs and preferences. The discussion of success factors for NPD in Cooper and Klienschmidt (2000) includes many activities which are actually some form of marketing research, for bringing in customer information at many different stages of the NPD process. Viaene and Januszewska (1999) argue strongly for more extensive integration of marketing, including marketing research, into food NPD as a way to keep up with volital market conditions. In the Thai food processing industry, large companies that use market research more extensively in the NPD process have higher new product success rates (Suwannaporn and Speece 2003). Some observers simply include consumer views as one element of environmental scanning necessary for successful implementation of NPD (e.g., Ahituv et al 1998).

However, the information needed to do NPD well is even broader than this, and includes a whole set of topics that are often discussed as environmental scanning. Wheelen and Hunger (2004) recommend attention to societal and environmental trends as strategic factors important for identifying future opportunities and threats. For example, knowledge of

local and regional economic conditions is one important factor in successful product innovation (Avermaete et al 2003). Knowledge of current and developing technology relevant to the food industry is another key issue (Bogue 2001). Generally, for a strategic approach, SMEs need some sort of long-term thinking supported by a formal, systematic environmental scanning process (McGee and Sawyerr 2003; Temtime 2004). They are more likely to actually use environmental scanning when they believe that technology turbulence is higher and when they have a proactive technology strategy.

We examine the use of environmental scanning in the NPD process among SMEs in the Thai food processing industry. Thailand is a middle income developing country, but has a very strong, internationally competitive agribusiness industry. Thus, it can provide a good example of how developing countries can be competitive in global markets. In addition, although the Thai food processing industry is characterized by a number of large corporations, it also has very strong SME participation. While not all SMEs do very much NPD, some do, and some of the very successful ones have learned about the need to track environmental trends (Ngamkroeckjoti et al 2005). For example, many Thai SME food producers who export are well aware of the need to use NPD to upgrade food safety standards as demands by the European Union (EU) and United States increase (The Nation 2003). Attention to this specific point, however, is forced by the regulatory systems in the major export markets. It is useful to see whether some SMEs gather environmental information more extensively for their NPD.

As a conceptual issue, there is a fair amount of discussion, sometimes with anecdotal evidence or specific case studies, about how and why environmental scanning should help companies perform better. Occasionally this discussion is specifically about new product development, or SMEs, or both. However, it is rare to have empirical data actually demonstrating that using environmental scanning has direct impact on new product performance. Further, not much of any of this discussion is in a context outside the major developed economies in the West, so it is useful to confirm that the concepts apply widely in very different contexts. Researchers experienced in cross-cultural work routinely advise that not all concepts or conceptual relationships can be directly transferred, so concepts should be confirmed when translated into very different cultural context, not assumed (e.g., Malhotra et al 1996). Managerially, of course, SME managers routinely must cope with limited resources. If we advise them to adopt more extensive use of environmental scanning, which has a cost, they will want to see some hard evidence that it will contribute to performance.

Environmental scanning and new product development

Environmental scanning (ES) is the acquisition and use of information about events, trends, and relationships in an organization's external environment. Such knowledge can assist management in planning the organization's future course of action, and one key purpose of environmental scanning activities within an organization is to provide information in support of strategy implementation. Strategic managers need to scan extensively for changes in environmental factors to create corporate policies for both short- and long-term missions (Wheelen and Hunger, 2002). Information needs evolve continuously as a result of volatility in the business environment and the diverse nature of businesses. Michman (1989) defined the main objective of environmental scanning as providing an early warning system of external events that are likely to have an impact upon corporate strategy and its performance.

Careful definition of the environmental scanning (ES) objectives is one major aspect of doing environmental scanning well. The objectives are shaped by top management's perceptions of the firm's environment and by corporate strategy (Wheelen and Hunger 2002). Singh et al (2002), for example, found that the success of an Executive Information System (EIS) depends on the use of appropriate scanning objectives and strategy

implementation. In this study, the main environmental scanning objectives among Thai food SMEs' relate to understanding market trends, technology developments, and competitive pressures. Based on research on banks in Brunei, Anwar and Sohail (2003) suggest that strategic objectives determine the form of market orientation adopted by bank managers. Generally, companies can define the set of objectives very narrowly, which needs relatively restricted environmental scanning activities, or quite broadly, which requires use of environmental scanning more extensively.

