

รายงานวิจัยฉบับสมบูรณ์

โครงการ การศึกษาความสามารถในการพัฒนาผลิตภัณฑ์
ใหม่ของอุตสาหกรรมอาหารในประเทศไทย

โดย ดร. ปรีศนา สุวรรณภรณ์ และคณะ

เดือน ปี ที่เสร็จโครงการ 30 มิถุนายน 2543

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ของอุตสาหกรรมอาหารในประเทศไทย

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สนับสนุนโดยสำนักงานกองทุนสนับสนุนการวิจัย

ชุดโครงการ ทุนวิจัยหลังปริญญาเอก

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ABSTRACT

Project Code : PDF/11/2542

Project Title : New Product Development Competencies in the Thai Food Industry

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Project Period : 1 July 1999 – 30 June 2000 (1 year)

Objective :

- 1) To assess factors affect NPD competencies in the Thai food industry.
- 2) To rational the NPD competencies factors of local and MNCs food industry in Thailand.
- 3) To present recommendation for NPD implementation aiming to increase NPD competencies in local food manufacturing to compete more efficiently in local market.

Abstract : New product development (NPD) in food processing industries is often one element which determines whether companies are able to remain competitive in rapidly changing consumer markets. Current research suggests that well managed NPD should be organized as a continuous learning process. . It should have strong information linkage across functions and outside the company to suppliers and customers. Qualitative analysis using in depth interview with three majors NPD related functions which are marketing, R&D and manufacturing are directed in order to investigate the NPD competency factors,. Twenty local and MNCs food companies in Thailand which have good potential in commercializing new products are interviewed. Data are analyzed and NPD competency factors are defined. We examine NPD in Thailand's food processing industry to determine how much it conforms (or not) to current thinking. Generally, only some multinationals and a few larger Thai companies make some attempt to integrate information from a wide knowledge base into their NPD. Even the ones that do it well by Thai standards still have some problems. Existing models of NPD are not very explicit on how information flows should be structured. From our examination of NPD in Thailand, we propose a model based on the continuous learning process in NPD. It suggests how to accumulate and integrate learning (about customers, technology, and NPD itself) across key internal functions (marketing, R&D, and manufacturing).

Keywords : new product development, continuous learning, R&D management, Thailand

บทคัดย่อ

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ชื่อโครงการ: การศึกษาความสามารถในการพัฒนาผลิตภัณฑ์ใหม่ของอุตสาหกรรมอาหารในประเทศไทย

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ระยะเวลาโครงการ : 1 กค. 2542 – 30 มิย. 2543 (1 ปี)

วัตถุประสงค์โครงการ :

1. เพื่อหาปัจจัยที่มีผลต่อความสามารถในการพัฒนาผลิตภัณฑ์ใหม่ของอุตสาหกรรมอาหารในประเทศไทย
2. เพื่อเปรียบเทียบปัจจัยที่มีผลต่อความสามารถในการพัฒนาผลิตภัณฑ์ใหม่ของบริษัทไทยและบริษัทข้ามชาติ
3. เพื่อเสนอแนะข้อควรปฏิบัติในการพัฒนาผลิตภัณฑ์เพื่อเพิ่มขีดความสามารถของบริษัทผลิตอาหารของคนไทยเพื่อสามารถแข่งขันกับบริษัทข้ามชาติในตลาดในประเทศได้

บทคัดย่อ : การพัฒนาผลิตภัณฑ์ใหม่ในอุตสาหกรรมอาหาร เป็นหัวข้อที่มักถูกใช้ในการพิจารณาว่าบริษัทจะสามารถแข่งขันในตลาดที่มีการเปลี่ยนแปลงอย่างรวดเร็วได้หรือไม่ งานวิจัยปัจจุบันเสนอแนะว่าการบริหารจัดการ การพัฒนาผลิตภัณฑ์ที่มีคุณภาพจะต้องเป็นองค์การที่มีการเรียนรู้อย่างต่อเนื่อง และควรจะมีการเชื่อมโยงข้อมูลข่าวสารระหว่างแต่ละแผนกในบริษัทและหน่วยงานต่าง ๆ ภายนอกบริษัทโดยเฉพาะผู้ขาย (Supplier) และ ลูกค้า การวิจัยนี้ได้ใช้วิธีการวิเคราะห์เชิงคุณภาพโดยการสัมภาษณ์เชิงเจาะลึกใน 3 แผนกที่เกี่ยวข้องกับการพัฒนาผลิตภัณฑ์ คือแผนกการตลาด, แผนกวิจัยและพัฒนา และแผนกผลิต เพื่อที่จะให้ได้มาซึ่งปัจจัยที่มีผลกระทบต่อศักยภาพในการพัฒนาผลิตภัณฑ์ในประเทศไทย เราได้สัมภาษณ์ 20 บริษัทผู้ผลิตอาหารทั้งบริษัทของคนไทย และบริษัทข้ามชาติในประเทศไทยซึ่งมีศักยภาพในการพัฒนาผลิตภัณฑ์ใหม่ เพื่อพิจารณาว่าการพัฒนาผลิตภัณฑ์ในบริษัทผลิตอาหารเป็นไปตามที่คาดการณ์ไว้หรือไม่ ผลการวิจัยแสดงว่าโดยปกติแล้วบริษัทข้ามชาติ และบริษัทไทยขนาดใหญ่บางบริษัท มีความพยายามที่จะนำความรู้ และข้อมูลข่าวสารเข้าใช้ในการพัฒนาผลิตภัณฑ์ รูปแบบ (model) การพัฒนาผลิตภัณฑ์ในปัจจุบันยังไม่ชัดเจนในแง่การนำเอาข้อมูลข่าวสารมาใช้ในการพัฒนาผลิตภัณฑ์ จากการศึกษาการพัฒนาผลิตภัณฑ์ในประเทศไทยเราได้เสนอ รูปแบบของกระบวนการเรียนรู้อย่างต่อเนื่องในการพัฒนาผลิตภัณฑ์ใหม่ ซึ่งแสดงถึงกระบวนการในการรวบรวมและสะสมความรู้เกี่ยวกับลูกค้า, เทคโนโลยี และการพัฒนาผลิตภัณฑ์ในระหว่างหน่วยงานต่าง ๆ ภายในบริษัท ได้แก่ แผนกการตลาด, แผนกวิจัยและพัฒนาและแผนกผลิต

