THE RELATIONSHIPS BETWEEN TECHNOLOGICAL TURBULENCE AND ENVIRONMENTAL SCANNING SOURCES OF INFORMATION IN THE THAI FOOD PROCESSING INDUSTRY

By

AREEYA SWANSON

A Thesis submitted in partial fulfillment
of the requirements for the degree of

Master of Business Administration

Graduate School of Business
Assumption University
Bangkok, Thailand

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ABSTACT

Technological turbulence drives the small and medium enterprises (SMEs) in developing countries to continuously learn about new technology and to develop new products and product processes activities, at a faster rate than ever before. It create uncertainty that can be competency destroying. Keeping up with environmental scanning sources of information will leverage SMEs to remain their competitive advantage.

This study aims to examine the relationship between the technological turbulence, which changes rapidly in the creation new product and product processes in the case of Thai food processing industry in Bangkok. Technological turbulence, in this study, is measured by the characteristics of rapid change in new product, product process, and research and development. Questionnaires from chief executive officers (CEOs) or SME's owners of 100 SMEs through sample survey are used to examine the affects of technological towards scanning sources of information and to test the propose.

The finding highlights that technological turbulence has the strong affects upon the use of information sources in environmental scanning practice in the SMEs Thai food processing industry. It seems that chief of officer (CEO's) or SME's owner recognized the important of environmental scanning practice and would seek valuable information from several sources when the turbulence of technology occurs. Moreover, the recommendation for SMEs as well as for the government and future study are provided.

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CHAPTER 1

GENERALITIES OF THE STUDY

1.1 Background of the study

The largest segment of the industrial sector is not large enterprises, but rather small and medium enterprises (SMEs). They make a significant contribution to manufacturing output and employment. They are said to be the core of economic growth and development, the source of entrepreneurship, and developers of new products for market niches. The rapid change of technology is driving the SMEs in developing countries to continuously learn about new technology, develop new products, and develop new product processes, at a faster rate than ever before. If SMEs hope to survive in this fast moving technological world, they must adapt to a changing environment, not just locally but now globally. Environmental scanning is going become an important tool for the SMEs to acquire information about their global markets, which should greatly assist the SME's futures. Environmental scanning is the acquisition and use of information about events and trends in an organization's external environment, this knowledge would include; new product and product processes technologies, management techniques, quality assurance, rules and regulations, and much more (Marsili, 2000, Choo, 2002; Wignaraja, 2003).

SMEs in developing countries are not yet ready for global market technology, because traditional activities are unchanging such as; low level of productivity, poor quality of product, and only focusing on localized markets. Many SMEs do not have the financial resources or employee resources to gather information on technology innovation for new product development. Additional barriers to the SME's in developing countries are

language and lack of scientific and technical training. Although much of the current technical knowledge is available in open scientific and engineering literature, it is not easily accessible in all parts of the world because of lack of management information gathering systems. To strengthen industry in the long run, SMEs in the developing countries will have to modernize their management of international marketing information, enhance industrial science and technology capability and improve skills (Lall, 2000; Read *et. al.*, 2001).

In Thailand, SMEs have played an important role to strengthen the country's economy, since the crisis of 1997. SMEs help generate the country's economy through product output, employment, and utilization of regional resources. In Thailand, more than 90 % of the total number of enterprises in the manufacturing sector is SMEs. These SMEs are scattered both in Bangkok Metropolitan and regional areas. They employ about 65% of the country's workforce and represent 50% of GDP (Leopairot, 2002). Thailand is well recognized as an agricultural country and is only one of a few countries in Asia that registers as a volume food producer and exporter in Asia. More than 40% of the SMEs in Thailand belong to food industry (Bunmark, 1999).

A similarity between Thailand's SMEs and other developing countries SMEs, is that developing countries SMEs are traditionally characterized by mass production with low-value, mostly unskilled-labor, and standardized products. Many of them lack in product innovation, research and development (R&D), and appropriate training to upgrade their human resources (Surussavadee, 2001). Furthermore, it appears that SMEs sometimes do not understand the value of new product development and are likely to minimize their data review activities (Boonritmontri, 2001).

SMEs in food processing industry in Thailand are encountering a rapidly changing technology, new product developments, and intense global market competition. For these reasons, it is a must for Thai SMEs' food operators to expeditiously improve their capabilities in production and product development, resulting in better quality and a better price, compared with those of their rivals. Additionally, the well-managed new product developments should be organized as continuous learning processes and should have strong information linkage across functions inside and outside the firm, from suppliers to customers. New product developments in many Thai companies often suffer from poor cross-functional communication, which can lead to costly mistakes and loss of time in getting new products to the market quickly (Swannaporn *et al*, 2000). Keeping up with external environment factors and rapidly changing technology is increasing in importance for those SMEs that wish to have a competitive advantage. External environmental factors and rapidly changing technology are major drivers of change and efficiency improvements (Wignaraja, 2003). Environmental scanning has become an efficient tool for the SMEs to use to remain competitive in world markets and should greatly assist the organization's future (Choo, 2002).

This study is built on a conceptual framework showing the relationships between technology turbulence and sources of information used in environmental scanning and how technological factors affect the scanning of sources of information, but limited to SMEs, thereby excluding large companies. In particular, the researcher aims to investigate this matter in SMEs in the Thai food processing industry, an industry that is very important to Thai economy.

1.2 Statement of the problem

Technology is widely known as an increasingly important factor in the world competitiveness. In Thailand, there are many new SMEs in the food processing industry, but many have failed within a few years or sooner. SMEs have been faced with difficulties in technological development. Many of them lack in product innovation, research and development (R&D) and appropriate training to upgrade their human resources (Surussavadee, 2001). They lag behind and cannot keep up with the very fast-moving changes in the business environment, technological turbulence, causing them lose competencies and competitiveness in the marketplace. This falling behind is because of a lack of management information, limit resources, and lack of understanding of the benefits that can be gained by keeping up with the external environment and changing technology.

Recently, there are only a few empirical studies that have been conducted in Thailand to expose the advantages of environmental scanning practice, to SMEs. Without any clear indication of the benefits that SMEs can gain, it becomes hard for them to adopt and implement the practice of environmental scanning as part of their strategy process. For this reason, this study is conducted mainly to examine the relationships between technology turbulence (in terms of rapidity of change) and sources of information used in environmental scanning of SMEs in the Thai food processing industry. Therefore, considering all the details above, this research study has attempted to answer the following:

- Does technological turbulence affect to the use of information sources in environmental scanning associated with new product development among SMEs in Thai food industry?

1.3 Research objectives

The purposes of this research study are summarized as follows:

(a) To examine the relationships between technological turbulence and sources of information used in environmental scanning for new product development; and

(b) To provide recommendations for SMEs in Thai food processing industry and the government.

1.4 Scopes of the study

The scope of the study is technological turbulence and environmental scanning sources of information. The study is focused on affects of technological turbulence toward the uses sources of information in environmental scanning in the Thai food processing industry. The scope of technological turbulence is restricted mainly to changes in technologies (developing new product and product processes, research and development (R&D), ability to predict technology for the next five years, opportunities of product, and new product ideas through technological breakthroughs). Sources of information, mainly focuses on publications, public organizations, customers, suppliers, competitors.

Data collection of the target population, including pretest, is accomplished from sales representative offices located in Bangkok and metropolitan areas, and questionnaires are distributed in several food fairs to ensure access to the target population in the study. These fairs are organized by government or private agencies and held in department stores and commercial buildings. The samples of this study are SMEs in the Thai food processing industry. SMEs in this study are defined by the Ministry of

Industry as follows; SMEs refer to those whose employees are not over 200 persons or who have investments on fixed assets that are not over 200 million Baht. The target respondents are either SME's owners or chief executive officers (CEOs) who are chosen because of their involvement in the scanning decisions in developing new products within the company.

1.5 Limitations of the study

The study is focused on the SMEs of Thai food processing industry. The researcher has distributed the questionnaire at food fairs exhibitions in order to retrieve the most accurate data. One of the most critical limitations in this study is accessibility to SME's owners or CEOs, particularly when proposing to fill in the questionnaire. Since the target respondents are top executives or management level, they are always busy and have little time. In some instances, the target respondents expressed concern over the confidentiality of the data and think that it is too deeply embedded to be extracted by an external researcher. Additionally, the proportion of small to medium companies included in the samples is not predetermined. The findings from the study represent the results as a combination of both small and medium companies overall and may not be implied separately. Other constraints are subject to limited period of time, limited budget, and the respondents' misunderstanding towards the study.

1.6 Significance of the study

The researcher considers that the findings from this study about the relationships between the turbulence of technology environment and societal environment can be of considerable benefit to the following parties:

(1) SMEs that are currently in business or those who plan to start a business in the future in the food Industry will benefit from this study, to alert SMEs in the food processing industry of the important of the environmental scanning external environment of changes in the technologies and the uses sources of information in order to acquire knowledge more effectively. Also, SMEs in other sectors can also apply the basic concepts and adapt it to suit their requirements.

(2) Government agencies and other private associations can benefit from this research study in many ways. For example, they can provide more efficient training programs to educate SMEs to raise their competitiveness. In terms of information support, they can distribute publications about updated news on relevant technology that SMEs in the specific industry should be made aware.

(3) From the academic perspective, this study provides contributions for further study.

1.7 Definition of term

Environmental Scanning: The acquisition and use of information about events, trends and relationships in an organization's external environment, the knowledge of which would assist management in planning the organization's future course of action (Choo, 2002). This meaning is similar used in this study.

Environmental Uncertainty: The degree of complexity plus the degree of change existing in an organization's external environment (Wheelen and Hunger, 2002).

Food Processing Industry: The industry that brings agricultural products such as vegetables, poultry, and fish to the production process by using various technologies in order to make convenient consumer products. It also includes industries that preserve agricultural products for a longer period of time by using basic conversion process (Cheasakul, 2000).

New Products: Products which did not exist previously in the company. These could be products with totally new technical developments or they could be revisions of existing products with new packaging or a new financial service (Ahituv *et al.*, 1998). In this study, new products were defined variety foods which launched onto the market during 1998-2003.

New product in Thai food industry: The formulating of new product concepts, assessing the feasibility of the concepts from technical, manufacturing and business standpoints, demonstrating the product performance and benefits and the viability of the business opportunity and scaling up to commercial status (Kotler, 2003).

Processed Food: Agricultural products such as vegetables, poultry, and fish which are undergone some kind of processing by using various technologies to make convenient consumer products (Cheasakul, 2000).

Product R&D: Concentrating on marketing and is concerned with product or product-packaging improvements (Wheelen and Hunger, 2003).

Process R&D: Concerned with engineering, concentrating on quality control and the development of design specifications and improved product equipments (Wheelen and Hunger, 2003).

Product Technology: Elements of technology embodied in the goods and services of a firm (Narayanan, 2001).

Process Technology: Techniques of producing and marketing goods and services (Narayanan, 2001).

Small and Medium Enterprises (SMEs): Businesses in the production, trading (wholesale and retail) and service sectors which fixed assets not over 200 million baht or a number of employees not greater than 200 persons (Boonritmontri, 2001).

SME's Owner: A person who owns small and medium business including entrepreneurs and owner managers (Cheasakul, 2000).

Sources of information: Sources of information rang from human to high-technology business intelligence (Choo, 2002).

Technological environment: Includes the institutions and activities involving with creating new knowledge and translating that knowledge into new outputs, products, processes and materials (Hitt et al., 2002).

Technological turbulence: The degree of change of technological associated with new product technologies (Moorman and Miner, 1997).

Technology development: Human activities that converts knowledge and ideas into physical hardware, software, or services (Khalil, 2000).

Technological discontinuity: The progress of technology in relation to product and process innovation (Khalil, 2000)

CHAPTER 2

A LITERATURE OF REVIEW

The following discussions are intended to review and highlight the major concepts and theoretical formations relevant to the study. Four major areas of literature review are conducted in this chapter. The first part is concerned with prior empirical studies in the field of the technological turbulence. The second part is concerned with environmental scanning sources of information of new product development. The third part is related technological factors and environmental scanning sources of information. The fourth is concerned with the food processing industry in Thailand.

2.1 Technological turbulence

2.1.1 Defining and characteristics

Moorman and Miner (1997) defined technological turbulence as a degree of change associated with new product technologies. Similarly, the pace of technological change is seen as a rate at which the focal product and its features are changing. In generally sense, the rapid change of technological creates uncertainty that can be competency destroying and give rise of information processing problem of search efforts in order to acquire new information. Therefore, the rapid change of technological may enforce some additional demands on a firm's search process (Weiss and Heide, 1993). The environmental uncertainty, in the forms of technology change, can creates radical innovation which upheavals within an industry and the patterns of technology change drive the evolution of competitiveness, process and product technologies are such type of technological change (Narayana, 2001).

In conjunction with the rapid pace of technological change, market behavior has been changed such as demands of high-quality products. The rapid change in technology combined with consumers' new attitude has forced a move away from the use of fixed production line (Khaili, 2000). Technological change gives way to create new products and processes (Narayanan, 2001). The context of technological turbulence characteristics were indicated in the prior research study, Moorman and Miner (1997) as follows:-

- Product technology
- Process technology
- Product R&D
- Process R&D
- Predictable technology changes for the next fives years
- Big opportunities of the product
- New product ideas through technological breakthroughs

Product technology

Product technology is such type of technological change, it refers to the output of an organization and the elements of technology embodied in the goods and services of a firm.

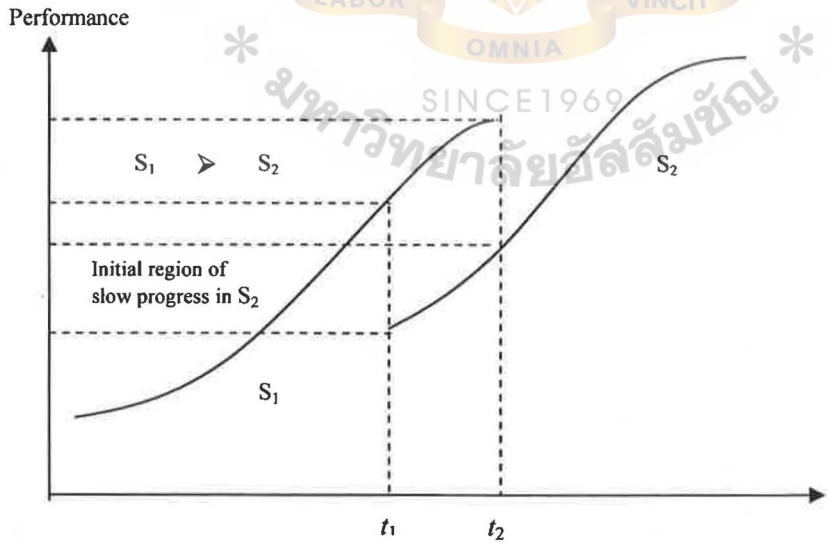
Process technology

Process technology refers to the way an organization conducts its business and techniques of producing and marketing goods and services which is included work methods, equipment, distribution, and logistics. It is embedded in a firm's value chain.