ES objectives link the strategic direction of top management to decisions about which primary ES factors must be considered in assessing environmental uncertainty. Abels (2002), for example, says that environmental scanning focuses on technology, regulatory activity, economy, and current competition, as well as competitive intelligence. Thus, ES factors can focus on specific entities (customers, competitors, and suppliers), general environment (social, political, regulatory, technological, and economic), demographics, and ecology (e.g., Daft et al 1988; Weber 1984; Ginter and Duncan 1990). Beal (2000) showed that managers of small businesses particularly collect information about customers and competitors for aligning corporate strategy. In Thailand, even before the 1997 economic crisis really forced companies to pay more attention to the external environment, some local companies periodically scanned environmental factors to keep up with enterprise and industry trends (Ngamkroeckjoti and Johri 2003). As with ES objectives, the types of information gathered can be fairly narrow or quite broad, depending on how extensively the company uses environmental scanning.

ES information sources are about the range of sources from which environmental scanning data is obtained, and the depth of data gathering from those sources. This ES factor has had less discussion in the literature. Ngamkroeckjoti et al (2005) suggest that a wider range of sources of information is part of the more extensive use of environmental scanning which can help companies in new product development.

One of the functions into which environmental scanning data feeds is NPD. Early on, Pavia (1991) found that successful firms use environmental scanning as sources of information to generate new product ideas and to define criteria used to screen during the NPD process. Abels (2002) argues that new product development is an activity which needs ES data, because many environmental factors can influence NPD success and the environment changes. Ahituv et al (1998) suggested that environmental scanning is an important strategic planning tool in helping managers to achieve their targeted performance when introducing new products. They explored particularly how information systems help in effective capture and analysis of environmental scanning information. Companies that are most successful in the design and launch of new products are likely to have used environmental scanning effectively and caught the trend of environmental changes (Hise and Groth 1995; Ahituv et al 1998). However, very little research has actually examined the direct effect of environmental scanning on new product performance in SMEs. Thus,

H1: More extensive use of environmental scanning will lead to better new product performance.

Technological turbulence

Technological turbulence is about the rate of change of product and process technologies used to transform inputs into outputs (e.g., Kohli and Jaworski 1990; Jaworski and Kohli 1993). Some observers focus specifically on change associated with new product technologies (Moorman and Miner 1997). The role of technological turbulence in business operations and outcomes is not very extensively researched, and most studies look at the turbulence as a moderating factor in how some practices affect outcomes. For example, it can moderate the relationship between market orientation in various contexts and performance (Jaworski and Kohli, 1993; Appiah-Adu, 1997). Cadogan et al (2003) found

that export orientation, with its associated information needs, is most important in situations of high environmental turbulence. The cost of developing an export orientation may be higher than the end benefit under low turbulence.

Some work looks how technological turbulence influences firms' strategy formulation and strategy implementation, such as intentions to continue in an alliance, increased information-sharing and communication, and inclusion of customers in the NPD process (e.g., Auh and Menguc 2005; Jung et al 2006; Lin and Germain 2004; Morgan 1999). These issues usually include something about information gathering for strategy. Occasionally, there are studies of how firms use environmental scanning to monitor technological turbulence (e.g., Halal *et al.,* 1998; Borjesson *et al,* 2006). However, little research explicitly examines whether perceptions of technological turbulence really encourage more extensive use of environmental scanning. It seems reasonable that they do, given that technological turbulence does have an impact strategy formulation. Certainly, companies need information to make strategic decisions.

H2: Stronger perception of high technological turbulence will lead to more extensive environmental scanning.

Technology Strategy and Environmental Scanning

Technology strategy is an important issue in overall corporate strategy, and likely to have an impact in any industry where product and process technology plays a role in competitiveness. Zahra et al (1994) examined some of the key issues in technology strategy, including technological innovation posture, dominant technological thrust and goals, globlaization of technology strategy, technology sourcing, technological investments, and organizational mechanisms.