คำสำคัญ : การพัฒนาผลิตภัณฑ์, การเรียนรู้อย่างต่อเนื่อง, การจัดการการวิจัยและพัฒนา, ประเทศไทย

ชื่อโครงการ: การศึกษาความสามารถในการพัฒนาผลิตภัณฑ์ใหม่ของอุตสาหกรรมอาหารในประเทศไทย

ชื่อโครงการ: New Product Development Competencies in the Thai Food Industry

EXECUTIVE SUMMARY

1. ความสำคัญและที่มาของปัญหา

Increase in consumer demand and buying power altogether with the highly trade protection in the Thai food industry encourage foreign investor to establish their manufacturing facilities locally especially the giant multi-national companies (MNCs) (TDRI 1997 ; FAO 1992). The local food industries face stiff competition especially with MNCs which have relatively more investment budget, core brand, and high technology. The increase in consumer's sophistication and changes in consumer taste and preferences have put strong pressure on local food manufacturer to adjust themselves in order to catch up with changing market and new market opportunity (Buisson 1993 ; Crippen & Oates 1992). Food exports in Thailand have recently been hit by tough price competition from lower wage Asian countries (Asia Pacific Food Industry 1991; BP 1996). Further, the depreciation of Asian currencies as a result of economic crisis has made the Thai food processors loose price competitiveness (Srihanam 1997). To remain competitive, Thailand will have to focus more on value added food products in the future which will require increased investment in R&D. As a consequences, new product development (NPD) is becoming an important factor in domestic food markets. They must upgrade NPD capabilities or slowly be squeezed out from the higher end of the market by MNCs, and from the lower end by low cost producers in lower wage countries. Local food manufacturers need to be circumspect their NPD competencies in order to find their core competitiveness. Our study will focus on accumulated process learning and information feedback loops among the key functions which contribute to NPD success. We follow the literature in taking integration as an important factor in continuous learning and NPD, and specifically include R&D, marketing / sales, and manufacturing in the research. We also look at information flow from key external parties, especially customers and suppliers. Although current models of NPD discuss process stages and integration of information across functions, they often do not look very carefully at information flow and feedback loops in the flows.

2. วัตถุประสงค์

- To assess factors affect NPD competencies in the Thai food industry.
- To rational the NPD competencies factors of local and MNCs food industry in Thailand.
- To present recommendation for NPD implementation aiming to increase NPD competencies in local food manufacturing to compete more efficiently in local market.

3. บทคัดย่อ

Abstract : New product development (NPD) in food processing industries is often one element which determines whether companies are able to remain competitive in rapidly changing consumer markets. Current research suggests that well managed NPD should be organized as a continuous learning process. It should have strong information linkage across functions and outside the company to suppliers and customers. Qualitative analysis using in depth interview with three majors NPD related functions which are marketing, R&D and manufacturing are directed in order to investigate the NPD competency factors,. Twenty local and MNCs food companies in Thailand which have good potential in commercializing new products are interviewed. Data are analyzed and NPD competency factors are defined. We examine NPD in Thailand's food processing industry to determine how much it conforms (or not) to current thinking. Generally, only some multinationals and a few larger Thai companies make some attempt to integrate information from a wide knowledge base into their NPD. Even the ones that do it well by Thai standards still have some problems. Existing models of NPD are not very explicit on how information flows should be structured. From our examination of NPD in Thailand, we propose a model based on the continuous learning process in NPD. It suggests how to accumulate and integrate learning (about customers, technology, and NPD itself) across key internal functions (marketing, R&D, and manufacturing).

4. ผลงาน/หัวข้อเรื่องที่ได้ตีพิมพ์ในวารสารวิชาการระดับนานาชาติ

ชื่อเรื่องที่ตีพิมพ์ : Continuous Learning Process in New Product Development in the Thai Food Industry

ชื่อวารสารที่ตีพิมพ์ : British Food Journal

NEW PRODUCT DEVELOPMENT COMPETENCIES IN THE THAI FOOD INDUSTRY

INTRODUCTION

Food processing companies invest in R&D to ensure future success in the market. However, the companies developing and marketing new products often experience more failure than success. In the US, more than 10,000 new food products were developed in 1990, out of which 1300 of these products were considered "significant" (Gorman 1991). According to a 1995 Prepared Food's R&D Investment Survey, it showed astonishing result that as many as 13% of 736 surveyed US food companies reported that "none" of the company's gross sales in 1994 were invested into R&D. On average, US companies spend less than 4% of gross sales on R&D (Gorski 1994). Top ten lists of the favorite NPD efforts surveyed in the US food companies are reduced fat foods, nutritional database development, fat free products, new market line extensions, new food product concepts, reduced calorie diet foods, least cost ingredient reformulations, new food product categories, reduced cholesterol foods and all natural / no additive foods respectively (Gorski 1994). The failure rate of these significant products was high. On average, a company in the USA needs to introduce 13 new products into the market place to ensure one successful product. Moreover, 46 percent of all new product development costs go into products which fail (Power, et al. 1993). Surak (1996) suggested that more new products can succeed if food processors change the way they do NPD. Hollingsworth (1996) also mentioned that new product development strategies and ways of doing business should change to follow changes in market and technology.