Research and development (R&D)

R&D deals with product and process innovation and improvement. The basic R&D is conducted by scientists in well-equipped laboratories where the focus is on the theoretical problem areas. The best indicators of a company's capability in this area are its patents and research publications (Narayanan, 2001). Figure 2.1 shows a key concept in R&D which are put into developing a new product or process. It is showing the rate of change of the performance parameter over time. The specific technology approaches certain limits set by the fundamental laws of nature. This phenomenon is known as the concept of discontinuity of S-curves in technology. Further progress requires a fundamental technological change from an entirely new and frequently different knowledge base, a new S-curve needs to be created, resulting in a technological discontinuity (Khaill, 2000).

Figure 2.1 Technological discontinuity



Source: Khaill, T (2000). "Management of Technology: The key to competitiveness & Wealth Creation" (International Edition), Singapore: McGraw-Hill, p.255

As illustrate in Figure 2.2 (see pp 14), product and process R&D tends to vary as a product moves along its life cycle.

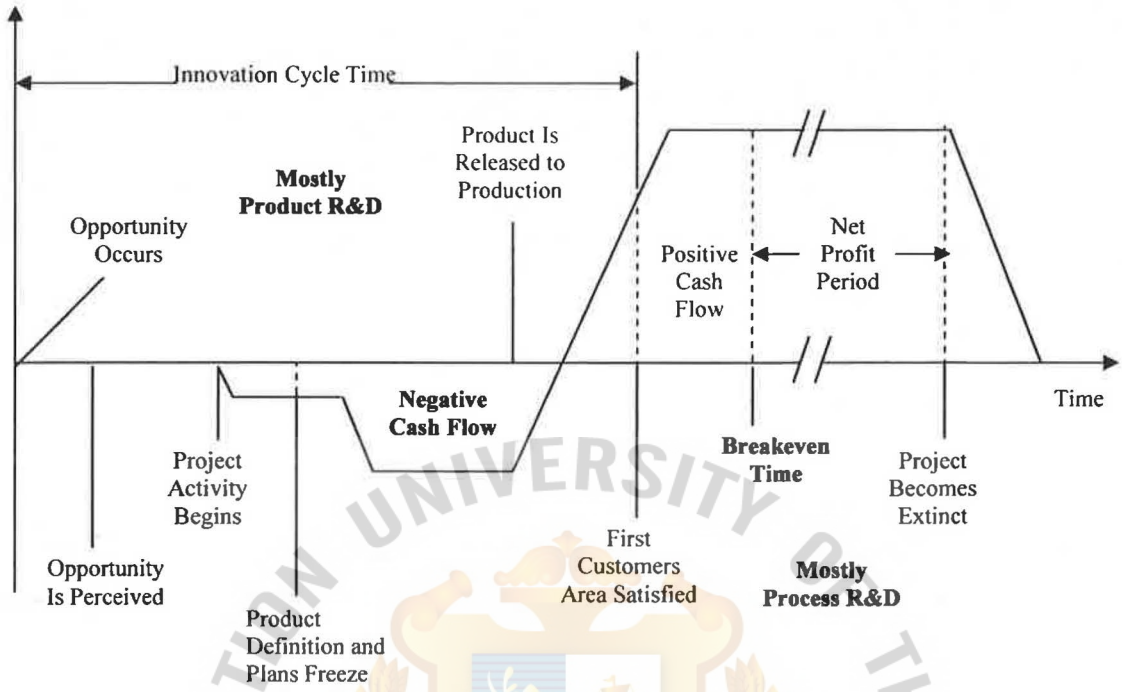
Product R&D

In the early state, product innovations are most important because the product's physical attributes and capabilities most affect financial performance (Wheelen and Hunger, 2002). Product R&D concentrates on marketing and is concerned with the product or product-packaging improvements. The best measurements of ability in this area are the number of successful new products introduced and the percentage of total sales and profits coming from products introduced within the past 5 years. Product R&D normally dominates the early stages of a product's life cycle (when the product's optimal form and features are still being debated).

Process R&D

Product process is concerned with engineering, concentrating on quality control and the development of design specifications and improved production equipment. A company's capability in this area can be measured by consistent reductions in unit manufacturing costs and by the number of product defects. Process R&D becomes especially important in the later stages when the product's design is solidified and the emphasis is on reducing costs and improving quality, improves manufacturing facilities, increasing product quality, and faster distribution. Figure 2.2 (see pp 14) shows the proportion of product and process R&D tends to vary as a product moves along its life cycle (Wheelen and Hunger, 2001).

Figure 2.2 Product and process R&D in the innovation life cycle



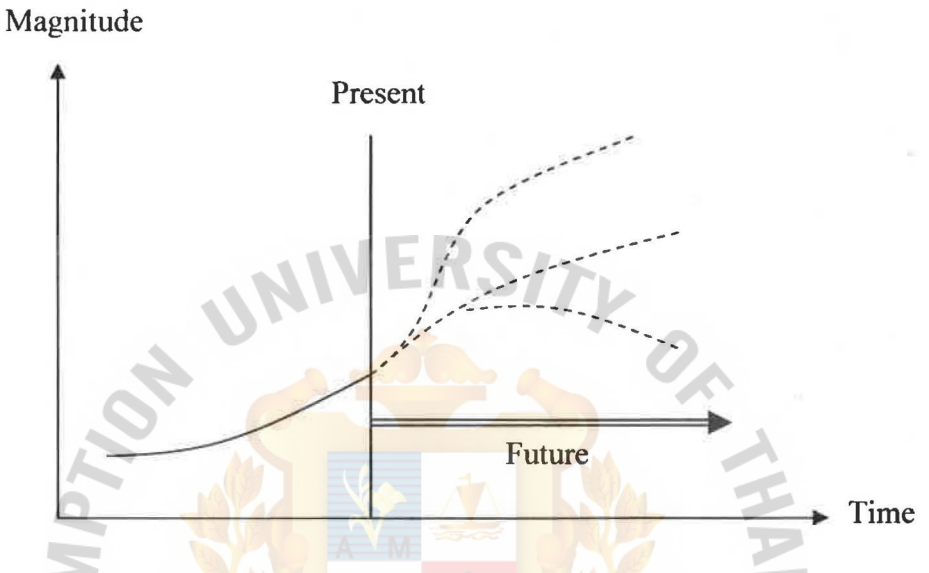
Source: Wheelen, T.L., and Hunger, J.D. (2002) "*Strategic Management and Business Policy*" (8th ed.,) New Jersey: Prentice Hall International Inc., p.286.

Predictable technology for the next five years (Forecasting)

Forecasting provides visions of the future that can be used to guide actions of the present in anticipation of future state. The approaches to technological forecasting (prediction) vary with the stage of technological development and the intent of the forecast. Potentially, each of the technologies may provide opportunities for substitution by superior technologies. The problem of predicting the future is more difficult with technology that is experiencing rapid change. Figure 2.3 (see pp 15) shows three extrapolations of the possible future growth pattern of a technology. A future state depends on the characteristics and physical limits of the technology, the

social and environmental factors influencing its development, and market conditions compared to those of its competitors (Khaill, 2000).

Figure 2.3 Growth pattern and possible future state of a technology



Source: Khalil, T. (2000). "Management of Technology: The Key to Competitiveness & Wealth Creation" (International Edition), Singapore: McGraw-Hill, p.254

Product opportunities

An opportunity is one of characteristics in competitive domains. It drives the firms' capacity of process, process and product to develop new product that fulfills and meet customers' preferences.

New product idea through technology breakthrough

The way to overcome the barriers to successful product innovation, using multifunctional teams with significant autonomy dedicated on project.

2.1.2 Literature reviews on technological turbulence

During 1990s, only a few studies began to pay attention to the issue of technological turbulence (Jaworski and Kohli, 1993; Weiss and Heide, 1993, Moorman, and Miner, 1997; Morgan, 1999; Calantone *et al.*, 2003) (See Table 2.1)

Table 2.1 Major research concerns technological turbulence

Year, Author, and Title	Concept, Focus, Empirical Basis, Type of Model
• 1997 • Moorman and Miner • The impact of organizational • memory on new product performance and creativity • Context: USA	• Investigating effects of environmental turbulence on organizational memory-new product outcome relationships, 92 new product development • Conceptual framework • Survey data
• 1993 • Jaworski and Kohli • Market orientation: antecedents and consequences • Context: USA	• Examination on the relationship between market- oriented and performance. • Conceptual framework • Cross-sectional survey data
• 1993 • Weiss and Heide • The nature of organizational search in high technology markets • Context: USA	• Testing buyer's behavior in high technology markets, identifying key dimensions of high technology market and effects on organizational buyer's search behavior. • Conceptual framework • Survey data
• 1999 • Morgan, R.E. • Environmental determinants of export decision making • Context: UK	• Conceptual propositions concerning the respective relationship perceived technological turbulence in the domestic market and export strategy development. • Conceptual model
• 2003 • Calantone, *et al.* • The Effects of Environmental Turbulence on NPD • Context: UK	• Specifying firm innovativeness, market orientation and top management risk taking as antecedents to NPD speed and corporate strategic planning. • Based-lined Model • Cross-sectional survey

Moorman and Miner (1997) defined technological turbulence as the degree of change associated with environmental scanning in producing new product technologies. The study of 92 new product development projects found that technological turbulence moderate the impact of organizational memory dispersion on creativity of new products, but on short-term financial performance, as turbulence is likely to reduce the

value of prior learning, which forces the organization to search of and process more information about the environment. The study found that knowledge is not an unconditionally positive asset and suggest that developing and sustaining valuable organizational memory may require attention not only to the appropriate levels of memory but also to managing subtle aspects of memory dispersion and deployment. It implied that the organizations may fail to harvest the full value of organizational learning, if they fail to understand the subtle ways in which different features of organizational memory influence product development.

Jaworski and Kohli (1993) defined technological turbulence as the rate of technological change. The authors classified the impact of technological turbulence upon the relationship between market orientation and business performance. Under these circumstances, market orientation is the principles of market segmentation drive new product development efforts in the marketing department. They stated that the organizations that work with nascent technologies, undergoing rapid change may be able to obtain a competitive advantage through technological innovation. By contrast, organizations that work with stable technologies are relatively poorly positioned to leverage technology for gaining a competitive advantage. The researchers found that the market orientation of a business is an important determinant of its performance regardless of the technological turbulence. They suggest that the importance of information from the client is lower because he knows little about the emergent technologies.

Weiss and Heide (1993) examined the perception of buying behavior of new product development towards technological change. They discovered that the higher perceived technological change tends to increase scanning the external environment of buyer's new products. The researchers explained that the pace of technological change is defined as the rate at which the focal product and its features are changing. For instance, in the product category of computer work stations, which themselves are based on rapidly improving.

Morgan (1999) proposed the conceptual concerning the respective relationships between competitive intensity, perceived technological turbulence and product-market turbulence, and export strategies development in the domestic market and market strategy development at the pre-export level. The paper examined, the perceived technological turbulence to the domestic market was confidently related to export strategy development at the pre-export level.

Calantone *et al.* (2003) studied the affects of environment turbulence of technology towards the strategies planning for new product development and the corporate performance. It is indicated as moderate effects to market orientation and innovation developed (technological vs. administrative). Turbulence crates a situation where considerable uncertainty and unpredictability confront new product development manager. The studies found, technological turbulence was modeled as direct antecedent the new product development process.

2.2 Defining Environmental scanning sources of information

2.2.1 Defining and characteristics

Environmental scanning is reviewed as the acquisition and use of information about events, trends and relationships in an organization's external environment, the knowledge of which would assist management in planning the organization's future course of action. Organizations scan the environment in order to understand external forces of change so that they may develop effective responses that secure or improve their position in the future. To the extent that an organization's ability to adapt to its outside environment depends on knowing and interpreting the external changes that are taking place, environmental scanning constitutes a primary mode of organizational learning (Choo, 2002).

In additionally, the effective of scanning environmental is seen as necessary to the successful alignment of competitive strategies with environmental requirements and the achievement of outstanding performance. The frequency and scope of environmental scanning on environment-competitive strategy alignment those obtain information on several aspects of specific environmental sectors such as customer, competitors, suppliers (Beal, 2000).

2.2.2 Literature review concerns environmental scanning sources of information

Sources of information have been classified from different perspectives by several authors (Ahituv *et. al.,* 1998; Beal, 2000; Sawyerr *et. al.*, 2000; Woodcock *et. al.*, 2000, Choo, 2002). (See Table 2.2, pp 20)

Table 2.2 Major Research concerns environmental scanning sources of information

Year, Author, and Title	Concept, Focus, Empirical Basis, Type of Model
• 1998 • Ahituv, N., Zif, J., and Machlin, I. • Environmental scanning and information systems in relation to success in introducing new products. • Context: Israel	• To examine the level of environmental scanning and the use of information systems to seek a link with the firm's success in introducing new products. • Personal interview. • Survey data
• 2000 • Beal, R. M. • ES, competitive strategy, and organizational performance in small manufacturing firms. • Context: U.S.	• Test of contingency theories that link environmental conditions, competitive strategy, environmental scanning, and organization performance. • Integrative model. • Cross-sectional survey data.
• 2000 • Sawyerr, O. O, Edbrahimi, B. P., and Thibodeaux, M. S. • Executive environmental scanning, information source utilization and firm performance: The case of Nigeria. • Context: Nigeria	• Investigation of information source usage, environmental scanning practices, and organization performance of SMEs. • Non-probability sample • Personal interview. • Structured questionnaire
• 2002 • Choo, C.W • Information management for the intelligent organization • Context: Canada	• To examine organization behavior and information resources, information needs, organizing and storing information, developing information products and services, distributing information, and using information. • Conceptual model

Ahituv *et al.* (1998) studied the pattern of scanning in terms of frequency of scanning and information channels. The research studied of the 40 firms in Israel was performed the results, are analyzed to determine the degree of using information systems by CEOs for strategic decision making and to seek a link with the firm's success in introducing new products. The studies find that firms succeeding better with new products will show a higher correlation between strategic uncertainty and the frequency of environmental scanning, especially in the economic, technological and socio-cultural sectors than less successful firms. The studies imply that top executives in the more successful firms are more flexible in adapting their pattern of scanning to their environment and that they do not rely only on fixed patterns of information, but the

formal of information sources are more used. In addition, the more successful firms carry out scanning at a higher frequency in the competitor, customer and technological sectors than less successful firms.