Sharif (1994; 1997) showed how four common technology strategies relate to business strategy.

- Technology leader – leadership through developing state-of-the-art technologies first. We note that this is quite rare among Thai producers. Instead, we might consider some of them as fast followers;
- Technology follower – following with rapid application and adaptation of new advanced technologies as others develop them;
- Technology exploiter – exploiting the use of standardized technologies with some adaptation; and
- Technology extender – extension of the salvage value of obsolete technologies by simply using old, off-the-shelf technologies.

Thailand's food processing industry does not really have true technology leaders, but there are a number of companies that are quite proactive in keeping up with technology and doing NPD to stay ahead of the market, essentially some form of fast follower. Many companies, too, are simply exploiters and extenders (Ngamkroeckjoti et al 2005).

Many observers tie technology strategy directly to the ways companies manage new product and process development, particularly whether they aim to be leaders or early in the market with innovations, or follow others (e.g., Zahra and Bogner 1999; Cooper 2000; Oswald and Nelson, 2000). Ryan (1996) argued that leading-edge technology and innovation are the top priority in meeting customer requirements in many markets. Similarly, Nambisan (2002) asserts that proactive approaches to technology enhance NPD flexibility so that new products are able to stay current with consumer demand. Several researchers see environmental scanning as a critical element in using technology strategy to gain competitive advantage through NPD Greenwald and Rudolph 1996; Chiesa and Manzini 1998). Thus,

H3: Proactive technology strategy of firms will lead to more extensive use of environmental scanning.

The basic framework implied by these three hypotheses is summarized in Figure 1.

[Figure 1 about here]

Methodology

Prior qualitative research on SME food processors in Thailand indicates that some of the most successful SMEs use environmental scanning extensively and make considerable use of the information captured in their NPD decisions. Technology strategy of the company and managers' perceptions about technological turbulence seem to influence the relationship between environmental scanning and NPD outcomes. However, the researchers note that larger samples are needed to confirm the results of qualitative work with any high level of confidence (Ngamkroeckjoti et al 2005).

An initial set of questions was taken from the literature. The items representing environmental scanning objectives, environmental scanning factors, and environmental scanning sources of information, had been developed in prior research in Thailand (Ngamkroeckjoti 2000), and were only slightly adapted to fit the SME food industry context. Measures of new product performance, perceptions of technology turbulence, and a question to assess the type of technology strategy that the target companies follow were newly adapted from the literature. The technology strategy question distinguished between followers who aim to be among the first within the Thai market and those who want to be early but not first. We saw this distinction in the qualitative work, and Cooper (2000) has argued that the "fast follower" technology strategy, aiming to enter quickly after others introduce the product, is the best plan for a successful new product.

Questions on the initial list were discussed in-depth with twelve experts experienced with the issues of new product development in the food industry, as noted in Table 1. The experts assessed how well individual items represented the concepts they were supposed to measure and helped fine-tune the wording. The questionnaire was finalized once consensus was reached among the experts and the researchers on all items.

[table 1 about here]

While there was quite a lot of translation and back translation between Thai and English going on during this process, the version used in the actual survey was in Thai, so it was the Thai version that was the base for details of fine-tuning the wording, testing the reliability testing, and so forth. No one actually answered the English version, so it simply aims to accurately reflect content but was not fine-tuned for actual field use.

A small pretest was done to test reliability and to allow for last-minute fine-tuning of the questionnaire items. The draft questionnaire was distributed at an SME trade fair to 50 participants. Thirty SME managers completed the pretest survey, and they were debriefed by the researcher, who attended the trade fair to distribute and collect the questionnaire. Some minor adjustments were made on wording of a few items, but also, one section of questions on environmental scanning techniques was cut. It was apparent that SMEs did not use many of the sophisticated data gathering and data analysis techniques, but relied on simple methods. Since feedback also showed that the questionnaire was slightly too long, this ES techniques part was simply eliminated. Reliabilities were quite good on the items representing new product performance, ES objectives, ES factors, ES information sources, and technological turbulence, as indicated in Table 5 below. Technological turbulence had a Cronbach alpha score of .74, which is already quite good, indicating reliability well within the acceptable range. All other Cronbach alpha scores were even higher.