Thailand's food companies are no exception to this need to improve NPD, as we have noted in the first chapter. To understand how NPD should be improved, it is important to see how R&D and NPD is generally managed world wide. Then we can see where Thailand fits in, and what it will need to do simply to come up to current standards of practice, or even to eventually move into the forefront in NPD. We begin this review by looking at the Asian and specifically the Thai context of R&D and the food industries, as far as this is known from the somewhat scant literature on Asia. This provides basic context within which further discussion of R&D and NPD must be considered.

Asian and Thai Context of Food Processing R&D

In more developed regions, food processing companies must invest in R&D to remain competitive in the marketplace. However, R&D intensity is quite low in Thailand across all industries. The total R&D expenditure in Thailand accounted for only 0.11 percent of GDP (208 million US\$) in 1996. By comparison, Japan committed about 3.66 percent of GDP (153,181 million US\$) in 1996 or 2.8 percent of GDP even 10 years ago (in 1988). Korea committed approximately 3.06 percent (13,522 million US\$), and allocated 0.5 percent of GDP 15 years ago when it was at a similar stage of development to Thailand now. Taiwan lag Korea slightly, but still committed 1.78 percent (5,048 million US\$), or 1.8 percent of GDP 10 years ago (in 1988) (World competitiveness report online 1999; Chantramanklasri 1994 and 1997). Thailand's very low R&D intensity does not tell the complete story. R&D in food processing in Thailand is a very small part of total R&D spending. Agriculture R&D accounted for 19 percent of all R&D in 1991, and most of this was for primary food crops research, not food processing (AIT 1996).

Even if R&D spending in Thailand increases, several problems need to be addressed to make R&D more effective. Public sector R&D results are poorly communicated to the private sector, so most R&D results are never commercialized (Chantramanklasri 1997). Most of public sector research is quite vague, too general, and not commercially viable (interview with TDRI, 1997). Since Thailand have a limited R&D resources and most of the R&D are in development work rather than research work so commercialization of public sector's research plays a role. Moreover, private sector needs are also poorly communicated to public sector R&D institutions. (TDRI 1989; Bhumiratana et al 1992).

The link between individual company and public sector research is important in leading Asian countries. For example, in Korea, the Korea Food Research Institute (KFRI) is a non-profit organization. Its main task is to carry out basic and applied research for the benefit of farmers and fishermen through the development and transfer of technologies in the processing, storage, and marketing of agriculture and fishery food products. Another task is to help the food companies to introduce new processing methods and provide information about the latest technological developments. KFRI's accomplishment are substantial and the institute has been playing an important role in Korean food companies. The institute has contributed to advances in processing equipment and in manufacturing practices by utilizing the latest equipment and facilities. It has also established a new pilot plant to produce processing products for market testing (Tech Monitor 1994).

KFRI conducts joint research with the food companies and universities to improve research efficiency and application of the research results as requested by public organizations or private corporations. The institute assists national agencies in laying down national standard for food products, and establishing a Korean

Standard for food products. Projects such as the development of new products, improving new processes or products, better utilization of raw materials, product assessment, and by-product utilization, have been carried out successfully under KFRI sponsorship, with close relations between the institute and the food companies. The institute maintains strong ties with international research organizations in many countries, through research collaboration, and exchange of information and personnel. KFRI has played a major role in the UNDP Regional Network Program for the small scale food companies, continuously offering food technology and information service in the form of short term training courses for trainees from developing countries in Asia (Tech Monitor 1994).

In Taiwan, the food companies have complained about the lack of coordination at various levels between R&D institutions and the manufacturing sector, as well as inadequate focus on research developments. In response to these complaints, the Industrial Development Bureau (IDB) recently set up a technology committee on "Food Products and Biotechnology." This committee is to conduct programs on improving current techniques in food processing, introducing high technology, strengthening and consolidating research and management of food safety. It is also supposed to set up an applied research institute and formalize circulation of food product news. The areas identified for food R&D are aseptic food processing and packaging, automation of traditional food manufacturing processes, product safety and nutrition, cold storage and freezing techniques, development of ingredient flavor and additive, establishment of food standards and the use of biotechnology in processing. (Asia Pacific Food Industry 1993).

The Taiwan government plans to encourage specific research in institutions on problems identified by private sector. The results will be transferred to the latter

for application. Government plans to extend grants to the private sector to undertake independent research. Government has made provisions for R&D spending growth rate of 30 percent per year. It is expected to achieve two goals which are, encouraging private sector spending on R&D and building links between industries and research institutes, resulting in lower cost and risk in R&D investments. Large companies such as President, Weichuan, Taishui and Chou Chin have responded positively to the government's plans and have set up research centers (Asia Pacific Food Industry 1993).