Beal (2000) suggested that broad scanning of information on several aspects of specific environmental sector (such as customer, competitors, and suppliers) in terms of scope and frequency relates alignment between an industry life cycle stage and a competitive strategy. The significant relationship does not connote a casual relationship between scanning behavior and environment-strategy alignment. However, the broad scanning of information dealing with customers and competitors appears to be more associated with aligning competitive strategy with industry life cycle stage than does the scanning of other sectors. The studies imply that general managers of small manufacturing firms seeking to compete effectively in growth and mature industries should obtain and analyze various types of information about competitors and customers independent of the strategy employed. On the other hand, firms pursing either a combination of low cost leadership and quality differentiation or a combination of low cost leadership and service differentiation in mature industries should monitor and analyze information regarding their own resources and capabilities as well as diverse information on customers and competitors.

Sawyerr *et al.* (2000) examined scanning practices (in terms of frequency and interest), sources of information used, and organization performance of CEOs of 47 small to medium-sized manufacturing firms in Nigeria. The results indicate that environmental scanning frequency did not vary significantly for the task and general environment. The lack of a significant difference between the means of personal and impersonal

sources of information is found as they describe personal sources as untrustworthy. The study concluded that environmental scanning and information source use are influenced by the characteristics of the external environment within which the organization exists.

Types of information sources

Choo (2002) classified sources of information into three categorizes, consisting human, textual, and on-line database. This classification is based on the need to identify future trends and actively respond to immediate change of environment. The human source is usually used when the manager has to deal with ambiguous situations, and high levels of environmental uncertainty with limited amount of information. The human source provides information informally for the executive to develop insights. Textual sources are generally useful when information is formal and structured in formats. Compare to the human sources, textual has greater accuracy. On-line databases are requiring analytic skills but useful source for researching questioned on complex issues.

Importance of information sources

A previous empirical study of environmental scanning practice (Ngamkroekjoti, 2000) explained the most important sources of information are trade publications, trade journals, reports of trade and professional associations, customers, company-sponsored surveys, and scientific journals accordingly. The next most important sources are government publications, research organizations and consultants, such as SRI international and the Brookings Institute. The author described more, there has been a change in the information revolution is moving toward specialized sources, such as trade publications and industry-specific government publications. This is because an

organization needs information at all levels, from basic to specific. They also concluded that it is possible that these specialized publications provide information that is easily understood by users.

Howley (2000) examined the use of external marketing consultancies for the purpose of NPD success. The studied explained, using both personal and telephone interviewing, of 50 British-based consumer goods companies, focusing the used of specialist NPD marketing consultancies. The study significantly indicated that consultancies were the most popular in the used outsource, due to that the consultancies was to bring in an objective view from outside the companies to engaged in development process, to make-decision on new product development. The results has shown, the firms who's the most successful in the new product process are strongly rely on the outside advice-consultancies, also to bring in NPD expertise gained in different markets.

2.3 Related literature concerned about technological turbulence and environmental scanning sources of information

Rapid pace of technological change creates uncertainty and gives rise to an information processing problem. The rate of technological change may impose some additional demands on a firm's search process (Weiss and Heide, 1993). Several authors study on technological factor and sources of information (Suwannaporn and Speece, 2000; Raymond, *et. al.,* 2001; Reed, *et. al.,* 2002) (see Table 2.3, pp 24)

Table 2.3 Major research concerns technological turbulence and environmental scanning sources of information

Year, Author, and Title	Concept, Focus, Empirical Basis, Type of Model
• 2000 • Suwannaporn, P., *et al.* • New product development in the Thai food industry. • Context: Thailand	• To examine success factors of NPD in technological driven industries as focused on information sharing between R&D, production, and external interface. • Process-oriented model. • Interview and survey data
• 2000 • Woodcock, D. J.,*et al.* • New product development in British SMEs. • Context: UK.	• Report on NPD activities of British SMEs. • Emphasis on performance data recording, performance review procedure and production personnel. • Pilot study of six SMEs. • Multiple interview data
• 2001 • Raymond, L., *et al.* • Technological scanning by small Canadian manufacturers. • Context: Canada	• Demonstration of how technological scanning manifests itself in Canadian manufacturing SMEs • Attempt to specify key determinants of technological scanning activity. • Multiple case studies. • Survey data.
• 2001 • Reed, *et., al* • Information acquisition for technological innovation and strategy in small firms. • Context: UK	• Exploration how small firms seek and acquire information which will have an impact on their technological innovation and formulation of technology strategies. • Combination of interview and survey data.

The prior empirical study of Suwannaporn *et al.* (2000) examined the success factors of new product development in the Thai food processing industry and determined how much it conforms to the current research, suggesting that well-managed new product development should be organized as a continuous learning process and should have strong information linkage across functions and outside a firm to suppliers and customers. They found that generally only some multinationals and a few larger Thai firms attempt to integrate information from a wide knowledge base into their new product development. It appears that new product development in most Thai companies suffers from poor cross-functional communication, which can lead to costly mistakes and loss of time in getting new products to the market quickly. These problems are less likely to occur in the MNCs, which try to incorporate new managerial

practices into their new product development process. From the examination of new product development in Thailand, they propose a model based on the continuous learning process in new product development, suggesting how to accumulate and integrate learning (about customers, technology and new product development itself) across key internal functions (marketing, R&D and manufacturing). The model suggests customer information circulating through and contributing to new product development knowledge. Synthesis of these two moves companies toward new products appropriate to target customers. Similarly, information about technology feeds into R&D, manufacturing and cycles through new product development and existing products. This model of information flow for continuous learning in new product development seems to give some useful guidance on thinking about information sources, information flows, and parts within the company, which should be linked into the information network.

Woodcock *et al.* (2000) reported the pilot study of the efforts of six British SMEs to enhance their new product development capabilities. Despite the fact that the firms involved have all shown positive attitudes toward new product, they discover that most of them deficient in formal competitor and market analysis, formal documented procedures and performance record during new product development process. Moreover manufacturing are typically involved too late in the new product development process. The primary reasons for not collecting such data were a fear of possible costs involved and a lack of awareness of the value of such information, including not knowing precisely what data to collect and how to analyze it. This shortage of information hinders the ability of management to learn and thus improve the future generation of new products. They recommend the collection and use of such

information to systematically measure and improve their performance. Data collected also need to be periodically reviewed and benchmarked in the context of competition.

Raymond *et al.* (2001) tested a research model, which results in identifying four, interrelated dimensions of scanning activity, namely scanning objectives, type of information, information sources, and management practices. The findings exhibit the samples firms' perception of their environment, R&D characteristics, and strategy are the factors that had the most impact on technological scanning in decreasing order of importance. These are followed by the firms' information networks and owner-manager's level of education. When perceiving increased uncertainty and turbulence in their environment, SMEs place greater emphasis on different scanning objectives and different types of information, and they tend to increase the frequency with which they communicate with various information sources. In more turbulent environment, SMEs tend to specialize in one or two scanning methods rather than disperse their efforts, thus entailing simpler and thus more effective management practices. Information networks are also found to have positive impact on technological scanning practices with the presence of local professional associations and research centers, and with management involvement in associations, SMEs have the ability to satisfy a wider range of information needs, most importantly product and process innovation-related information.

The prior research studied the needs of information of small firms in UK, for supporting technological innovation (Reed *et al.*, 2001) described that information acquisition of the knowledge of new product and process technologies is an important tool to advance the firms' development efficiency. Small firms were differ from large

in information acquisition as lack of management information systems and concentration of information gathering responsibilities due to lack of human resource and also, only lower quantity and quality of information available. The studies found that the preferred methods used to acquire information by the SMEs surveyed were trade journal and the internet and followed by the information network. However, the greatest barriers of the small firms in acquiring the information, was the time to do the research they needed. Additional barrier, information needed was not much available in the public domain, sometimes, it was confidential or not written in anyway. The studies concluded that small firms in stable industries are in a reasonably good position to access information to help them with technological innovation and strategy formulation but only, if they have a relevant and active trade association providing them with information via the Internet, meetings or trade journals. Small firms are most comfortable with looking for information from such sources and it meets their preference for personal sources since they are dealing with known industry colleagues. Moreover, the alternative sources of information would be to outsource it to consultants or information service such provided by some business link.

2.4 Food processing industry

2.4.1 Defining and characteristics

Food processing industry is the industry that brings agricultural products such as vegetables, poultry, and fish to the production process by using various technologies in order to make convenient consumer products. It also includes industries that preserve agricultural products for a longer period of time by using basic conversion processes. A firm may use a medium process to produce semi-manufactured products or a full form of production process to make finished goods (Cheasakul, 2000).

Van Wezel and Van Donk (1996) described product characteristics of processed foods as follows:

- The nature and source of raw materials in food processing industry often implies a variable supply, quality and price due to unstable yields from farmers.
- It is contrast with concrete manufacturing by volume or weights are used; and
- Raw materials, semi-manufactured products and end products are perishable.

Chaowakul *et al.* (1997) summarized the major characteristic of the Thai food processing industry as follows:-

- Food industry adds values to primary products. They can be either intermediate products which need to undergo some kind of processing before consumption or final products which are ready to consume right away. Examples of intermediate products are frozen shrimps and frozen poultry while final products are canned fruits and canned vegetables.
- Food processing industry is typically a labor-intensive industry. As a result, growth in the industry can create subsequently employment to the nation. Problems related to labor such as an increase in labor costs and lacks of labor are the main obstacles to this industry.
- Factories are usually located near supply of raw materials in order to avoid expensive transportation costs and potential damages during the delivery of raw materials.

Food processing industry brings about lots of foreign currencies through exports to Thai economy year. The Thai food market is composed of food products (approximately 61%) and beverages (another 39%). Processed food groups include fruits and vegetables, shrimps and seafood, poultry and poultry meat products, rice grain and cereal products, sugar and confectioneries, and juice and beverages. Exports account for slightly over half of the industry's output. The balance is consumed domestically. However, for some sectors or specific companies, a greater proportion may be exported up to 85%. The food processing industry covers a diverse range of product segments. The maturity and technological development of products and markets in each of the segments vary considerably. The market for some segments, such as dairy and convenience foods, is growing faster than the average for the industry as a whole, while the market for other products, such as canned pineapple and frozen poultry, are nearing saturation.

(Source: www.nfi.or.th, retrieved on 15th March 2004)

2.4.2 Background of the food industry in Thailand

According to National Food Institute of Thailand (NFI), Thailand is well accepted as an agricultural country and is an exporter in Asia. Thailand's fertile soil and bountiful water resources have largely contributed to its production surpluses. For this reason, Thailand is one of the world's leading producers of rice, producing about 24 million tons and is one among the world's largest suppliers of sugar, tapioca, and pineapple. Tropical fruits are also abundant in the country. The development of the food industry is very much associated with the country's entry to international trade. The food industrial development may be summarized as follows:-

Before 1960	Most exports were surplus agricultural products. 70% of which are foods. The technologies available in the country to preserve foods were only drying, pickling and sugar glazing.
1960-70	Through the introduction of the Government Industrial Promotion Privileges, Thailand substituted most of its imported products with its product surpluses. Likewise, the technology to process sweetened condensed milk, canned fruits and vegetables and vegetable oil were then imported from Taiwan and Japan.
1970-80	It was only at this stage that the country started to earn from the processed products exports. Products were initially targeted for local consumption. However, surpluses were exported. Lacking in experience in bulk production and marketing, producers felt the need to improve their technical know-how to improve product quality and meet importers' requirements.
1980-90	This stage was characterized by its rapid industrial pace of development. Having already established their markets and also brought in some technologies from the US and Europe, the country's export registered a 26% growth rate in 1990 which was mostly the frozen and chilled export commodities.
1990-2000	The present stage is gearing towards high competition in the world markets. Great concern is now placed on hygiene and sanitation of production, food safety, wholesomeness, production costs, value-added, standards, environment and regulations

Source: http://www.nfi.or.th, Retrieved on 15th March 2004

2.4.3 Thai food industry today

Food industry is an important economic sector in Thailand for three major reasons. Firstly, it constitutes 14.4% of the country's total exports in 2002. Secondly, it provides employment to some twenty million people, including agricultural and food processing sector. Lastly, it provides market to some 80% of the raw food materials. Currently, Thailand is the world's leading supplier of longan, durian, mangosteen and longkong. Moreover, the country now ranks among the top ten exporters of the following food commodities:

- World's largest exporter of canned pineapple, pineapple juice and concentrates.
- Second largest exporter of seafood (especially tuna)
- World's largest exporter of frozen shrimps
- One of the top ten exporters of frozen chicken

Source: http://www.nfi.or.th, Retrieved on 15th March 2004

In 2001, the food export of Thailand was worth 444,706 million Baht or 9,975 million $US which was about 15.0% of the country's 2.89 trillion Baht exports. In 2002, the food export of Thailand was slightly dropped to 426,662 million Baths while the export volumes showed a bit increase (see Table 2.4)

Table 2.4 Thai Food Exports Value (1997- 2002)

Year	Value (Million Baht)	Value (Million $US)	Value (1,000 Tons)
1997	333,128	10,582	19,421
1998	398,803	9,589	17,134
1999	376,814	10,008	20,017
2000	399,170	9,912	20,283
2001	444,706	9,975	27,964
2002	426,662	9,897	28,926

Source: National Food Institute of Thailand (2004)

CHAPTER 3

RESEARCH FRAMEWORK

This research is a study of the relationships of technological turbulence and scanning sources of information, pertaining to SMEs in Thai food processing industry. To analyze these relationships a conceptual model is constructed. Theoretical background for the model is explained in the following paragraphs. The model and the variables are based upon the review of literature from Chapter 2. The development of hypotheses corresponding with the model will be presented in the following paragraphs. Finally, the independent and dependent variables will be detailed.

3.1 Theoretical framework

A theoretical framework provides a conceptual understanding of the basic processes underlying the problem situation. This process will suggest key dependent and independent variables. Models are used as representations of theoretical systems so that they can be tested, examined and generally analyzed (Malhotra, 1999).

3.1.1 Technological turbulence

Technological turbulence is viewed as the degree of change associated with creation of new product development and creation of processes activities (Moorman and Miner, 1997). It creates uncertainty that can be competency destroying (Wise and Heide, 1993). The innovations create upheavals within an industry and the patterns of technology change drive the evolution of competitiveness. Product process and production process are such types of technological change (Narayana, 2001). The rapid change in technology combined with consumers' new attitude has forced a move away

from the use of fixed production line (Khaili, 2000). Knowledge assets can be leveraged to achieve competitive learning. Following the prior study by (Moorman and Miner, 1997), the characteristics of technological turbulence, which are combined in this study, are shown in (see Table 3.1).