The sample frame for the main sample initially consisted of lists of SMEs from the National Food Industries (NFI) and Institute for Small and Medium Enterprises Development (ISMED) in Thailand. These lists are moderately representative, but government data is not able to track this dynamic sector with complete accuracy. Companies who were mainly in the rice milling business were excluded, since this is a very common and quite traditional small business which conducts hardly any NPD. Also, companies were excluded if they did not seem to have any semi-processed or processed products, since there is not much NPD in raw agricultural products, at least in the sense of product development discussed here. A complete mailing was made to the 530 SMEs which remained as reasonable prospects for the research on NPD. However, after 10 weeks, only 47 surveys were returned, and only 11 of these were usable. Many of the returned questionnaires notified us that the company had closed or was closing down, and others said that they did not do any NPD.

Previous mail sampling in the Thai food processing industry reported a response rate of about 20 percent (Suwannaporn and Speece 2003), but that was for mid- to large size companies. Especially among the smaller of the SMEs, the situation is much more fluid because of changes of address as well as many businesses which had been dissolved. Thus, the decision was made to use SME trade fairs, as this had worked well in the pilot survey. The researchers visited four trade fairs, sponsored by the Department of Industrial Promotion (2 events), the Department of Export promotion (1 event), and sponsored by the private sector (1 event). The majority of companies were on the original SME lists, but if not, brief screening was done to be sure that the company approached actually was an SME in the food industry. Responses were also tracked to insure no duplication, within the main sample, or with any company that was used in the pilot. An additional 113 completed questionnaires were collected, resulting in a total of 124 respondents in the main survey.

Slightly more than two-thirds of the respondents' companies had under 50 employees, while the rest were evenly distributed across the two categories of 50-99 employees and 100-200 employees. Three-fourths of the companies had registered capital of under Baht 25 million, which is about US$ 625,000 at a rate of 40 Baht / 1 US$. Only 10 percent had registered capital of over Baht 100 million, about US$ 2.5 million. Nearly one quarter of the respondents considered their company to be in the start-up phase, and another 40 percent felt the company was in the growth phase. These figures show something about the dynamism of the SME sector in Thailand, which is why lists of SMEs would have many addresses that are outdated. Overall, the sample characteristics confirm that the sample does represent the SME sector well.

Results

In the questionnaire, respondents were asked to focus on a specific new product, introduced recently, in which they had had a role during product development. The most common products about which respondents indicated they were answering were cereal products (28.2 percent of the time), vegetable or fruit products (similarly 28.2 percent of the time), beverages (17.7 percent), and meat & poultry products (16.1 percent), and seasonings (8.1 percent). Only a few products could not be easily classified into these categories. Half the respondents were talking about a product which had been launched within the past year, and only about 12 percent of them were answering about products where their experience was more than two years old. For the product under consideration, half of the respondents indicated that the time spent on new product development was one year or less. Only about 14 percent of respondents answered about products that had spent two or more years in the development process.

On most measures of new product performance, the products had performed about as planned. Turnover rate, market share, and sales volume had means not far from the scale midpoint, indicating performance close to target. The growth rate measure was judged to be a little above target on average, while payback of investment was generally considered

to lag target planning slightly, but neither of these means ranged very far from the scale midpoint (3.15 and 2.80, respectively). However, customer acceptance was generally regarded to be well above target planning, as indicated by the mean of 3.48 (Table 2).

[Table 2 about here]

In terms of the objectives in using environmental scanning, the strongest motive was for use in adjusting the strategies of the company, which scored at 3.92 on the five point scale. Formulating strategy in the first place, raising managers' awareness, analyzing industry trends, and assessing the impact of environmental changes on financial goals were also strong reasons for using environmental scanning, all scoring well above the mid-point in the range of 3.69 to 3.77. Trying to predict future driving forces in the industry and acting as an early warning system were seen as slightly less useful, with scores a little above the scale mid-point. These SME respondents were fairly neutral about using environmental scanning to generate a set of scenarios (Table 3).