Thailand's Relative Standing in Food Products R&D

In terms of R&D intensity and public / private linkages, Thailand's food companies do not look very much like that in more developed Asian countries. Husin (1995) has suggested broad guidelines for where appropriate R&D activities in small and medium scale food companies in Asia can be executed. These include:

- R&D technology / processes which are not too capital intensive.
- Establishment of scientific methods for production, especially for traditional foods.
- R&D to develop new products to diversify the product range, e.g. convenience food, health food and minimally processed food.
- R&D on use of alternative or new raw materials for established products.
- R&D to improve shelf life of products by proper processing, emphasis on hygiene and sanitation, and reducing the usage of preservatives.
- R&D on proper storage of raw materials and products.
- R&D to improve packaging.
- R&D in graphic design to improve product presentation.
- R&D on use of by-products for the food companies.

- R&D on waste management.
- R&D to improve quality of products.

Most of his recommendations seem to be oriented more toward relatively underdeveloped Asian countries, which need basic upgrading of their food industries. Japan, Korea, or Taiwan, where food companies are highly competitive regionally and internationally, already do such R&D, but it is not the focus of their efforts, since their industries are already well developed. Many elements are also appropriate for larger companies, and, in fact, most large companies in leading Asian countries already do some R&D on these things. Again, these are basic issues, and leading companies would not make them the focus of their efforts.

In the case of Thailand, the food companies are moving away from traditional Asian norms, though it is not as advanced yet as in Japan, Korea, or Taiwan. R&D for small scale primary food products, such as traditional food products or the uses of custom process (e.g. drying or fermentation) are of relatively less commercial value than other countries. These food products only serve the primary customer needs such as shelf life extension and hygiene. Nowadays, Thai consumers and international customers which many Thai companies supply are becoming more sophisticated and have broader choices. They will not buy food that is only edible and safe, but it should offer unique benefit and suit their preferences in taste, feeling (product and package), and service (FAO 1992). As mentioned, Thailand seems to be in a transitional stage; the food companies are growing up fast, but R&D in the food companies has not caught up.

This is confirmed in a 1989 survey by TDRI on the Thai biotechnology industry, which includes the food processing sector. The final report showed that innovation capability of the food sector was significantly poorer than its

technological capability, and much lower than in industrialized countries. The absence of R&D activities in the private sector and weak science and technology infrastructure were cited as the main reasons. Failure to integrate commercial considerations into research agendas was specifically cited as the reason when compared to industrialized countries (TDRI 1989; Bhumiratana et al 1992; Chantramanklasri 1997).

Weak commitment to R&D by the private sector is partly due to booming demand during the past two decades, which caused an emphasis on capacity expansion and utilization rather than on innovation. It is also partly because of a lack of awareness of the importance of R&D and the lack of fiscal incentives (UNIDO 1992). Also, the private sector usually depends completely on foreign technology without much R&D for assimilating, learning, or adapting such technology. The reason for this may be because the companies are partially protected from competition, and focus only on the local market. There is not much pressure to build technological capability (Chantramanklasri 1997).

Both public and private sectors realize, in principle, the importance of technology to improve the quality of processed food products which may boost the country's competitive edge in export markets. TDRI has suggested that Thailand should study a country like Japan, where the government supports consumer research in leading markets. This has led to the concept of a "National Food Institute" to provide training and knowledge to food companies both on technical and marketing issues, and to be a coordinating body within the food companies and public sector (Chantramanklasri 1997).

However, despite awareness of the importance of R&D, few local food companies have separate R&D budgets and staff. Most of the local companies

often believe that small firms cannot benefit from R&D, since it is too expensive and they lack skilled personnel. They prefer to buy technology and know-how in the form of machines, franchising, licensing, joint venture, or acquisition. They have even failed to build their own competency in the search process for appropriate technology, and rely on consultants even to acquire technology.

Internal Linkages and Interfaces in Food NPD.

Strong internal communication is also a key issue in the success or failure of NPD. The integration of R&D and marketing activity is a necessary condition for success in innovation projects. Moenaert, et al. (1995) studied the importance of the communication between R&D and marketing and concluded that success rates in NPD were higher when the innovation team reduced uncertainty about user needs, technology, competition, and required resources. Knowledge within the NPD team about these things was related to the interfunctional transfer of information between R&D and marketing. For example, the cross functional group in Spangler Candy Company consists of the technical service manager and marketing manager which found that the communication between these groups is extremely important.

Poor communication can lead to costly mistakes and loss of time. In the food companies, observers note that technical people must often educate the marketing people. Marketing must know about latest technical regulations, recent advances in technology applications, the latest packaging information such as new concepts, materials and designs, and new ingredient and formulation concepts, as well as any technical feedback from the customer. It also needs information when there is a problem with the product or in the plant. Marketing can interface directly with the

production manager so that a project can be completed satisfactorily without misunderstanding (Taylor & Hurley 1993).

These same observers note, on the other hand, that marketing should also provide substantial amounts of information. This includes keeping the technical people informed on new products / concepts, about product progress and success, or lack of success, and the broad range of customer needs. Communication and information flow in both directions is necessary for NPD to function efficiently.

Collaboration in Food Industry NPD

Strong external linkages are also critical, and can extend to formal collaboration. If they do their own R&D, companies with access to R&D on a global scale would likely be more competitive, because it provides a much larger knowledge base. Such access may come within the company, as in the case of MNCs. But it can also come through collaboration with others, and even MNCs with global R&D may collaborate. Another broad reason for collaboration is that some forms can allow intermediate forms between simply buying technology embodied in products, and developing new products completely with own R&D. A final reason is simply corporate cost cutting. Limited resources and shortened product cycles put great pressure on R&D. In the food companies, the challenge is increasingly met through the relationships between food companies and their suppliers. Food companies tend to invest less in basic and exploratory research, and thus rely more on suppliers through alliances. Advantages to going outside for development are cost effectiveness, and increasingly, project speed.