Table 3.1 Characteristic of technological turbulence

Technological Turbulence	Reference
Product technology	Narayanan, (2001)
Product process technology	Narayanan, (2001)
R&D in product	Wheelen and Hunger,(2002)
R&D in production processes	Wheelen and Hunger,(2002)
Opportunities for the product	Narayanan, (2001)
Predictable the technology for the next five years	Narayanan, (2001)
New product ideas through technology breakthroughs	Wheelen and Hunger,(2002)

3.1.2 Environmental Scanning Sources of Information

Sources of information were classified into three categories, human, textual, and on-line database. This classification is based on the need to identify future trends and actively respond to immediate change of environment. The human source is usually used when the manager has to deal with ambiguous situations, and high levels of environmental uncertainty with limited amount of information. The human source provides information informally for the executive to develop insights. Textual sources are generally useful when information is formal and structured in formats. Compared to the human sources, textual has greater accuracy (Choo, 2002).

Obtaining information across several different environmental sectors furnishes a company with more relevant information which appears to be strongly associated with pursuing new product-oriented strategies, and developing effective competitive new product strategies, that can enable a company to gain competitive advantage (Beal, 2000). Measurements of sources of information scanning that are used in this study are given (see table 3.2).

Table 3.2 Various sources of information used in environmental scanning

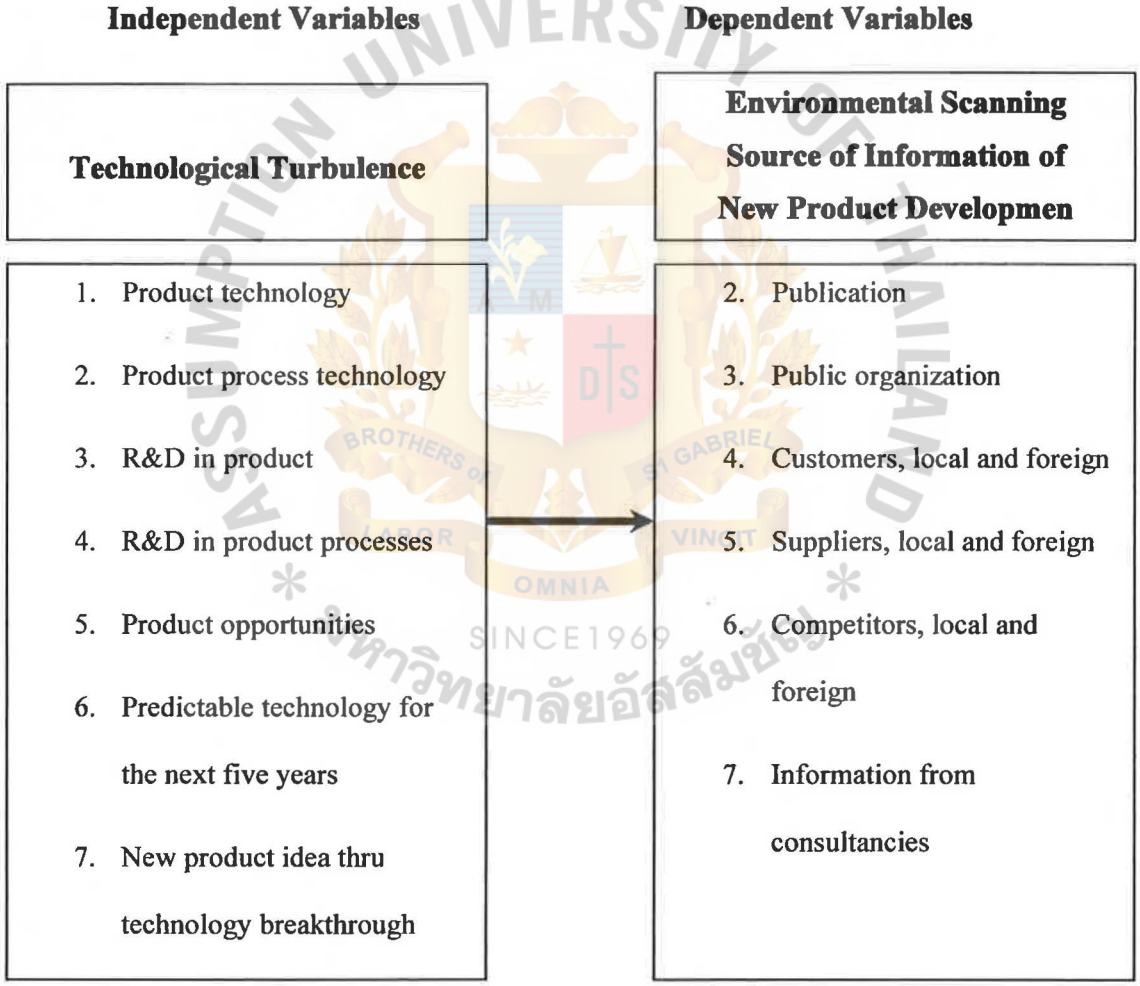
Sources of Information	Reference
Publications (both from public and private organizations)	Choo (2002)
Public Organization, such as Board of Investment (BOI), The Federal of Thai Industries (FTI), and Institute for SMEs development (ISMEs)	Choo (2002)
Customers, local or foreign	Beal *et al.* (2000)
Suppliers, local or foreign	Beal *et al.* (2000)
Competitors, local or foreign	Beal *et al.* (2000)
Information from consult company	Howley (2002)

3.2 Conceptual framework

The conceptual model used in the study is built upon the model of Moorman *et al.* (1997). Figure 3.1 (see pp 35) displays the outline model links scope of technological turbulence and scanning sources of information. The model specifies that technological factor has relationship with environmental scanning sources of information of new product development. There are seven characteristics in technological turbulence, namely product technology, product process technology, R&D product, R&D product process, product opportunities, forecasting technology in 5 years ahead, and new

product ideas through technology breakthrough, to be examined in this study. On the other hand, environment scanning sources of information, namely publication, public organization, customers, suppliers, competitors, consultancies, are measured as external sources. These measurement items are derived from existing, well-validated scales on the review of technological turbulence literature (see Table 3.1, pp 33)

Figure 3.1 Conceptual framework adapted from Moorman and Miner (1997)



3.3 Research hypothesis

A hypothesis is an unproven statement or proposition about a factor or phenomenon that is of interest to the research. It may, for example, be a tentative statement about relationship between two or more variables as stipulated by the theoretical framework or analytical model (Malhotra, 1999). Research hypotheses are categorized based on the two modes in this study, the characteristics of technological turbulence and characteristic of scanning external source of information. The statements are also set up to be accordance with the objective of this research.

Hypothesis:

H_0: $ß_0 = 0$ There is no relationships between technological turbulence and the use of sources of information in environmental scanning associate with new product development among the SMEs food processing companies.

H_1: $ß_1 \neq 0$ There is relationships between technological turbulence and the use of sources of information in environmental scanning associate with new product development among the SMEs food processing companies.

3.5 Definition of variables

Table 3.3 (see pp 37) shows the variables, which are categorized into two distinctive groups and their concept definitions as follows:-

Table 3.3 Concept and definition of variables

Variables	Concept and Definition
Technological Turbulence	The degree at rate of technological change, associated with new product creation (Moorman and Miner, 1997), as the moderator effects upon, as follows by:- • Product and production processes • R&D in product & production process • Opportunities of new product • Predictable technology in 5 years ahead • Possibilities of large number in NPD
Environmental Scanning, Sources of Information	Broad scanning of information on several aspects of specific environmental sector (Beal, 2001). In specify of:- • Publications, both private and public • Public organizations, both private and public • Customers, both local and foreigner • Suppliers, both local and foreigner • Competitors • Information from consultancies

3.6 Variables measurement

Table 3.4 (see pp 38) shows the measurement of the influencing variables, in this study is interval level, measurable variables are described as follows:-

Table 3.4 Operational definition of influencing variables

Variables	Operational definition	Measure Descriptions	Scales	Question Number
Technological Turbulence	The technology in this product area is changing rapidly	Five-level Likert scale (1-5)	Interval	Q5
	The technology in the production process in developing new product is changing rapidly.	Five-level Likert scale (1-5)	Interval	Q5
	The technology in research & development process in developing new product in this industry is changing rapidly	Five-level Likert scale (1-5)	Interval	Q5
	The technology in research & development process in the production process is changing rapidly	Five-level Likert scale (1-5)	Interval	Q5
	Technological changes provide big opportunities in this product area.	Five-level Likert scale (1-5)	Interval	Q5
	It is very difficult to forecast where the technology in this product area will be in the next five years.	Five-level Likert scale (1-5)	Interval	Q5
	A large number of new product ideas in this area have been made possible through technological breakthroughs.	Five-level Likert scale (1-5)	Interval	Q5

Table 3.4 Operational definition of influencing variables (continue)

Variables	Operational definition	Measure Descriptions	Scales	Question Number
Sources of Information	Publications, both from public and private organizations	Five-level Likert scale (1-5)	Interval	Q4
	Public Organization, Such as Board of Investment (BOI), The Federal of Thai Industries (FTI), and Institute for SMEs development (ISMEs)	Five-level Likert scale (1-5)	Interval	Q4
	Customers, local or foreign	Five-level Likert scale (1-5)	Interval	Q4
	Suppliers, local or foreign	Five-level Likert scale (1-5)	Interval	Q4
	Competitors, local or foreign	Five-level Likert scale (1-5)	Interval	Q4
	Information from consultancies	Five-level Likert scale (1-5)	Interval	Q4
Company Profile	1-50 persons 51-100 persons 101-200 persons	A three-choice question (1-3)	Nominal	Q6

Table 3.4 Operational definition of influencing variables (continue)

Variables	Operational variables	Measure Descriptions	Scales	Question Number
Company Profile	1-50 persons 51-100 persons 101-200 persons	A three-choice question (1-3)	Nominal	Q6
	Less than 25 Million Baht 25.01 - 50 Million Baht 50.01 - 100 Million Baht 100.01-150 Million Baht 150.01-200 Million Baht	A five-choice question (1-5)	Nominal	Q7

CHAPTER 4

RESEARCH METHODOLOGY

This chapter provides an overview of research methodology for this study. It includes a sampling design, a data collection method and a framework of data analysis. The following six sections detail the procedure of the quantitative analysis employed. The first section identifies methods of research used. The second section identified respondent and sampling procedure, including target population, and sampling design (sampling unit, sampling frame, sampling plan, and sampling size). The third section involves data collection in terms of technique and instrument used. The fourth identifies the research instrument and questionnaire. The fifth section demonstrates pretest of the questionnaire and its results, and the sixth section presents the statistical technique used for data analysis.

4.1 Methods of Research Used

Quantitative is defined as the numerical presentation and manipulation of observation for the purpose of describing and explaining the phenomena that that observation reflects. A survey is as one form of quantitative research; the investigator may not be able to intervene and form groups or may not be interested in relating variables. Instead, researcher seeks to describe trends in a large population of individuals. In this case, a survey is a good procedure to use because the researcher administers a survey or questionnaire to the entire population of people in order to describe the attitudes, opinion, behaviors, or characteristics of the population (Creswell, 2002). This study has employed the quantitative research in order to approach trends and explaining the relationships among variables found in the describing. To conduct this inquiry, the

researcher specifies narrow questions, locates or develops instruments to gather data to answer the questions, and analyzed numbers from the instruments using statistics.

4.2 Respondents and sampling procedures

Sample selection

The role of SMEs in Thailand's economic development have received greater attention as a result of contribution the country's economy through product output, employment, and utilization of regional resources (Liaopairot, 2002). According to Boonritmontri (2001), SMEs are defined as "small- and medium-sized companies whose businesses are in the manufacturing, trading and services sectors." Production sector covers industrial manufacturing, mining and agricultural processing. Trading sector consists of wholesale and retail businesses including both exports and imports. Service sector is businesses that support and facilitate production and trading sectors, for example, hotels, tourism, maintenance, warehouse and transportation. In general, SMEs is classified by using one of the following two criteria; a number of employees or fixed assets of the company (see Table 4.1). SMEs also include micro enterrises, which refer to companies that have a number of permanent employees not over five persons.

Table 4.1 Classification of SMEs by Ministry of Industry

Business	Small Enterprises		Medium Enterprises	
	Fixed Assets (Million Baht)	Employment (In Persons)	Fixed Assets (Million Baht)	Employment (In Persons)
1. Production	< 50	< 50	>50 - 200	51-200
2. Services	< 50	< 50	>50 - 200	51-200
3. Wholesale	< 50	< 25	>50 - 100	26-50
4. Retail	< 30	< 15	>30 - 60	16-30

Source: Boonritmontri, R. (2001)

Food processing industry is one of the most attractive and promising industries, also, the new products activities in this industry are very actives; it drives the companies to invest more on research and development (R&D) in product and production process. In the food industry, agricultural products are undergone some kind of processing by using various technologies to make convenient consumer products and to satisfy the market (Cheasakul, 2000). Therefore, more than 40% of SME industries belong to the food section (see Table 4.2).

Table 4.2 Percentage of Industry, Investment and Employment of Thai SMEs

Industry	Number of Companies (%)	Investment (%)	Employment (%)
Food and Beverage	42.2	12.0	14.2
Textiles and Leather Products	4.2	5.5	15.7
Paper and Paper Products	9.3	8.8	13.0
Chemical, Rubber and Plastic	3.4	9.8	6.9
Iron, Steel and Non-Ferrous	12.4	13.7	14.8
Machinery and Equipment	15.8	14.1	15.5
Others	12.7	36.1	19.9
Total	**100.0**	**100.0**	**100.0**

Source: Bunmark, J. (1999)

4.2.1 Target population and element

Target population is the collection of element or objects that possess the information sought by the research and about which inferences are to be made (Maholtra, 1999). The target population and population element of this study is the company that complies with the criteria that; it is categorized as small and medium enterprises (SMEs) as defined by Ministry of Industry, its major business is in food processing industry and the company's target planning could be measured by the chief executive officers (CEOs) or the owners.

Sample unit

In the study, sample unit is concentrated on a single element subject (Zikmund, 2003), which is SMEs in Thai food processing industry (in specify; meat and poultry, fruit and vegetables, cereal products, tea-coffee and confectionary, and seasoning). Target respondents are the CEOs or SME's owners in the food processing industry, who are the ones who make decisions on the scanning sources of information used in environmental scanning of new products development within the company.

4.2.2 Sampling frame

Sampling frame is selected from the list of elements that a sample may specify. Therefore, in this study, the sampling frame is defined by identifying a name list, which contains of SMEs in Thai food processing industry (in specify; meat and poultry, fruit and vegetables, cereal products, tea-coffee and confectionary, and seasoning), in Bangkok and metropolitans.