By far the most commonly scanned information is about competition, with a mean slightly above 4 on the five point scale. After that, a variety of environmental factors had means in a narrow range from 3.26 to 3.31, including national and local economic factors, socio-cultural and legal factors, and local technology trends. These SME respondents were somewhat less oriented toward the international scene, and means for global technology, and Asia-Pacific and global economic factors ranged very near the scale midpoint in frequency of analysis, as did political factors. Scanning information was most likely to come from customers (most important at 3.78), competitors, and public organizations such as government offices. Publications and suppliers were also used a little more frequently than other sources. Seminars/ exhibitions / conferences and word-of-mouth through personal relationship network scored slightly above the scale midpoint, while these SME respondents did not utilize consulting companies, partnerships, or trade associations as extensively as other information sources (Table 3).

[Table 3 about here]

The respondents generally were somewhat neutral about whether actual product technology changed very rapidly, and about whether the thinking about technology development was changing very rapidly (as measured by scanning forecasts about technology). The means for these two items were only slightly above the scale midpoint. However, they were more likely to think that process technology would change, and that the technology used in R&D for developing both product and process would change. These means were in the range of 3.30 to 3.36. Overall, though, they felt that the biggest changes were likely to come in how the industry thinks about and uses the technology – this seems to reflect the feeling that industry personnel become more knowledgeable about how technologies can be useful as they gain experience. Agreement was well above the scale midpoint both the changing opportunity assessments on technology use, and changing actual new product ideas that are successful because of technology breakthrough (Table 4).

[Table 4 about here]

The check on reliability across the items used for the composite variables in the research (new product performance, environmental scanning objectives, ES factors, ES information sources, and technological turbulence) showed good results. One item, trade associations, had to be dropped from the composite variable representing environmental scanning information sources because of poor internal correlation with the rest of the items. Otherwise, all items were retained and all Cronbach alpha scores were well within the range

of acceptability. Four of the Cronbach alpha scores were above 0.80, and the ES sources of information was at 0.77, which indicates quite high reliability on all five composite variables (Table 5). Most of the scores improved slightly from the pretest, which probably indicates that the fine-tuning on some of the wording details helped slightly.

[Table 5 about here]

The questionnaire provided a brief description about how companies following the various four technology strategies used and adapted technology, and respondents choose the description that most closely matched their companies. Thailand does not really have any true innovators, but the in-depth interviews showed that fast followers needed to be distinguished from followers. The fast followers move in very quickly to acquire and adapt new technology as soon as it appears if they feel it will be useful. Followers can move quickly and adapt also, but tend to wait until market demand has been demonstrated. Extender and exploiters are as in the literature above, although the in-depth interviews showed that these two categories may not be very distinct in Thailand. In the survey, 23 respondents (18.5 %) identified their companies as fast followers, 51 (41.1 %) as followers, and the rest were mostly self-identified as extenders, with only a few exploiters. For the analysis, exploiters were grouped with extenders, since the number in the category was too small for much reliable analysis and the in-depth interviews had already suggested that the two categories were difficult to distinguish.

Environmental scanning and new product development

Table 6a shows the regression results which examine the impact of environmental scanning on new product performance. In this table, the overall mean of the environmental scanning items on all three sub-dimensions is used. Thus, the represents a measure of how comprehensively companies use environmental scanning. The equation is significant ($p = .001$), and this overall measure explains about 8.8 percent of variance in the measure of new product performance. There is a positive relationship; more comprehensive use of environmental scanning improves new product performance. Thus, H1 is confirmed.

[Table 6a about here]

The three environmental scanning sub-dimensions measure different aspects of this comprehensive use of ES. The ES objectives relate to wider use of ES information within the company, to support a broader set of objectives. The ES factors relate to a wider range of issues covered, and deeper coverage of information about the issues. The ES information sources is about how extensively companies look for the information. Table 6b indicates that it is really the broader range of issues covered which accounts for the ES impact on new product performance; ES factors is positively related to NP performance ($p = .001$). The other two ES sub-dimensions were not significant. In other words, the type of data used matters, and gathering information about a wider range of topics leads to better new product performance. The specific objectives the information is used for, and where the information came from are relatively unimportant as long as the company is using the information.