Supplier alliances: From the food processor's viewpoint, moving more of the research activities to suppliers can save both money and time. The research is

done by specialists who have expertise, product knowledge, ideas, and commitment. Some large MNCs select vendor with suitable R&D capabilities and cost structure. They share an open, participatory relationship with suppliers. The suppliers do the basic technology such as developing new packaging or raw materials and new processing equipment. Suppliers may be brought in from the beginning of NPD, sharing in market research and formulation development. In MNCs, closer linkage with their suppliers is of utmost interest. The companies open up information to suppliers to accelerate project timetables and enhance the chance of project success (Hollingsworth 1995).

From the suppliers' point of view, there are many possible alliances, from R&D cooperation on specific ingredients specified by the food processor customer to full scale cooperation in development of the whole product. For suppliers, advantages of such alliances are that they clear and specific knowledge of what the customer wants to achieve in the market place, and can work much more effectively to help deliver it (Mannion 1996).

Many food producers rely more on suppliers for specific ingredient knowledge related to the formation of their product rather than doing their own R&D on all ingredients. Major food suppliers in USA spend 6-7 percent of revenues on R&D, which is double the food company average. But the main obstacle of such alliances is concern among many customers over the customer's confidentiality. Long term contact to built up strong relationships, together with good information, communication, and management of the collaboration can help eliminate these obstacles, but this ideal is not always achieved (Mannion 1996).

Although supplier alliances are a relatively new issue in the food companies worldwide, this is a very promising strategy that may change the way of R&D is done

in food industries. In Thailand, some MNCs, such as Unilever, try to apply this concept using the supply chain management to help upgrading or educating their suppliers. However, Thai companies have a tradition of strong business secrecy. Strong competition and fear that competitors will gain access to information, especially about new product development, is likely to inhibit widespread adoption of collaborative R&D with suppliers in the near term.

Corporate alliances: Corporate alliances in R&D in the food processing industry are less practiced than strategic alliances in other areas, such as marketing (Ku Khang 1993). But some food companies still use this strategy to maintain their leadership in product development. For example, in 1995, Nabisco and ConAgra announced a joint venture. Nabisco was to develop a new line of cookies, crackers and snacks under ConAgra's Healthy Choice brand (Hollingsworth 1994, 1996).

In Thailand, corporate alliances in the food companies are mainly marketing alliances (Ku Khang 1993). The purposes are beneficial access to economies of scale, distribution channels, or market activities such as advertising and promotion. The success of such alliances depend on the strength of personal relationships, realization of some business benefit between the companies, and influence on the strategic alliance from the parent companies. Some examples of such alliances in Thailand include: Unilever and Osodsapa allied with Sermasuk, the joint venture of Pepsi Cola in Thailand, in order to use their strong distribution channels in soft drinks to distribute Lipton Ice Tea and the sport drink "Marathon" respectively. Wander Co., the producer of Ovaltine, launched Ovaltine UHT in alliance with Foremost to produce and distribute their products. Ovaltine UHT is considered Ovaltine's brand, but Foremost gains get advantage from the production and distribution fees, and also has access to Wander's sales data (Kaedee 1993).

Government research institutes: With downsizing and mergers, most food company R&D centers are not doing their own basic research. Most food science and food technology academic research programs have been doing more applied than basic research. This means that truly new ideas and technologies are probably not being developed, since without funding from either the public sector or industry, the research will not be done (Labuza 1994). This lack of much basic research should leave opportunities for universities and government research laboratories to collaborate with private companies for basic and eventually applied research. In Thailand, though, public sector research institutes have problems and constraints related to technology, management, and government policy (Kampempool 1988). Although research has been done in these institutes, only a little quality research actually reaches implementation and makes significant impact in society (Bhumiratana et. al 1992).

For strengthening R&D collaboration between public institutions and industry in Thailand, companies must be encouraged to demand research services. Universities and research institutes must be encouraged to pursue more industry-related research. Transfer agencies, such as an agency concerned with the design of the industry relevant research programs and the commercialization of research results should play a key role to overcome some of these barriers. For example, the Chula Unisearch of Chulalongkorn University provides some of these functions, though it is not highly active in them (UNIDO 1992).

Regional cooperation: In 1990, the Asian Small Scale Food Industry Network (ASFIN) was initiated by FAO. This project aims at a technical information exchange system connecting five countries: Indonesia, Malaysia, Philippines, Thailand and Korea. In Korea, the Korea Food Research Institute (KFRI) has

gained much credit for fostering the remarkable growth of Korea's food processing industry. Therefore, it was selected as the leading institute of the network. The objective of this project is to answer the needs Asian food industries and promote technology transfer through cooperation and complementary efforts among the national food research institutes in the region. Net work was strengthened through a data base system between member countries and by publication of research results, while KFRI provides expert and facilities (Kim 1995).

Another example of a project in which Thailand participates is the cooperation between the Korea Advanced Institute of Science and Technology (KAIST) and the Thailand Institute of Scientific and Technological Research (TISTR). This aimed to promote development of science and technology between two countries, including in the food companies. During 1982-1988, three projects about low cost extrusion cooking systems were undertaken with satisfactory research results. KAIST agreed to give a license for the system to TISTR, and TISTR was to sub-license to a local private company (Moleeratanond 1988).