4.2.3 Sampling technique

The study uses a non-probability sampling to conduct the research. Non-probability sampling is used as a sampling technique in which units of sample are selected on basis of personal judgment or convenience somewhere in the selection process (Churchill and Iacobucci, 2002). The sample method of this study provides a convenient, economical way to the researcher and does not require a list of population.

4.2.4 Sampling Size

Based on the prior study of the SMEs in Thai food-processing industry (Chapter 2), according to Suwannaporn and Speece (2000), the sample size in the Thai food industry is only 20%. The total number of small and medium food processing companies, which specialize in the cereal products, meat & poultry, seasoning, beverages and fruit & vegetables, account for 4,787 companies at the end of 2001 (Table 4.3). The sample select from lists of food companies, whose product focus only on processed, not include rice mill, where located in Bangkok and metropolitan.

Table 4.3 Distribution of SMEs in Thai Food Industry

Commodity	Small-Sized	Medium-Sized	Total
Meat & Poultry	529	40	569
Fruit & Vegetables	411	57	468
Cereal Products	2,792	61	2,853
Tea, Coffee & Confectionary	471	25	496
Seasonings	384	17	401
Total	**4,587**	**200**	**4,787**

Source: http://www.nfi.or.th/thai-food-industry/factory-eng.html

4.3 Data Collection

Sample survey was used as the research technique in this study, in exploring the impact of technological turbulence associated with new product development and source information use in environmental scanning. Survey is the most common method in generating primary data. Data collection is based on communication with a representative sample by using a questionnaire. Survey can provide a quick, inexpensive, efficient, and accurate means of assessing information about a population (Zikmund, 2003).

The study has relied on both primary and secondary data. Initially, secondary data include documentary research from textbooks, research studies, magazines, journals, articles, thesis, ABI database, and websites is gathered in order to review literature on the relevant topics as the following:-

- Small and medium enterprises (SMEs)
- Food processing industry
- Definition of technological turbulence
- Definition of environmental scanning sources of information

The collection of primary data is conducted through questionnaires distributed to the target respondents at the food exhibitions organized by both government and private agencies. In one food exhibition, at least two visits were made. A first visit was aimed to distribute questionnaires face-to-face to the target respondents as well as to brief on the purpose, content, and procedure for completing questionnaires to the target respondents. Second and third visits were made to pick up the questionnaires for those respondents who did not finish the questionnaire during the first visit. Four exhibitions, accounting for nine visits, yielded 120 usable questionnaires in total.

4.4 Research instrument and questionnaire

The instrument used in the study is self-administered questionnaire. This method uses a questionnaire that is filled in by a respondent rather than the interviewer and relies on the efficiency of the written words rather than that of the interviewer. This allows respondents time to think and fill in the questionnaire at their convenience.

Questionnaire

The survey questionnaire is built upon the literature review of the variables and contents. It is divided into four parts, comprising seven questions. The purposes of the questionnaire are as the following:

- To examine the using source of information in environmental scanning, in relation to the impact of technological turbulence.
- To identify the scope, frequency and extent to which SMEs perform the practice of environmental scanning source of information.

The questionnaire consists of four parts:

Part 1: This part of questionnaire contains three questions which investigates new product information including the presence of new product launches, time spent on designing and launching process of new product, and the period in which new product was launched into the market.

Part 2: This part of questionnaire examines sources of information used in environmental scanning of new product development. Five points-level Likert scales will be used to indicate as follows:

Not use at all	=	1
Slightly use	=	2
Neutral use	=	3
Considerable use	=	4
Extensively use	=	5

Part 3: This part of questionnaire investigates the scope of scanning in technological turbulence. Five points-level Likert scales will be used to indicate as follows:

Strongly disagree	=	1
Disagree	=	2
Neutral	=	3
Agree	=	4
Strongly agree	=	5

Part 4: This part of questionnaire contains demographic profile of the sample in regard to its size, and investment on fixed asset value.

4.5 Pilot test and result

The main purpose of a questionnaire pilot test is to adjust the questionnaire items based on the assessment result. Data from reliable questionnaires are likely to be the same (or reproducible) no matter how often the same questions are asked. Data from a valid questionnaire, measures variables a researcher intends to measure. Pilot test validates the questionnaires and allows the researcher to determine the questionnaire reliability and validity. The pretest and pilot study have the same objectives, which are to ensure that the questionnaire responses are of satisfactory quality, as they will be used to answer the research questions (Dillman, 2000).

In this study, the pilot test was carried out on 9th, 12th, and 16th March 2003 in the SMEs Fair held at Silom Complex. The fair was organized by the department of industrial promotion, Ministry of Industry. The pretest involved 30 SME's owners or managers who completed the questionnaire in the presence of the researcher, asking

questions as problems or ambiguities arose. The respondents were urged to comment on the sequence of questions as well as on the wording format. The final version of the questionnaire reflected a minor modification for improvement suggested by respondents in the pretest prior to actual data collection. Most of the modification dealt with the words or terms used which were considered too complicated or sometimes confusing by the respondents.

Reliability and validity of questionnaire

This section describes how the issues of reliability and validity were established in this study. It starts with the approaches used to establish and improve the reliability and validity of the questionnaire. The questionnaire responses are reliable if responses to the same questions are familiar whenever the questions are asked. Questionnaire responses are valid if they are measures of what an author intends to measure. The questionnaire is a principle means for data collection; its reliability and validity receive special attention (Babbie, 1986).

In a pretest, 30 questionnaires are used to test the reliability of the scales in the questionnaire. Scale reliability is assessed using coefficient alpha. The results of pretest reliability test are presented (see Table 4.4, pp 50)

Table 4.4 Reliability Test Results

Scales	Number of Items	Alpha Values
1. Technological turbulence	7	0.7443
2. Environmental scanning sources of information	6	0.7573

It can be concluded that the survey questionnaire is reliable as coefficient alpha values are greater than 0.60 in every variable, coefficient alpha access the significant of reliability.

4.6 Statistical Treatment of Data

The researcher uses Statistical Package for Social Science (SPSS) Version 11.5 to analyze the data from questionnaires into the easily interpretable formats. All the statistical procedures are carried out by computer software package to ensure accuracy as well as minimal cost and time. Hypothesis testing is conducted to explore the relationships between technological turbulence and external sources of information used in environment scanning.

Regression Analysis

Regression analysis is a powerful and flexible procedure for analyzing associative relationships between a metric dependent variable and one or more independent variables. The model is used to predict one variable from one or more other variables. Regression model allows the researcher predictions about past, present, or future events to be made with information about past or present events. Although the independent variables may explain the variations in the dependent variable, this does not necessarily

imply causation. The use of the term dependent or criterion variable is dependent on the independent variables in a causal sense (Hair *et al.*, 1998). Regression is concerned with the nature and degree of association between variables and does not imply or assume any causality. In the bivariate regression model, the general form of a straight line as following:-

$$Y = \beta_0 + \beta_1 X_i$$

Where, Y = dependent or criterion variable

X = independent or predictor variable

β_0 = intercept of the line

β_1 = slope of the line

Decision Rule for Interpretation

The statistical significance of the linear relationship between X and Y may be tested by examining the hypotheses as follows:-

H_0: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$

The null hypothesis implies that there is no linear relationship between X and Y. The alternative hypothesis is that there is a relationship, positive or negative, between X and Y. The result is determined by three statistical factors; the significant F and the R square root (r^2) and the Beta coefficient.

Significant F (sig.F.)

Significant F measures the significant relationship of every independent and dependent variables.

R Square (r^2)

The coefficient r^2 is the square of the simple correlation coefficient obtained by correlating the two variables; r^2 measures the managerial significance and its strength of the relationship between dependent and independent variables. The coefficient r^2 varies between zero and one.

Standard coefficient (Beta)

The Beta coefficient allows for a direct comparison between coefficients as to their relative explanatory power of the dependent variable.

CHAPTER 5

DATA ANALYSIS AND FINDING

Data collection for this study was gathered at four food exhibitions held in Bangkok during March to July 2003. This chapter presents the analysis of collected data. A total of 100 valid questionnaires were collected and then further processed for the final analysis by SPSS program. This chapter presents two types of statistical analysis that are applied to the conceptual framework and further used for explaining result from questionnaires. The first, descriptive statistic, describes general characteristics of SMEs. The second type, inferential statistic, describes the relationship between technological turbulence and sources information used in environmental scanning.

5.1 Descriptive statistics

Descriptive analysis refers to the transformation of raw data into a form that will be easy to understand and interpret (Zikmund, 2003). The data will be presented as frequency distribution and percentage distribution. This section is composed of three parts. The first part explains the demographic profile of the sample SMEs in the study. The second part deals with technological turbulence characteristics. The third part describes the degree of environmental scanning that SMEs performed.

5.1.1 SME's profile

Table 5.1 Number of employees

Number of Employees (Persons)	Frequency	Percentage
1. 1 -50 persons	62	62.0
2. 51 - 100 persons	19	19.0
3. 101 - 200 persons	19	19.0
Total	**100**	**100.0**

Table 5.2 Investment on fixed assets

Investment on Fixed Assets (Million Baht)	Frequency	Percentage
1. Less than 25 million Baht	73	73.0
2. 25.01 - 50 million Baht	7	7.0
3. 50.01 - 100 million Baht	9	9.0
4. 100.01 - 150 million Baht	4	4.0
5. 150.01 - 200 million Baht	7	7.0
Total	**100**	**100.0**

Table 5.1 and 5.2 indicates that the majority of the samples are: small-sized enterprises, with a number of employees not over 50 persons (67%), and investment on fixed assets not over 50 million baht (73%). The rests of the samples are from medium-sized enterprises, which account for approximately one fourth of the sample.

Table 5.3 Times spent on designing and launching process of new product

Duration (Years)	Frequency	Valid Percentage
1. Less than 1 year	47	53.40
2. Between 1 year and 2 years	20	22.70
3. Between 2 and 3 years	8	9.10
4. More than 3 years	13	14.80
Total	**100**	**100.0**

Table 5.4 Period of Launching New Product into the Market

Period of Launching (Year)	Frequency	Valid Percentage
1. 2003	43	49.40
2. 2002	23	26.4
3. 2001	11	12.60
4. 2000	4	4.00
5. 1999	1	1.10
6. 1998	5	5.70
Total	**100**	**100.0**

Table 5.3 and 5.4, indicate that more than half of new products investigated in the study took less than one year in the process of designing and launching into the market while, those who took more than three years in the designing and launching process account for only 13% and about half of new products were launched into the market in 2003. The following rankings of new product launches are 2003, 2002, 2001, 1998, 2000, and 1999 respectively.

5.1.2 Frequency of technological turbulence

Table 5.5 Frequency distribution of "changes in technology in product group"

Changes in technology in product group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	7.0	7.0	7.0
	Disagree	28	28.0	28.0	35.0
	Neutral	24	24.0	24.0	59.0
	Agree	28	28.0	28.0	87.0
	Strongly agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

From Table, 5.5, about 28% of the participants rated both "disagree" and "agree" with the change in technology in product group

Table 5.6 Frequency distribution of the perception in "changes in technology in product process in NPD"

Changes in tech in product process in NPD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	6.0	6.0	6.0
	Disagree	20	20.0	20.0	26.0
	Neutral	22	22.0	22.0	48.0
	Agree	41	41.0	41.0	89.0
	Strongly agree	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

From Table, 5.6, about 41% of the participants rated "agree" with the change in technology in product process in NPD.

Table 5.7 Frequency distribution of changes in "technology in R&D in NPD"

Changes in tech in R&D in NPD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	4.0	4.0	4.0
	Disagree	19	19.0	19.0	23.0
	Neutral	22	22.0	22.0	45.0
	Agree	46	46.0	46.0	91.0
	Strongly agree	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

From Table, 5.7, about 46% of the participants rated "agree" with the change in technology in R&D in NPD.

Table 5.8 Frequency distribution of the perception in "changes in technology, in R&D in product process in NPD"

Changes in technology in R&D in product process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	2	2.0	2.0	2.0
	Disagree	21	21.0	21.0	23.0
	Neutral	28	28.0	28.0	51.0
	Agree	36	36.0	36.0	87.0
	Strongly agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

From Table, 5.8, about 36% of the participants rated "agree" with the change in technology in R&D in product process.

Table 5.9 Frequency distribution of "product opportunities"

Product opportunities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	5.0	5.0	5.0
	Disagree	7	7.0	7.0	12.0
	Neutral	16	16.0	16.0	28.0
	Agree	56	56.0	56.0	84.0
	Strongly agree	16	16.0	16.0	100.0
	Total	100	100.0	100.0	

From Table 5.9, about 56% of the participants rated "agree" with product opportunities

Table 5.10 Frequency distribution of "predictable technology for the next five years"

Predictable technology for the next five years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	4.0	4.0	4.0
	Disagree	23	23.0	23.0	27.0
	Neutral	40	40.0	40.0	67.0
	Agree	22	22.0	22.0	89.0
	Strongly agree	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

From Table, 5.10, about 40% of the participants rated "neutral" of the predictable technology for the next five years.

Table 5.11 Frequency distribution of "new product succeeds through technology breakthroughs"

New product successes thru technology breakthroughs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	6.0	6.0	6.0
	Disagree	8	8.0	8.0	14.0
	Neutral	29	29.0	29.0	43.0
	Agree	43	43.0	43.0	86.0
	Strongly agree	14	14.0	14.0	100.0
	Total	100	100.0	100.0	

From Table, 5.11, about 43%of the participants rated "agree" with new product successes through technological breakthroughs.