[Table 6b about here]

Impact of technological turbulence on environmental scanning practice

Table 7 indicates that companies which perceive greater technological turbulence are more likely to use environmental scanning more comprehensively. The parameter on technological turbulence is positive and significant ($p = .003$). This result supports H2. The

technology strategy of the company did not have any impact, as indicated by the lack of significance on either parameter of the two dummy variables representing the three categories of technology strategy (extender/exploiter is the baseline category in this equation). Thus, H3 does not seem to be supported.

Looking specifically at the environmental scanning sub-dimensions, neither technological turbulence nor technology strategy had an impact on the ES objectives (Table 8a). Greater perceived technological turbulence leads to wider and deeper information coverage ($p = .010$; Table 8b), and to a wider range and more extensive use of various information sources ($p = .007$; Table 8c). Thus, the impact of technological turbulence hypothesized in H2 and demonstrated overall in Table 7 works through these two specific sub-dimensions of environmental scanning. The follower technology strategy seems to scan a wider range of information sources more extensively, as indicated by the positive coefficient on the dummy variable for follower ($p = 0.23$). Perhaps followers need to time adoption of technology and introduction of new products using the technology more carefully than do fast followers or extenders/exploiters. This specific result does give weak support for H3, but overall, these tables indicate that technology strategy is not a very important determinant of environmental scanning practice.

[Table 7 about here]

[Table 8a about here]

[Table 8b about here]

[Table 8c about here]

CONCLUSION

The more comprehensive use of environmental scanning is certainly not the only reason for better new product performance, however, it does account for roughly 9 to 13 percent of variance in NP performance, depending on exactly what aspects of ES are examined. Environmental scanning alone will clearly not save poor products, overcome poor distribution, or replace the need for coherent marketing communications. Nevertheless, the use of environmental scanning is a significant contributing factor to better new product performance – it can give companies an edge over the competition if competitors are also competent in the main areas of NPD and marketing.

There is also a significant relationship between technology turbulence and environmental scanning practice. Again, this relationship only accounts for a small part of the reasons for using environmental scanning, but this result does indicate that SMEs which perceive more technology turbulence tend to use environmental scanning more extensively. The perceived turbulence does not seem to encourage a broader set of scanning objectives, but it does lead to examining a wider set of factors and using a broader set of information sources.

Followers, here specifically those who have good technology capabilities but want to let others enter the market first and then quickly follow, do scan a broader range of information sources than fast followers or companies with passive technology strategies. This is probably consistent with Cooper's (2000) assertion that the follower strategy is more effective – followers need to keep track of the early entrants to time their own entry carefully – but for the most part, the different technology strategies do not much affect environmental scanning practice.

These results were found in the food processing industry, but they may not hold in other industries where technology plays a much greater role. Certainly, there are different

levels of technology sophistication and usage among firms in food processing, and firms can gain advantage through better NPD. But some industries have much greater reliance on technology content, and technology change is much more rapid, so that distinctions in technology strategy are likely to be much greater. Nevertheless, even in food processing, the use of environmental scanning has an impact on the outputs of the NPD process; it is likely to have an even greater impact in industries where technology is even more important and changes more rapidly. Thus, this evidence indicates that even SMEs can see real performance benefits from making more extensive use of environmental scanning.