Role of Consultants: In the US, with the uncertainty of the economic situation in the early 1990s, many companies embraced. The R&D department was one area that typically had to endure cost cutting measures, and many companies cut full time researchers and research support staff to reduce labor costs. In addition, the increase in some sorts of food regulation, such as the nutritional labeling act, made some types of research mandatory. Food companies responded by greatly increasing their use of outside consultants. They viewed hiring specialist consultants to work on a project basis as much more efficient (Mattson 1993). Such consultants are brought in on very specific topics. In developed countries, multiple

party alliances such as food processor, supplier, and consultant are becoming a common practice.

According to my and my colleagues experiences as consultants with the food industries in Thailand, the role of consultants in R&D in the Thai food companies is not very extensive. When they are used, is usually on the basis of personal contacts between individual high-level managers and the consultant. Such consultants are not usually professional consultants, but rather university or government laboratory staff, who work on consulting projects on a part time basis.

This brief summary of collaboration in food companies R&D indicates that collaboration of all sorts is probably more common and more effective in developed countries than in Thailand. Collaboration with suppliers or other companies is hindered by traditional strong concerns about business secrecy. Thailand's research institutes do participate in international projects, which would give them access to the global state of knowledge. However, research institutes do not usually have very good linkage with the food companies. Research institute personnel do most of what consulting there is, which does bring some of the knowledge accumulated there to industry. However, consulting takes place on an ad hoc basis, rather than being strongly developed with a business mission to make such knowledge available to industry clients. Given all this, we would expect that food R&D in Thai companies somewhat lags that in more developed countries.

Current research suggests that one very important component for successful organization of NPD includes continuous learning and strong information flow, internally and from external sources. Thus, one indication of whether a company is stronger or weaker in NPD would be information transfer to NPD teams. Thailand

provides a good example, where the local food processing industry is strong and should be capable of competing in NPD if it organizes NPD well.

CONTINUOUS LEARNING PROCESS IN NPD

We focus here on analyzing NPD in the context of information flow and learning. According to many observers, new product development should be a continuous process, oriented toward the long term, i.e., it is a strategic issue (e.g., Hughes & Chafin 1996; Caffyn 1997). Platform strategies incorporate strategic aspects of a continuous learning process. Rather than focusing on specific new products, a company would focus on a “platform”, which is an area of NPD interest. The continuous work within the platform area provides a broad knowledge base that can quickly be applied to specific products (Muffato 1999).

Continuous learning fosters NPD, and has sometimes been considered one of the key strategic factors necessary for NPD success. According to Poolton & Barclay (1998), “well-planned corporate strategy provides the building blocks for innovation, so that past knowledge provides the basis for new and emerging strengths”. Continuous learning enables the NPD team to learn from success and mistakes in the past, and such information should be retained and contribute to the next cycle of NPD. Moreover, continuously generating ideas keeps the organization close to the needs of the market. It is cost efficient and can speed up the NPD process (e.g., Perls 1996; Caffyn 1997).

On the other hand, discontinuous learning, or a start-stop NPD process, creates many problems. One hidden cost is lost time to get the NPD team up to speed when the process is started anew from the beginning. Loss of current ready-to-go ideas is also a possibility. In order to remain on schedule, the NPD team may

pursue the idea nearest at hand, rather than good ideas which may have come up in previous cycles but were forgotten. If NPD teams do not incorporate prior learning well, the same mistakes may be repeated as in the previous cycle (Perls 1996).

NPD also fosters continuous improvement and learning. Assessment of NPD projects itself leads to learning, which can further lead to dissemination of improvements in the whole organization if patterns are identified which contribute to success (Bartezzaghi et al. 1997). In other words, continuous learning and NPD can be mutually reinforcing. These issues are particularly important for products with short life cycle. It is difficult to follow a methodical step by step NPD process because short product life and rapidly changing consumer needs quickly render products obsolete (Hughes & Chafin 1996).

Strong internal linkages are one component of continuous learning NPD, because they facilitate the flows of knowledge upon which continuous learning depends (Bartezzaghi, Corso & Verganti 1997). Successful NPD requires knowledge sharing across a very broad knowledge base, and barriers to information flow have a negative effect (Purser, Pasmore & Tenkasi 1992). For example, communication between marketing and R&D helps the NPD team reduce uncertainty about user needs, technology, competition (Moenaert et.al. 1995). It is well established that integrating consumer research (such as surveys and sensory evaluation) into food NPD enhances the chances for successful new product introduction (e.g., Bogue, et.al. 1999).

In the Asian context, Song, Montoya-Weiss & Schmidt (1997) demonstrate that strong marketing input improves new product performance in Korean and Taiwanese firms. But they do not discuss how strongly these firms attempt to integrate marketing into NPD. Some research indicates that such internal linkages

may be somewhat less strong in East Asia (at least among the Japanese companies in the study) than in North America or Europe (Khan & McDonough 1997). If so, this could put Asian companies at a disadvantage.

Although there is considerable variation among Thai food processing companies, overall they seem to be somewhat behind the Thai operations of their multinational competitors in organization of NPD. Usually, Thai companies follow some variation of the “stage-gate” system, passing the new product along a series of stages which are not well integrated. Thai companies are somewhat less likely than MNCs to develop truly innovative food products, and focus more on line extensions (Suwannaporn & Speece 1998; see, e.g., Cooper 1993 for stage-gate NPD). According to Lynn et. al. (1998), this would be expected, because the stage-gate process inhibits continuous learning.