Table 5.12 Summary table of frequency of technological turbulence

Technological Turbulence	**Degree of Scanning**					**Total**
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**	
Change tech. in product process	7	28	24	28	13	100
Change tech. in production process in NPD	6	20	22	41	11	100
Change tech. in R&D in NPD	4	19	22	46	9	100
Change tech. in R&D production process	2	21	28	36	13	100
Opportunities	5	7	16	56	16	100
Predictable technology for the next five years	4	23	40	22	11	100
NP ideas success thru technology breakthroughs	6	8	29	43	14	100
Total	**34**	**126**	**181**	**272**	**87**	**700**

Table 5.13 Summary table of percentage of technological turbulence

Technological Turbulence	Degree of Scanning (Valid Percentage)					Total
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Changes in tech. in product process	7.0	28.0	24.0	28.0	13.0	100
Changes in tech. in production process in NPD	6.0	20.0	22.0	41.0	11.0	100
Changes in tech. in R&D NPD	4.0	19.0	22.0	46.0	9.0	100
Changes in tech. in R&D product process	2.0	21.0	28.0	36.0	13.0	100
Product opportunities	5.0	7.0	16.0	56.0	16.0	100
Predictable technology 5 years ahead	4.0	23.0	40.0	22.0	11.0	100
NP ideas success thru tech breakthrough	6.0	8.0	29.0	43.0	14.0	100
Total	**34**	**126**	**181**	**272**	**87**	**100**

Table 5.14 Mean and standard deviation of technological turbulence

Variables of Technological Turbulence	Mean	Standard Deviation (S.D.)	Ranking
Changes in technology in product group	3.12	1.166	6
Changes in technology in product process in NPD	3.31	1.098	4
Changes in technology in R&D in NPD	3.37	1.022	3
Changes in technology in R&D in product process	3.37	1.022	3
Product opportunities	3.71	0.988	1
Predictable technology in 5 years ahead	3.13	1.022	5
New product ideas succeed through technology breakthroughs	3.51	1.030	2

The extent to which the sample SMEs in Thai food processing industry are perceive they are effected by technology turbulence factors, are counted in each sector. Table 5.12 displays the form of frequency distribution and Table 5.13 exhibits the frequency in the form of percentage distribution. The perception in each factor is evaluated from (1) strongly disagree to (5) strongly agree. It can be seen that the mean values range from 3.12 to 3.71 (see Table 5.14) with most values lying between (3) neutral and (4) agree. This indicates that the perception is above the middle of 1-5 scale. Based upon the mean values, it can be concluded that the sample SMEs perceive that product opportunities are the most effected by technology turbulence (mean = 3.71, S.D. = 0.988), followed by new product ideas succeed through technological breakthroughs (mean = 3.51, S.D. = 1.030), changes in technology in R&D in NPD and changes in technology in R&D product process , both are equal the same rank (mean = 3.37, S.D. = 1.022), changes in technology in product process in NPD (mean = 3.31, S.D. = 1.098), predictable technology for the next five years (mean = 3.13, S.D. = 1.022), and finally changes in technology in product group (mean = 3.12, S.D. 1.166).

5.1.3 Frequency of environmental scanning sources of information

Table 5.15 Frequency distribution of the information source "publication"

Publication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not used at all	5	5.0	5.0	5.0
	Slightly use	13	13.0	13.0	18.0
	Neutral use	36	36.0	36.0	54.0
	Considerably use	34	34.0	34.0	88.0
	Not used at all	12	12.0	12.0	100.0
	Total	100	100.0	100.0	

From Table 5.15, about 36% of the participants rated "neutral" and 34% of the participants rated "considerably" used publication sources.

Table 5.16 Frequency distribution of the information source "public organizations"

Public organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not used at all	4	4.0	4.0	4.0
	Slightly use	13	13.0	13.0	17.0
	Neutral use	36	36.0	36.0	53.0
	Considerably use	28	28.0	28.0	81.0
	Not used at all	19	19.0	19.0	100.0
	Total	100	100.0	100.0	

From Table 5.16, about 36% of the participants rated "neutral" and about 28% of the participants rated "considerably" used public organization sources.

Table 5.17 Frequency distribution of uses information sources "customers"

Local and foreign customers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not used at all	1	1.0	1.0	1.0
	Slightly use	3	3.0	3.0	4.0
	Neutral use	26	26.0	26.0	30.0
	Considerably use	45	45.0	45.0	75.0
	Not used at all	25	25.0	25.0	100.0
	Total	100	100.0	100.0	

From Table 5.17, about 45% of the participants rated "considerably" the use of customers as a source of information.

Table 5.18 Frequency distribution of the information sources "suppliers"

Local and foreign suppliers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not used at all	6	6.0	6.0	6.0
	Slightly use	13	13.0	13.0	19.0
	Neutral use	34	34.0	34.0	53.0
	Considerably use	36	36.0	36.0	89.0
	Not used at all	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

From Table 5.18, about 34% of the participants rated "neutral" and 36% of participants rated "considerably use" the use of suppliers as a source of information.

Table 5.19 Frequency distribution of the information sources "competitors"

Local and foreign competitors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not used at all	3	3.0	3.0	3.0
	Slightly use	9	9.0	9.0	12.0
	Neutral use	36	36.0	36.0	48.0
	Considerably use	26	26.0	26.0	74.0
	Not used at all	26	26.0	26.0	100.0
	Total	100	100.0	100.0	

From Table 5.19, about 36% of the participants rated "neutral" and 26% of participants rated "considerably" the use of competitors as a source of information.

Table 5.20 Frequency distribution of the information sources "consultancies"

Info from Consult Company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not used at all	21	21.0	21.0	21.0
	Slightly use	22	22.0	22.0	43.0
	Neutral use	37	37.0	37.0	80.0
	Considerably use	10	10.0	10.0	90.0
	Not used at all	10	10.0	10.0	100.0
	Total	100	100.0	100.0	

From Table 5.20, about 37% of the participants rated "neutral" and 22% of participants rated "slightly" used consultants as a source of information.

Table 5.21 Frequency of environmental scanning source of information

Sources of Information	Degree of Scanning					Total
	Not at all used	Slightly used	Neutral used	Considerably used	Extensively used	
Publications	5	13	36	34	12	100
Public organizations	4	13	36	28	19	100
Customers, local & foreign	1	3	26	45	25	100
Suppliers, local & foreign	6	13	34	36	11	100
Competitors	3	9	36	26	26	100
Consultant co.	21	22	37	10	10	100
Total	**40**	**73**	**205**	**179**	**103**	**600**

Table 5.22 Percentage of environmental scanning source of information

Sources of Information	Degree of Scanning (Valid Percentage)					Total
	Not at all used	Slightly used	Neutral used	Considerably used	Extensively used	
Publication	5.0	13.0	36.0	34.0	12.0	100
Public organization	4.0	13.0	36.0	28.0	19.0	100
Customers, local & foreign	1.0	3.0	26.0	45.0	25.0	100
Suppliers, local & foreign	6.0	13.0	34.0	36.0	11.0	100
Competitors	3.0	9.0	36.0	26.0	26.0	100
Consultant co.	21.0	22.0	37.0	10.0	10.	100
Total	**40**	**73**	**205**	**179**	**103**	**100**

Table 5.23 Mean and standard deviation of environmental scanning source of information

Variables of Environmental Scanning Sources of Information	Mean	Standard Deviation (S.D.)	Ranking
Publication	3.35	1.019	4
Public organization	3.45	1.067	3
Customers, local & foreign	3.90	0.847	1
Suppliers, local & foreign	3.33	1.035	5
Competitors	3.63	1.060	2
Information from consultancies co.	2.66	1.208	6

The tables given above, report the extent to which the sample SMEs in Thai food processing industry use environmental scanning and the sources of information they use. Table 5.21 displays the frequency distribution of environmental scanning sources of information and Table 5.22 exhibits in the information in the form of percentage distribution. In Table 5.23, the degree of environmental scanning sources of information in each preference is evaluated from (1) not use at all to (5) extensively used, indicated in the mean column. It can be seen that the mean values range from 2.66 to 3.90 (see Table 5.23) with most values lying between (3) neutral use and (4) considerably use. This indicates that measurement of scanning is above the middle of the scale of 1 to 5. Based upon the mean values, it can be concluded that the sample SMEs use information from customers the most (mean = 3.90, S.D. = 0.847), followed by competitors (mean = 3.63, S.D. = 1.060), public organizations (mean = 3.45, S.D. = 1.067), and publications (mean = 3.35, S.D = 1.019). About 21% do not use consultants, 6 % do not use suppliers, 3% do

not use competitors, 5% do not use publication, 4% do not use public organizations, 3% do not use competitors, and only 1% does not customers as sources of information.

5.2 Inferential Statistics

Inferential statistics is a tool to make inferences or judgments about a population on the basis of sample. Inferential statistics involves the analysis and verification for hypothesis statements in the populations, which are used to make inferences about the characteristics of the population. Thus, it enables the researcher to make conclusions from the statistical findings (Zikmund, 2003). In this study, the bivariate statistical technique applied in hypothesis testing. The regression analysis technique applied in a hypothesis testing.

5.2.1 Hypothesis Testing

A null hypothesis is a statement on which any change from what has been thought to be true will be due entirely to random error; whereas, an alternative hypothesis statement indicates the opposite of the null hypothesis. H_0 is assigned generally for null hypothesis and H_1 to the alternative hypothesis. The purpose of assigning hypothesis is to determining which of the two hypotheses correct (Zikhmund, 2003) is. The significance level is the critical probability in choosing between null hypothesis and alternative hypothesis, the probability level that this too low to warrant support of a null hypothesis. The insignificance level determines the probability level. The statistically significant correlations at the 0.05 level ($\alpha = 0.05$ at 95% confident level). Testing a hypothesis is presented one after another, accompanied with the table, showing the statistical results from SPSS. In this chapter, a summary of hypothesis-testing results is displayed (see Table 5.24, pp 68).

Table 5.24 Regression analysis of technological turbulence and environmental scanning sources of information

Model summary

Model	R	R square	Adjusted R square	Std. Error of the Estimate
1	.229(a)	.053	.043	.60025

a Predictors: (Constant), MEAN TT

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.961	1	1.961	5.443	.022(a)
	Residual	35.310	98	.360		
	Total	37.271	99			

a. Predictors: (Constant), MEANQ8
b. Dependent Variable: MEANQ6

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		b	Standard Error	Beta		
1	(Constant)	2.725	.290		9.402	.000
	MEAN TT	.197	.084	.229	2.333	.022

a. Dependent Variable: MEANQ6

5.2.2 Bivariate regression analysis

Bivariate regression is a procedure for deriving a mathematical relationship, in the form of an equation, between a single metric dependent or criterion variable and a single metric independent or predictor variable (Malhotra, 1999). In this study, we use the sum of the mean of each variable to calculate the relationship between the two variables. The bivariate regression equation as follows:

$$Y = \beta_0 + \beta_1 X_i$$

From the regression equation, if a given independent variable is "b_1" then "a" unit increase in the independent variable (X) is associated with "ab_1" change in the log odds of the dependent variable. The predict value can be calculated using the regression equation as follows:

$$\text{The use of sources} = 2.725 + 0.197\ (\text{Technological Turbulence})$$

For cross-sectional data, the regression coefficient for the predictor is the difference in response per unit difference in the predictor. For longitudinal data, the regression coefficient is the change in response per unit change in the predictor. The coefficients table shows that the use of the sources of information differ 0.197 units for every unit difference in the technological turbulence affects.

Testing of significance

Standard Error

It is the standard errors of the regression coefficients. It can use for hypothesis testing and constructing confidence level. For the standard error results given in Table 5.24, the coefficient table (see pp 68). The standard error of the use of sources of information coefficient is 0.84.

Standardized coefficient (Beta)

The term of beta coefficient is used to denote the standardized regression coefficient. The beta coefficient allows for a direct comparison between coefficients as to their relative explanatory power of the dependent variable. For the regression results given in Table 5.24, the coefficient table (see pp 68), the value of the beta coefficient is estimated as 0.2333

The *t* statistic tests the hypothesis that a population regression coefficient β_1 is 0, that is, H_0: $\beta_1 = 0$. It is the ratio of the sample regression coefficient *b* to its standard error. The appropriate test statistic is the *t* statistic as follows:

$$t = b / SE_b$$

When, *b* is non-standardize coefficient and SE_b is standard error, then,

$$t = 0.197 / 0.84$$

$$t = 2.333$$

To illustrate the *t* test statistic, with n-2 = 98 degree of freedom. From the statistical appendix, $\alpha = 0.05$ is 1.984 for a two-tailed test. The calculated *t* statistic exceeds the critical value, thus the null hypothesis is rejected. Hence, there is a significant linear relationship between the two variables. The positive sign of the slope coefficient indicates that this relationship is positive. In other words, technological turbulence has affect towards the information sources use in environmental scanning of new product development.

ANOVA Table

Analysis of variance (ANOVA) explains the story of how the regression equation accounts for variability in the response variable. The F statistic will be tested for examining the significance of the linear relationship between X and Y is another equivalent test for examining the significance of the coefficient of determination. The appropriate test statistic is the F statistic as follows:

$$F = \frac{Sum\ Square_{reg}}{Sum\ Square_{res} / (n-2)}$$

which, this has an F distribution with 1 and n-2 degree of freedom. The F test is a generalized form of the *t* test. If a random variable is *t* distributed with n degree of freedom, then t^2 is F distributed with 1 and n degree of freedom. The value of the F statistic as follows:

$$F = 1.961 / 0.360$$

$$= 5.443$$

with 1 and 98 degrees of freedom. From the statistic table, $\alpha = 0.05$ is about 3.540. The calculated F statistic exceeds the critical value and thus, the model is statistically significant, and corroborating the results of the t test. Thus, the relationship between X and Y is significance, it is meaningful to predict the values of Y based on the values of X and to estimate prediction accuracy. Subsequently, the null hypothesis of H_0: $\beta_1 = 0$ is rejected. This means technological turbulence has affects upon environmental scanning sources of information.

Correlation coefficient

The coefficient of R Square (r^2) is the square of the simple correlation coefficient obtained by correlating the two variables. The coefficient r^2 varies between 0 and 1. It signifies the proportion of the total variation in Y that is accounted for by the variation in X. From Table 5.24 (see pp 69), the strength of association may be calculated as follows:

$$r^2 = \frac{Sum\ Square_{reg}}{Sum\ Square_{res}}$$

Then, $= 1.961 / 37.271$

$= 0.53$

To illustrate the calculation of R Square (r^2), the value is close to 1, it means there is a high degree of association and positive coefficient relationship between the two variables.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

In this final chapter, a summary of the study and the findings are presented. Thereafter, discussions and managerial implications of the findings are described. Recommendations for SMEs in Thai food processing industry as well as for the government are subsequently proposed so as to fulfill the research objective (b). Finally, the researcher provides the guidelines for further study in the future.

6.1 Conclusions

6.1.1 Summary of the study

This research is mainly conducted to explore the relationships of technological turbulence and environmental scanning sources of information in the context-specific setting of SMEs in Thai food processing industry in Bangkok. In this study, technological turbulence is measured by the characteristics affects, namely changes in technology in product group, changes in technology in product process, changes in technology in R&D of new product development, changes in R&D in product processes, opportunities for the product, forecasting technology in 5 years ahead, and new product ideas through technological breakthrough. The study reveals additional findings on the extent of environmental scanning sources of information in SMEs based on perceptions of chief executive officers (CEOs) or SME's owners. In view of research methodology, the study employs a quantitative method, using regression analysis technique, in analyzing data from questionnaires. The samples, comprised of 100 CEOs or SME's owners as target

respondents, are captured in four food exhibitions held in Bangkok during March to July 2003. The final analysis on survey data is processed through the software, Statistical Package for Social Science (SPSS) Version 11.5.