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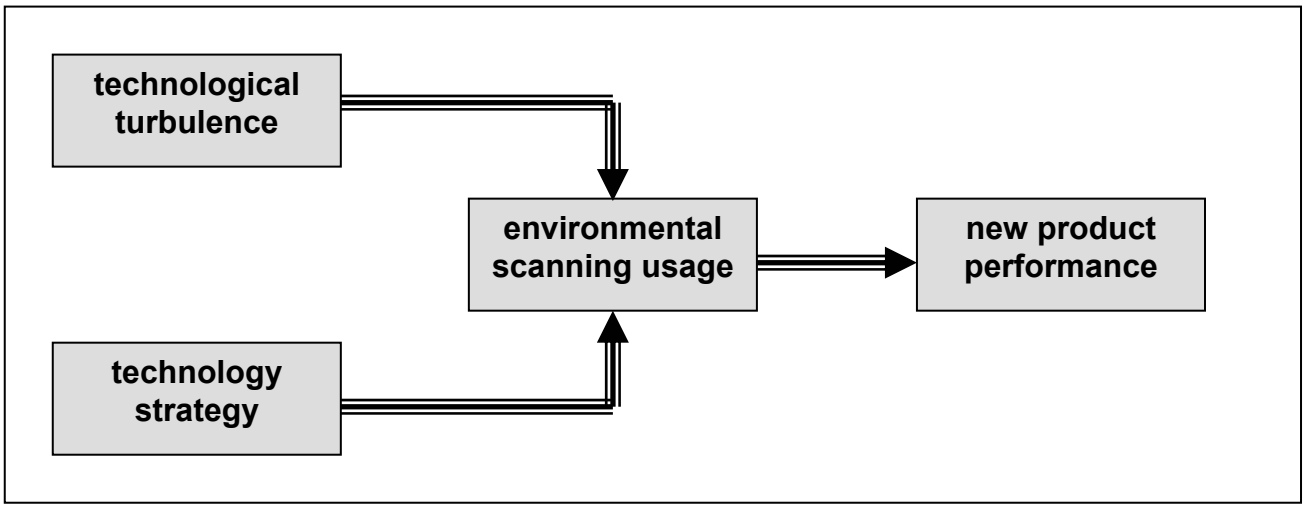

Figure 1: Conceptual structure

Table 1: Positions of the twelve experts

Organization	Position
Institute of Food Research and Product Development, Kasetsart University (state university)	director NPD expert
National Food Institute (government agency)	director assistant to director
Thai Food Processors' Association (private sector trade association)	president
Food Science and Technology Association of Thailand (trade association including both private & public sector)	president assistant to president
Thai Frozen Foods Association (private sector trade association)	manager
The Federation of Thai Industries (government sponsored trade association)	two managers
National Science and Technology Development Agency (government agency)	two managers

Table 2: Means and standard deviations of new product performance items

new product performance	mean	std dev
customer acceptance	3.48	1.10
growth rate	3.15	1.14
turnover rate	3.08	1.11
market share	3.00	1.02
sales volume	2.97	1.10
payback of investment	2.80	1.00
composite (mean) of new product performance	3.08	0.85

note: 5 point scale, 1 = far below target planning, 5 = much higher than target planning

Table 3: Means and standard deviations of environmental scanning items

environmental scanning objectives	mean	std dev
adjust the strategies of the company	3.92	0.86
formulate strategy	3.77	0.86
raise managers' awareness	3.77	0.87
analyze industry trends	3.74	0.88
assess the impact on financial goals	3.69	0.89
predict future driving forces	3.45	0.85
act as an early warning system	3.35	0.94
generate a set of scenarios about the behavior of environment	3.12	1.02
composite (mean) of environmental scanning objectives	3.60	0.60
environmental scanning factors	**mean**	**std dev**
competition factors	4.06	0.99
Thailand economic factors	3.31	1.08
district economic factors	3.31	1.09
socio-cultural factors	3.31	1.16
legal factors	3.29	1.07
local technology factors	3.26	0.96
global technology factors	3.08	1.08
Asia-Pacific economic factors	3.00	1.02
global economic factors	2.97	1.17
political factors	2.94	1.07
composite (mean) of environmental scanning factors	3.25	0.67
environmental scanning sources of information	**mean**	**std dev**
local and foreign customers	3.78	0.94
local and foreign competitors	3.58	1.11
public organizations	3.44	1.04
publications	3.31	0.99
local and foreign suppliers	3.27	1.04
seminars/ exhibitions/ conferences	3.15	1.07
relationships between friends/relatives locally or abroad	3.15	1.10
information from consulting companies	2.71	1.19
co-partner company cooperation	2.70	1.09
trade associations (dropped from the composite because of poor internal correlation with other items)	2.69	1.97
composite (mean) of ES sources of information	3.18	0.61
overall mean of environmental scanning items	3.34	0.51

notes: 5 point scale on all three sub-dimensions;
ES objectives, 1 = not important at all, 5 = very important
ES factors, 1 = not analyzed at all, 5 = analyzed extensively
ES information sources, 1 = not used at all, 5 = used extensively