Our study will focus on accumulated process learning and information feedback loops among the key functions which contribute to NPD success. We follow the literature in taking integration as an important factor in continuous learning and NPD, and specifically include R&D, marketing / sales, and manufacturing in the research. We also look at information flow from key external parties, especially customers and suppliers. Although current models of NPD discuss process stages and integration of information across functions, they often do not look very carefully at information flow and feedback loops in the flows.

METHODOLOGY

Since very little has been done previously on NPD in the food industry in Thailand, we relied on in-depth interviewing to thoroughly understand the NPD

process. Preliminary pilot work and interviews took place in four companies and in the Ministry of Industry. We also talked to officials and researchers in the government sponsored Thailand Development Research Institute (TDRI), which is currently setting up a food industry R&D center and has strong ties to agribusiness in Thailand. These sources all stressed that almost all private sector food products R&D in Thailand takes place in medium to large companies. They all also suggested that NPD management did not differ much by specific product categories. It does, however, differ by the length of the food product's life cycle, level of newness (new product line vs. addition / modification of existing products), and on the nature of the business and customers.

Aggregate industry figures on company size by sales revenue are not easily available, but classification by assets (exclusive of land value) are published, and would be roughly similar. In 1999, there were just over 14,100 food processing companies in Thailand. Just under three percent of these were classified as large companies, over Baht 100 million in assets (about US\$ 2.6 million at 1999 rates). Almost 14 percent were mid-sized, between Baht 10 to 100 million, and the remaining 84 percent were classified as small companies. We made no attempt was made to include small companies in the study. For the main study, ten Thai companies and five multinational companies were included in the sample.

Many of the Thai companies have joint ventures with foreign companies, but not in the divisions interviewed. The JVs form a small part of the overall business, and have little interaction with most other divisions. Two of the MNCs interviewed were also JVs. In these cases, the foreign partner had management control over NPD, manufacturing, and marketing, and the main role of the Thai partner was to give access through distribution channels. Some companies manufacture branded

packaged food products which are retailed to consumers; some make branded products for food service and catering customers; and some manufacture unbranded products according to specifications for OEM customers.

A summary of the companies is noted in Table 1. The largest Thai company had sales of around Baht 18.6 billion in 1996 (approx. US\$ 730 million at 1996 rates). The largest foreign company had sales in Thailand of about US\$ 643 million. Eight companies among both Thai companies and MNCs had sales over one billion Baht, which is considered large. (The government categorizes even though it does not publish aggregate statistics.) The rest were mid-sized. Our sample, then, represents the top 17 percent of companies, but companies in these categories do almost all of the real private sector R&D in Thailand.

Within each company, we mainly talked to R&D managers, marketing managers, manufacturing managers, but also sometimes the CEO or other top management. For comparison (mainly to take advantage of unexpected very easy access) we also included interviews with two major Taiwan food processing companies. They turned out to fit very much within the range of organization of NPD found in local Thai companies, so we rarely mention them specifically in further discussion below. Interviews with managers and with government and TDRI people were usually over two hours, with additional follow-up to clarify issues as we learned more about NPD in the industry. In addition, we had access to many corporate documents on NPD process within the company.

Table 1: Summary of Companies Participating In Study

Firm	Share Holders*	Annual Sales* (in Thailand, 1996)	Main Products
MNC1	Swiss 100%	16,408,280,000 B	Coffee, coffee creamer, dairy, ice cream, beverages, breakfast cereal, infant food, culinary products, chocolate & confectionery
MNC2	Dutch 100%	11,791,683,000 B	Culinary, frozen foods, ice cream, tea and yellow fats
MNC3	Singapore 90 % Swiss 10%	2,830,861,000 B	Health food
MNC4	Thai 51% American 49%	**1,600,000,000 B	Snack food (potato chip, corn chip etc.)
MNC5	Thai 52% Japanese 48%	712,281,000 B	Biscuit, confectionery
Thai1	Thai 100%	18,560,548,000 B	Farming, slaughtering, frozen poultry, frozen processed poultry products
Thai2	Thai 100%	7,493,487,000 B	Frozen seafoods (mainly OEM manufacturer)
Thai3	Thai 100%	2,886,784,000 B	Instant noodles, rice noodle, vermicelli, porridge, bakery products, beverages, confectionery
Thai4	Thai 75.31% Singapore 14.83% British 7.10% American 2.76%	2,070,226,000 B	Tapioca flour, instant noodles, breakfast cereal, sweetener, mungbean based product
Thai5	Thai 100%	966,967,000 B	Bakery products, frozen Chinese snacks (dim sum), dumplings
Thai6	Thai 100%	931,439,000 B	Snack food, breakfast cereal
Thai7	Thai 100%	641,124,000 B	Confectionery, glucose syrup
Thai8	Thai 100%	no data	Snack foods, confectionery, biscuits, drinks
Thai9	Thai 100%	**189,790,000 B	Ice cream
Taiwan1	Taiwan 100%	no data	Flour mill, edible oil, bakery, beverages, canning, frozen vegetables, processed meat, food service and restaurant
Taiwan2	Taiwan 100%	**27,200,000,000 NT\$	Flour mill, edible oils, instant noodles, soy sauce & products, cereals, beverages, dairy products, desserts, health food, frozen foods, meat products, bakery products

Source : * ARGC, Thailand Company Information 1997-1998

** Company information from brochure, internet, personal interview etc.

RESULT AND DISCUSSION

Results show that accumulated process learning and information flows are very important for the success of NPD. Internally, R&D must have good linkages with marketing and manufacturing. As noted in the literature (e.g., Olson et. al, 1995), functional specialists bring accumulated knowledge to NPD projects, reduce difficulties and development time, and increase the options open to the NPD team. Externally, linkages with suppliers, customers, and technology sources must be good. Information flow among multiple R&D projects is also important. Otherwise, some things get developed more than once, or some innovations never get introduced in other areas where they may be popular. Poor information flow in any of these components can greatly reduce the effectiveness of NPD.