6.1.2 Summary of the findings

Descriptive statistics

The sample SMEs are mostly small-sized companies (number of employees not over 50 persons or investment on fixed assets not over 50 million bath) with approximately one fourth, medium-sized companies (number of employees between 50 and 200 persons or investment on fixed assets more than 50 but not over 200 million bath). The findings indicate that the sample SMEs agreed that technological turbulence has affects on the use of sources in environmental scanning the most, followed by opportunities, new product ideas succeed through technological breakthrough, change in technology in R&D of new product development, changes in technologies in product processes, changes in technologies in production process, predictable technology for the next five years, and change in technology in product group respectively. Most of the mean values lie between (3) neutral agreed and (4) agreed, indicating that the average degree of scanning is a little above the middle of a 1-5 scale. Regarding environmental scanning sources of information, the majority of mean values lie between (3) neutral used and (4) considerably used, indicating that the average degree of scanning is a little above the middle of a 1-5 scale.

Inferential statistics

Table 6.1 summarizes the statistical results of hypothesis testing from SPSS program. Subsequently, the conclusions of hypothesis statements in the study are presented.

Table 6.1 A summary of hypothesis testing results in the study

Hypothesis Number	Descriptions	Findings	Evidences
1	Technological turbulence has relationship with environmental scanning sources of information	H_0 Rejected	Table 5.24

The regression analysis technique is used to evaluate the influences of technology turbulence upon environmental scanning sources of information among sample SMEs. There is a high degree of association and positive coefficient relationship between technology turbulence and environmental scanning sources of information. . The significant F is 0 022 is lower than the criteria of $\alpha = 0.05$ for a 95% confidential level, and R square (r^2) is 0.53, which is closer to 1, this means there is a high degree of association and positive coefficient relationship between the two variables. The resulting Beta coefficient is 0.2333, which shows the model was fitted to standardized data. Consequently, the null hypothesis is rejected and the alternative hypothesis is accepted. Thus the relationship between technological turbulence and environmental scanning sources of information is significant.

6.2 Discussions and managerial implications

This research study aims to understand the relationships between the technological turbulence and the used of sources of information in environmental scanning of new product developments. The simple linear regression model is used to evaluate the statistic relationship between the two variables. The result suggests that technological turbulence has strong affects upon the use of information sources in environmental scanning practices.

The quantitative results reveal that many of the successful chief executive officer (CEOs) or SMEs owners in Thai food processing industry who aware of the rapid change in technological, seek valuable information within its environmental from several sources to capture knowledge for their development capabilities, efficiency, and effectiveness of product innovation and process improvement or development. They recognized the importance of environmental scanning as an effective tool for tracking the trends and events and realize the competitive advantage scanning provides. The research study suggests that the environmental scanning helps in the creation of windows of opportunities, generation of new product ideas, and aiding in successful entry to the marketplace.

However, effective environmental scanning requires companies to practice frequently. The frequent scanning of the environment will allow firm's to align their competitive strategy with the environment and enable SMEs to choose among alternative new technologies to use within the corporation. The frequent scanning of the environment from several sources such as customers, competitor, and public organizations will provide

the SMEs with current information on the changing environmental conditions, informing them of improvements and modifications of new products and processes, that could help firms; increase product quality, improve quality of raw materials, provide more attractive packaging, and aid in faster launching new products to the market.

To keep up with new product ideas and the best fit to the customers' preferences, SMEs need to keep up scanning particularly to enable them to obtain accurate information. They also, have to have a strong linkage with their customers, allow more customer involvement in the R&D process, as it allows companies to better capture the consumer trends, this will aid in the successful entry into the market place and generate new ideas. Scanning and analyzing information on competitor's technology may enable companies to implement a strategic plan to compete with their rivals and help keep their current customers and possibly gaining new customers.

Public organizations such as Board of Investment (BOI), the Federal of Thai Industries (FTI), and Institute for SMEs development, are the places of accurate and crucial information, providing necessary training to empower SMEs in the food industry to compete in the market, not only local but internationally. However, the study finds that most SMEs in the food industry do not see their suppliers as sources of information. Suppliers should not be ignored as useful sources of information. Suppliers have contacts in the environment that may not be directly open to firms, such as competitor information and new product developments in the industry.

Within the context of technological turbulence, it can be seen that technological change evolves over time and creates a form of uncertainty in new product development, with the rapid changing of technology, what is current today may or may not be current tomorrow. This is the reason that firms must not stop scanning the environment for new technology. Those firms that fall behind in technology will be left behind, and loosing any competitive advantage that they once might of had.

External environmental factors and rapidly changing technology are major drivers of change and efficiency improvements, environmental scanning is an efficient tool for the SMEs to use to remain competitive in the market. The study suggest that SMEs need to keep up with environmental scanning by obtaining information from several sources such as customer, competitors, public organizations, that will enable them to stay up to date with crucial information. For those SMEs that wish to have a competitive advantage, environmental scanning is an efficient tool that can help them remain competitive in a changing environment.

6.3 Recommendations

6.3.1 SMEs

SMEs in food processing industry in Thailand are encountering a rapidly changing technology, new product developments, and intense global market competition. For these reasons, it is a must for Thai SMEs' food operators to expeditiously improve their capabilities in production and product development, resulting in better quality and a better price, compared with those of their rivals. For this reason, if SMEs are to compete

effectively in the marketplace, CEOs or SME's owners need to be more conscious of the emerging trends posed by their technological environment. To better understand the external forces of change and to develop new products successfully, which can secure or improve their position in the market, SMEs need to scan the environmental changes relevant to the company and respond to them accordingly. They must be able to predict discontinuities, which occur when one technology threatens to replace another (Khaill, 2000). To do so, SMEs in the food processing industry should be ready to pick up on events and trends, whether they have immediate or long-term impact on the company as it provides crucial information on the factors influencing the success of new product.

The findings suggest that SMEs that wish to have a competitive advantage need to keep up with external environment factors and rapidly changing technology. External environmental factors and rapidly changing technology are major drivers of change and efficiency improvements. Additionally, the well-managed new product developments should be organized as a continuous learning process and should have strong information linkage inside and outside the firm. Poor communication can lead to costly mistakes and loss of time in getting new products to the market quickly. Sources of information such as customers, suppliers, competitors, publication, and public organization are necessity to the firms to gather information for their capability knowledge.

6.3.2 Government

From a practical perspective, the Thai government can support the information needs of SMEs by making government policies and other data relevant to SMEs in food processing industry publicly available at no cost in a timely manner to SMEs. This data could include news about future trends in production technologies, market situations, and or industry outlooks. In respect to training and development, the government can strengthen SMEs by educating SME's owners in managerial and technical training to upgrade their human resources capabilities.

6.3.3 Further Study

This study research aims to evaluate the affects of technological turbulent upon the use of information sources in environmental scanning. Further study would explore the degree scanning in uncertainty environmental. Since the study is conducted with 100 SMEs in Thai food processing industry in Bangkok and metropolitan only, the results of the study are industry specific and limited to the SMEs in \ Thai food processing only, its extension to cover the food industry in other industrial areas will provide a further insight into how technological turbulence impacts upon environmental scanning sources of information. Therefore, because of the small sample size, the study's findings have to be taken with caution. Replications using larger and different samples in terms of different industries, different provinces, or concentrating on large companies instead of SMEs would help in gaining a better perspective on corporate scanning for further study in the future.

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APPENDIX A

Questionnaire

The following questionnaire pertains to the partial fulfillment of MBA thesis conducted by a graduate student of Assumption University, Thailand. The academic intent of this questionnaire is to obtain information on to what external sources of information of small and medium enterprises (SMEs) in Thai Food processing industry used in scanning technological turbulence. The questionnaire is consisting of seven questions. Your full cooperation in responding to all items in this questionnaire will be highly appreciated. Thank you very much for participating in our study.

Question 1 Name of the new product

_____ 1.1

Question 2 How many years have you spent on designing and launching process of this process of this new products? Please mark that most corresponds with your answer.

- ❑ Less than 1 year 2.1
- ❑ 1.01 – 2 years 2.2
- ❑ 2.01 – 3 years 2.3
- ❑ More than 3 years 2.3

Question 3 In which year was this new product launched into the market? Please mark that most corresponds with your answer

- ❑ 2003 3.1
- ❑ 2002 3.2
- ❑ 2001 3.3
- ❑ 2000 3.4
- ❑ 1999 3.5
- ❑ 1998 3.6

Question 4 Based on your answer to question 1, what is the extent to which the following sources of information were used to collect information about external environment in order to design and launch this new product? Please circle the appropriate boxes. Meaning of each level is shown as follows:

Types of source	Not at all used	Slightly used	Neutral used	Considerably used	Extensively used
4.1 Publications (both from public and private organizations)	1	2	3	4	5
4.2 Public Organization, such as Board of Investment (BOI), The Federal of Thai Industries (FTI), and Institute for SMEs development, etc.	1	2	3	4	5
4.3 Customers	1	2	3	4	5
4.4 Suppliers	1	2	3	4	5
4.5 Competitors	1	2	3	4	5
4.6 Internet	1	2	3	4	5

Question 5 To which extent that the company has tapped technology in designing and launching new product onto the market? Please circle the appropriate boxes. Please circle the appropriate boxes. Meaning of each level is shown as follows:

Technological Turbulence	Strongly disagreed	Disagreed	Neutral used	Agreed	Strongly agreed
5.1 The technology in this product area is changing rapidly.	1	2	3	4	5
5.2 The technology in the production process in developing new product is changing rapidly.	1	2	3	4	5
5.3 The technology in research & development process in developing new product in this industry is changing rapidly.	1	2	3	4	5
5.4 The technology in research & development process in the production process is changing rapidly.	1	2	3	4	5
5.5 Technological changes provide big opportunities in this product area.	1	2	3	4	5
5.6 It is very difficult to forecast where the technology in this product area will be in the next five years.	1	2	3	4	5
5.7 A large number of new product ideas in this area have been made possible through technological breakthroughs.	1	2	3	4	5

Question 6 How many permanentemployees does your company currently have in Thailand? Please mark an appropriate box

❑	a.	1-50	persons	6.1
❑	b.	51-100	persons	6.2
❑	c.	101-200	persons	6.3

Question 7 What is the most recent registered capital of your company? Please mark an appropriate box.

❑	a.	Baht	1 – 25	million	7.1
❑	b.	Baht	25.01 – 50	million	7.2
❑	c.	Baht	50.01 – 100	million	7.3
❑	d.	Baht	100.01 – 150	million	7.4
❑	e.	Baht	150.01 – 200	million	7.5

APPENDIX B

แบบสอบถาม

แบบสอบถามต่อไปนี้เป็นส่วนหนึ่งในการจัดทำวิทยานิพนธ์ของนักศึกษาปริญญาโทจากมหาวิทยาลัยอัสสัมชัญคณะบริหารธุรกิจแบบสอบถามนี้จัดทำขึ้นเพื่อศึกษาผลกระทบการเปลี่ยนแปลงทางด้านเทคโนโลยีต่อรูปแบบการใช้แหล่งข้อมูลภายนอกขององค์การขนาดเล็กและขนาดกลาง (SMEs) ในอุตสาหกรรมอาหารแปรรูปที่ทำการวิเคราะห์สำหรับการพัฒนาผลิตภัณฑ์ใหม่สู่ตลาด แบบสอบถามนี้มีคำถามทั้งหมด 7 ข้อ ผู้จัดทำขอขอบคุณท่านที่ให้ความร่วมมือในการตอบแบบสอบถามนี้มา ณ ที่นี้

คำถามที่1 ชื่อของผลิตภัณฑ์ใหม่ (โปรดระบุเป็นภาษาไทย หรืออังกฤษ)

_____ 1.1

คำถามที่2 บริษัทของท่านใช้เวลาในการออกและพัฒนาผลิตภัณฑ์ใหม่นี้ออกสู่ตลาดเป็นระยะเวลาประมาณกี่ปี โปรดทำเครื่องหมายบน❑ หน้าคำตอบที่คุณเลือก

- ❑ น้อยกว่า 1 ปี 2.1
- ❑ น้อยกว่า 1 ปี แต่ไม่เกิน 2 ปี 2.2
- ❑ น้อยกว่า 2 ปี แต่ไม่เกิน 3 ปี 2.3
- ❑ มากกว่า 3 ปี 2.4

คำถามที่3 ผลิตภัณฑ์ใหม่นี้ออกวางสู่ตลาดเมื่อปี พ.ศ.ใด โปรดทำเครื่องหมาย ลงบน ❑ หน้าคำตอบที่คุณเลือก

- ❑ พ.ศ. 2546 3.1
- ❑ พ.ศ. 2545 3.2
- ❑ พ.ศ. 2544 3.3
- ❑ พ.ศ. 2543 3.4
- ❑ พ.ศ. 2542 3.5
- ❑ พ.ศ. 2541 3.6

คำถามที่ 4 จากคำตอบในข้อที่ 1 บริษัทมีการใช้แหล่งข้อมูลต่างๆ ต่อไปนี้ เพื่อเก็บรวบรวมข้อมูลเกี่ยวกับสภาพแวดล้อมภายนอก เพื่อนำมาใช้ในกระบวนการออกแบบและกระบวนการส่งเสริมผลิตภัณฑ์ใหม่นี้สู่ตลาดมากน้อยเพียงใด

ที่มาของแหล่งข้อมูล	ใช้น้อยที่สุด	ใช้น้อย	ใช้ปานกลาง	ใช้มาก	ใช้มากที่สุด
4.1 สิ่งพิมพ์ (ทั้งจากองค์กรของรัฐและเอกชน	1	2	3	4	5
4.2 องค์กรของรัฐ เช่น คณะกรรมการส่งเสริมการส่งออก (BOI), สภาอุตสาหกรรมแห่งประเทศไทย (FTI), และสถาบันส่งเสริมและพัฒนาวิสาหกิจขนาดกลางและขนาดย่อม (ISMEs)	1	2	3	4	5
4.3 ลูกค้า	1	2	3	4	5
4.4 ผู้จำหน่ายวัตถุดิบ	1	2	3	4	5
4.5 คู่แข่งทางการค้า	1	2	3	4	5
4.6 อินเตอร์เน็ต	1	2	3	4	5

คำถามที่ 5 จากคำตอบในข้อที่ 1 บริษัทมีความเห็นเรื่องการเปลี่ยนแปลงเทคโนโลยีที่นำมาใช้ในกระบวนการออกแบบและกระบวนการส่งเสริมผลิตภัณฑ์ใหม่นี้อย่างไร