Table 4: Means and standard deviations of technology turbulence items

technology turbulence (change frequently)	mean	std dev
changing opportunity assessment to use new technologies	3.66	1.01
new product ideas that succeed through tech breakthrough	3.55	1.05
changes in technology used for R&D in product	3.36	1.03
changes in technology used for R&D in product process	3.35	1.07
changes in process technology	3.30	1.10
forecasts about technology 5 years ahead	3.16	1.04
changes in product technology	3.14	1.12
composite (mean) of technology turbulence	3.36	0.82

note: 5 point scale, 1 = strongly disagree, 5 = strongly agree

Table 5: Reliability of composite variables

composite variables	Cronbach alpha pretest (n=30)	Cronbach alpha main sample (n=124)
new product performance (6 items)	0.82	0.88
environmental scanning objectives (8 items)	0.78	0.81
environmental scanning factors (10 items)	0.82	0.83
ES information sources (9 items)	0.83	0.77
all environmental scanning items (27 items)	0.83	0.88
technological turbulence (7 items)	0.74	0.82

Table 6a: Regression, environmental scanning and new product performance

dependent variable: new product performance	R	R square	adjusted R square	F	sig.
	.297	.088	.081	11.819	.001
	unstandardized coefficients (B)	std. error	standardized coefficients (Beta)	t	sig.
(Constant)	1.900	.367		5.179	.000
ES overall	.371	.108	.297	3.438	.001

Table 6b: Regression, environmental scanning sub-dimensions and NP performance

dependent variable: new product performance	R	R square	adjusted R square	F	sig.
	.359	.129	.107	5.915	.001
	unstandardized coefficients (B)	std. error	standardized coefficients (Beta)	t	sig.
(Constant)	2.073	.375		5.522	.000
ES objectives	.032	.109	.029	.289	.773
ES factors	.347	.105	.366	3.315	.001
ES info sources	-.052	.101	-.052	-.519	.605

Table 7: Impact of technological turbulence and technology strategy

dependent variable: overall ES	R	R square	adjusted R square	F	sig.
	.287	.083	.060	3.573	.016
	unstandardized coefficients (B)	std. error	standardized coefficients (Beta)	t	sig.
(Constant)	2.744	.196		13.965	.000
tech turbulence	.164	.055	.264	3.003	.003
dummy for fast follower	-.010	.126	-.007	-.078	.938
dummy for follower	.112	.098	.109	1.142	.256

Table 8a: Technological turbulence, technology strategy, and ES objectives

dependent variable: ES objectives	R	R square	adjusted R square	F	sig.
	.192	.037	.013	1.521	.213
	unstandardized coefficients (B)	std. error	standardized coefficients (Beta)	t	sig.
(Constant)	3.143	.235		13.389	.000
tech turbulence	.123	.065	.170	1.887	.062
dummy for fast follower	-1.433E-02	.151	-.009	-.095	.924
dummy for follower	.101	.117	.084	.863	.390

Table 8b: Technological turbulence, technology strategy, and ES factors

dependent variable: ES factors	R	R square	adjusted R square	F	sig.
	.274	.075	.050	3.074	.031
	unstandardized coefficients (B)	std. error	standardized coefficients (Beta)	t	sig.
(Constant)	2.767	.242		11.438	.000
tech turbulence	.174	.066	.236	2.621	.010
dummy for fast follower	-.211	.154	-.136	-1.373	.173
dummy for follower	-.125	.121	-.102	-1.032	.304

Note: these results after deleting 5 outliers with standardized deviation > 2 in absolute value.

Table 8c: Technological turbulence, technology strategy, and ES info sources

dependent variable: ES info sources	R	R square	adjusted R square	F	sig.
	.314	.099	.076	4.339	.006
	unstandardized coefficients (B)	std. error	standardized coefficients (Beta)	t	sig.
(Constant)	2.432	.235		10.362	.000
tech turbulence	.180	.065	.241	2.764	.007
dummy for fast follower	.135	.151	.085	.897	.372
dummy for follower	.271	.117	.219	2.312	.023