การเปลี่ยนแปลงด้านเทคโนโลยี	ไม่เห็นด้วยอย่างยิ่ง	ไม่เห็นด้วย	ไม่มีความคิดเห็น	เห็นด้วย	เห็นด้วยอย่างยิ่ง
5.1 เทคโนโลยีในกลุ่มผลิตภัณฑ์นี้มีการเปลี่ยนแปลงอย่างรวดเร็ว	1	2	3	4	5
5.2 เทคโนโลยีในกระบวนการผลิตของการพัฒนาผลิตภัณฑ์ใหม่มีการ เปลี่ยนแปลงอย่างรวดเร็ว	1	2	3	4	5
5.3 เทคโนโลยีในกระบวนการวิจัยและพัฒนาของการพัฒนาผลิตภัณฑ์ใหม่ในอุตสาหกรรมนี้มีการเปลี่ยนแปลงอย่างรวดเร็ว	1	2	3	4	5
5.4 เทคโนโลยีในกระบวนการวิจัยและพัฒนาของกระบวนการผลิตมีการเปลี่ยนแปลงอย่างรวดเร็ว	1	2	3	4	5
5.5 การเปลี่ยนแปลงทางด้านเทคโนโลยีสร้างโอกาสให้แก่ผลิตภัณฑ์ในกลุ่มนี้เป็นอย่างมาก	1	2	3	4	5
5.6 การพยากรณ์แนวโน้มของการเปลี่ยนแปลงเทคโนโลยีในกลุ่มผลิตภัณฑ์นี้ในอีก 5 ปีข้างหน้าเป็นเรื่องที่ยากมาก	1	2	3	4	5
5.7 มีความคิดในการพัฒนาผลิตภัณฑ์ใหม่ในกลุ่มผลิตภัณฑ์นี้เป็นจำนวนมากที่ประสบความสำเร็จ เนื่องจากมีการนำเทคโนโลยีใหม่ๆ มาใช้	1	2	3	4	5

คำถามที่ 6 ปัจจุบันบริษัทของท่านมีพนักงานประจำในประเทศไทยเป็นจำนวนเท่าไหร่ กรุณาทำเครื่องหมายใน ❑ เพียงข้อเดียว

❑	1-50 persons	6.1
❑	51-100 persons	6.2
❑	101-200 persons	6.3

คำถามที่ 7 ปัจจุบันบริษัทของท่านมีทุนจดทะเบียนเท่าไหร่ กรุณาทำเครื่องหมายใน ❑ เพียงข้อเดียว

❑	น้อยกว่า 25	ล้านบาท	7.1
❑	มากกว่า 25 แต่ไม่เกิน 50	ล้านบาท	7.2
❑	มากกว่า 50 แต่ไม่เกิน 100	ล้านบาท	7.3
❑	มากกว่า100 แต่ไม่เกิน 150	ล้านบาท	7.4
❑	มากกว่า 150 แต่ไม่เกิน	ล้านบาท	7.5

APPENDIX C

RELIABILITY ANALYSIS - SCALE (ALPHA)

Correlation Matrix

	V6.1	V6.2	V6.3	V6.4	V6.5
V6.1	1.0000				
V6.2	.4854	1.0000			
V6.3	.1581	.2068	1.0000		
V6.4	.1575	.3854	.3837	1.0000	
V6.5	-.0005	.0147	.5546	.1584	1.0000
V6.6	.0402	.1434	.0454	.4299	.1689
V8.1	.0578	.1591	.0327	.0589	.1098
V8.2	-.0709	.0608	.0663	.1223	.1429
V8.3	-.1257	.1052	-.0969	.1795	-.0495
V8.4	-.1160	.1608	.1016	.2368	.1836
V8.5	.0316	.0484	.1703	.1340	.1376
V8.6	-.0539	.1311	-.0198	.0259	.1381
V8.7	-.1430	-.1282	.1286	.2479	.0450

	V6.6	V8.1	V8.2	V8.3	V8.4
V6.6	1.0000				
V8.1	.0436	1.0000			
V8.2	.2630	.5860	1.0000		
V8.3	.2176	.5560	.7161	1.0000	
V8.4	.3649	.4882	.6351	.6515	1.0000
V8.5	.2213	.3200	.2793	.2976	.1775
V8.6	.1917	.1564	.4139	.3406	.3213
V8.7	.1733	.2850	.2607	.3565	.2509

	V8.5	V8.6	V8.7
V8.5	1.0000		
V8.6	.0878	1.0000	
V8.7	.4249	.1668	1.0000

RELIABILITY ANALYSIS - SCALE (ALPHA)

N of Cases = 100.0

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.3723	2.6600	3.9000	1.2400	1.4662	.0933

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	1.0985	.7172	1.4590	.7418	2.0344	.0323

Reliability Coefficients 13 items

Alpha = .7545 Standardized item alpha = .7526

Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	MEANQ8[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: MEANQ6

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.229[a]	.053	.043	.60025

a. Predictors: (Constant), MEANQ8

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.961	1	1.961	5.443	.022[a]
	Residual	35.310	98	.360		
	Total	37.271	99			

a. Predictors: (Constant), MEANQ8

b. Dependent Variable: MEANQ6

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.725	.290		9.402	.000
	MEANQ8	.197	.084	.229	2.333	.022

a. Dependent Variable: MEANQ6

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Name of new product	98	1	5	3.06	1.598
Time spent in design and launch	88	1	4	1.85	1.099
Time product launched (month)	80	1	12	5.65	3.684
Time product launched (year)	87	1	6	1.99	1.360
Publication	100	1	5	3.35	1.019
Public org	100	1	5	3.45	1.067
Local and foreign customers	100	1	5	3.90	.847
Local and foreign suppliers	100	1	5	3.33	1.035
Local and foreign competitors	100	1	5	3.63	1.060
Info from consult co.	100	1	5	2.66	1.208
Changes in Tech in product group	100	1	5	3.12	1.166
Changes in Tech in prod process in NPD	100	1	5	3.31	1.098
Changes in Tech in R&D in NPD	100	1	5	3.37	1.022
Changes in Tech in R&D in prod process	100	1	5	3.37	1.022
Opportunities	100	1	5	3.71	.988
Forecast tech in 5 yrs ahead	100	1	5	3.13	1.022
NP ideas successed thru tech breakthrough	100	1	5	3.51	1.030
No of employess	100	1	3	1.57	.795
Registered cap	100	1	5	1.65	1.226
Valid N (listwise)	72				

Frequencies

Statistics

		Name of new product	Time spent in design and launch	Time product launched (month)	Time product launched (year)
N	Valid	98	88	80	87
	Missing	2	12	20	13
Mean		3.06	1.85	5.65	1.99
Std. Error of Mean		.161	.117	.412	.146
Std. Deviation		1.598	1.099	3.684	1.360
Variance		2.553	1.208	13.572	1.849
Range		4	3	11	5
Minimum		1	1	1	1
Maximum		5	4	12	6

Statistics

		Publication	Public org	Local and foreign customers	Local and foreign suppliers	Local and foreign competitors
N	Valid	100	100	100	100	100
	Missing	0	0	0	0	0
Mean		3.35	3.45	3.90	3.33	3.63
Std. Error of Mean		.102	.107	.085	.104	.106
Std. Deviation		1.019	1.067	.847	1.035	1.060
Variance		1.038	1.139	.717	1.072	1.124
Range		4	4	4	4	4
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

Statistics

		Info from consult co.	Changes in Tech in product group	Changes in Tech in prod process in NPD	Changes in Tech in R&D in NPD
N	Valid	100	100	100	100
	Missing	0	0	0	0
Mean		2.66	3.12	3.31	3.37
Std. Error of Mean		.121	.117	.110	.102
Std. Deviation		1.208	1.166	1.098	1.022
Variance		1.459	1.359	1.206	1.044
Range		4	4	4	4
Minimum		1	1	1	1
Maximum		5	5	5	5

Statistics

		Changes in Tech in R&D in prod process	Opportunities	Forecast tech in 5 yrs ahead	NP ideas successed thru tech breakthrough
N	Valid	100	100	100	100
	Missing	0	0	0	0
Mean		3.37	3.71	3.13	3.51
Std. Error of Mean		.102	.099	.102	.103
Std. Deviation		1.022	.988	1.022	1.030
Variance		1.044	.976	1.044	1.061
Range		4	4	4	4
Minimum		1	1	1	1
Maximum		5	5	5	5

Statistics

		No of employess	Registered cap
N	Valid	100	100
	Missing	0	0
Mean		1.57	1.65
Std. Error of Mean		.079	.123
Std. Deviation		.795	1.226
Variance		.631	1.503
Range		2	4
Minimum		1	1
Maximum		3	5

Frequency Table

Name of new product

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cereal	26	26.0	26.5	26.5
	Meat & Poultry	16	16.0	16.3	42.9
	Seasoning	9	9.0	9.2	52.0
	Tea, coffee, cocoa	20	20.0	20.4	72.4
	Vegetable, fruit	27	27.0	27.6	100.0
	Total	98	98.0	100.0	
Missing	Missing	2	2.0		
Total		100	100.0		

Time spent in design and launch

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 1 yr	47	47.0	53.4	53.4
	1.01 - 2 yrs.	20	20.0	22.7	76.1
	2.01 - 3 yrs.	8	8.0	9.1	85.2
	3.01+ yrs.	13	13.0	14.8	100.0
	Total	88	88.0	100.0	
Missing	missing	8	8.0		
	9	4	4.0		
	Total	12	12.0		
Total		100	100.0		

Time product launched (month)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	January	11	11.0	13.8	13.8
	February	9	9.0	11.3	25.0
	March	11	11.0	13.8	38.8
	April	8	8.0	10.0	48.8
	May	7	7.0	8.8	57.5
	June	3	3.0	3.8	61.3
	July	3	3.0	3.8	65.0
	August	3	3.0	3.8	68.8
	September	5	5.0	6.3	75.0
	October	10	10.0	12.5	87.5
	November	5	5.0	6.3	93.8
	December	5	5.0	6.3	100.0
	Total	80	80.0	100.0	
Missing	missing	20	20.0		
Total		100	100.0		

Time product launched (year)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2545	43	43.0	49.4	49.4
	2544	23	23.0	26.4	75.9
	2543	11	11.0	12.6	88.5
	2542	4	4.0	4.6	93.1
	2541	1	1.0	1.1	94.3
	2540	5	5.0	5.7	100.0
	Total	87	87.0	100.0	
Missing	missing	13	13.0		
Total		100	100.0		

Publication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not used at all	5	5.0	5.0	5.0
	used lv.1	13	13.0	13.0	18.0
	used lv.2	36	36.0	36.0	54.0
	used lv.3	34	34.0	34.0	88.0
	used very extensively	12	12.0	12.0	100.0
	Total	100	100.0	100.0	

Public org

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not used at all	4	4.0	4.0	4.0
	used lv.1	13	13.0	13.0	17.0
	used lv.2	36	36.0	36.0	53.0
	used lv.3	28	28.0	28.0	81.0
	used very extensively	19	19.0	19.0	100.0
	Total	100	100.0	100.0	

Local and foreign customers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not used at all	1	1.0	1.0	1.0
	used lv.1	3	3.0	3.0	4.0
	used lv.2	26	26.0	26.0	30.0
	used lv.3	45	45.0	45.0	75.0
	used very extensively	25	25.0	25.0	100.0
	Total	100	100.0	100.0	

Local and foreign suppliers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not used at all	6	6.0	6.0	6.0
	used lv.1	13	13.0	13.0	19.0
	used lv.2	34	34.0	34.0	53.0
	used lv.3	36	36.0	36.0	89.0
	used very extensively	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

Local and foreign competitors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not used at all	3	3.0	3.0	3.0
	used lv.1	9	9.0	9.0	12.0
	used lv.2	36	36.0	36.0	48.0
	used lv.3	26	26.0	26.0	74.0
	used very extensively	26	26.0	26.0	100.0
	Total	100	100.0	100.0	

Info from consult co.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not used at all	21	21.0	21.0	21.0
	used lv.1	22	22.0	22.0	43.0
	used lv.2	37	37.0	37.0	80.0
	used lv.3	10	10.0	10.0	90.0
	used very extensively	10	10.0	10.0	100.0
	Total	100	100.0	100.0	

Changes in Tech in product group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	7	7.0	7.0	7.0
	disagree	28	28.0	28.0	35.0
	neutral	24	24.0	24.0	59.0
	agree	28	28.0	28.0	87.0
	strongly agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

Changes in Tech in prod process in NPD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	6.0	6.0	6.0
	disagree	20	20.0	20.0	26.0
	neutral	22	22.0	22.0	48.0
	agree	41	41.0	41.0	89.0
	strongly agree	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

Changes in Tech in R&D in NPD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	4.0	4.0	4.0
	disagree	19	19.0	19.0	23.0
	neutral	22	22.0	22.0	45.0
	agree	46	46.0	46.0	91.0
	strongly agree	9	9.0	9.0	100.0
	Total	100	100.0	100.0	

Changes in Tech in R&D in prod process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	2	2.0	2.0	2.0
	disagree	21	21.0	21.0	23.0
	neutral	28	28.0	28.0	51.0
	agree	36	36.0	36.0	87.0
	strongly agree	13	13.0	13.0	100.0
	Total	100	100.0	100.0	

Opportunities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	5	5.0	5.0	5.0
	disagree	7	7.0	7.0	12.0
	neutral	16	16.0	16.0	28.0
	agree	56	56.0	56.0	84.0
	strongly agree	16	16.0	16.0	100.0
	Total	100	100.0	100.0	

Forecast tech in 5 yrs ahead

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	4	4.0	4.0	4.0
	disagree	23	23.0	23.0	27.0
	neutral	40	40.0	40.0	67.0
	agree	22	22.0	22.0	89.0
	strongly agree	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

NP ideas successed thru tech breakthrough

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	6	6.0	6.0	6.0
	disagree	8	8.0	8.0	14.0
	neutral	29	29.0	29.0	43.0
	agree	43	43.0	43.0	86.0
	strongly agree	14	14.0	14.0	100.0
	Total	100	100.0	100.0	

No of employess

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 -50	62	62.0	62.0	62.0
	51-100	19	19.0	19.0	81.0
	101-200	19	19.0	19.0	100.0
	Total	100	100.0	100.0	

Registered cap

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-25 million baht	73	73.0	73.0	73.0
	25.01-50 million baht	7	7.0	7.0	80.0
	50.01-100 million baht	9	9.0	9.0	89.0
	100.01-150 million baht	4	4.0	4.0	93.0
	150.01-200 million baht	7	7.0	7.0	100.0
	Total	100	100.0	100.0	