INTERNAL LINKAGES

Linkages across R&D projects: In the MNCs, local R&D, the regional R&D center, and R&D in the mother company usually had some sort of communication. Giant MNCs such as Unilever manage their innovation effort across countries, across product categories, and between functions. They want rapid communication and diffusion of successful innovations throughout the company, and strongly link innovation strategy to business strategy and improved efficiency in the innovation process. For example, one MNC has a regional R&D center in Thailand. It coordinates contact with R&D in the home country and among local R&D centers in Southeast Asia and the Pacific Rim. One of the Thai center's main functions is to provide information to NPD projects about NPD elsewhere in the company.

The Thai companies usually do not show this level of integration of information. For example, one major conglomerate has businesses in a very wide range of products in many countries, including chicken farming and processing, prawn farming and processing, sausages, dairy products, bakery products, and many frozen foods. However, the R&D groups in different businesses have never communicated or shared information, and there is no corporate policy on sharing such information. Often business groups even regard themselves as competitors, and would like to resist sharing information on R&D.

Linkages to multiple functions within R&D projects: The integration of R&D, marketing, and manufacturing activity is often critical for success in innovation projects. Usually this is related to organization of projects (Suwannaporn & Speece 1998). While most Thai food processing companies have NPD “teams”, the stage-gate nature of NPD activity often reduces any cross-functional information. NPD projects may start with consensus among team members, but then the NPD process becomes a series of independent activities. Marketing may give specifications, but then leaves R&D along to develop a prototype, which everyone views as R&D’s main responsibility. Marketing gets the prototype after it is done, and has to test market and later market the final product. Manufacturing comes in near the end of this, and has to convert the prototype into something which can be mass produced.

Such a process is very common in companies where top management or manufacturing lead NPD, but it even happens to some extent in companies with marketing-led NPD. For example, a leading Thai instant noodle manufacturer formally places R&D for new products under marketing. However, R&D came up with an instant rice product, developed a prototype, and then gave it to marketing without having had much input from marketing during the process. Marketing did

not quite know what to do with the instant rice, because, unlike instant noodles, instant rice has very little demand in Thailand. The project is on hold, as marketing waits to see if some competitor will launch first, to test the market.

In other words, we found that NPD in most local companies suffers from poor cross-functional communication, which can lead to costly mistakes and loss of time in getting new products to market quickly. These problems are somewhat less likely to occur in the MNCs, which try to incorporate new managerial practices into their NPD process. For example, some MNCs utilize a matrix organization for NPD project management, with an overall project team leader. Team members contribute throughout the NPD process, not sequentially on specific phases.

Some MNCs and also a few large Thai companies with more effective NPD organize by product groups corresponding to market segments. For example, one company has a “children’s ice cream” group, an “adults” group, and also a group devoted to “teens”. Because NPD is focused on specific types of customers, the group is forced to consider market demand even if marketing does not lead the project. Group members from different functions are usually assigned to participate in the group long term, but there is some rotation of personnel to keep new thinking coming into the group. Leadership depends on the nature of specific projects. For example, manufacturing would lead a project which included a major role for process innovation. R&D might lead a project which had to come up with a totally new product, and marketing might lead line extension projects.

Formal inclusion of key functional expertise is not always sufficient – team members must be involved in day-to-day operations to insure that information about actual practice feeds into NPD. Even well organized NPD can overlook this. For example, the project team for developing a new ice cream bar in one MNC included

members from R&D, marketing, and manufacturing. The manufacturing person specialized in ice cream production equipment, but did not work routinely on the production line. The team developed prototypes of new bars consisting of several colors, which could be produced with existing company technology. Once introduced, however, the production process encountered unexpectedly high wastage. Ingredients left over from one batch could not be recycled into the next batch because colors could not be mixed in recycling. NPD would have worked better with an information feedback loop directly from manufacturing, so that colors could be developed and a manufacturing sequence scheduled to avoid the problem.

EXTERNAL LINKAGES

Supplier linkages: Manufacturing is a key conduit through which accumulated knowledge about the external technology base comes into the NPD process. Worldwide, suppliers are increasingly becoming the source of technology and information about technology in the food processing industry. Supplier expertise in basic technology is one consideration when food companies select vendors. Suppliers play a major role in developing new packaging or raw materials, as well as processing equipment (Hollingsworth 1995). A great deal of R&D is imported into the food industry, embodied in processing and packaging equipment. In-house R&D is less necessary in such cases (Galizzi & Venturini 1996).

This is a common pattern in Thailand, where Thai food manufacturers are not a major source of technology innovation. Most innovation in process technology depends on expertise acquired from equipment suppliers, rather than direct R&D, and much product technology also actually comes from ingredient suppliers. This gives suppliers a role in NPD, especially if the result would require unique process

or product technology. It also limits the scope of NPD, because supplier technology is usually aimed at a broader market, not customized to a particular food industry's requirements. The scope is also further limited sometimes by widespread adherence to concepts of business secrecy. Many companies dislike any sharing of information about their own operations, even if well informed outside observers could easily figure out most of the information based on their own experience.

For some product categories, these trends limit competitiveness somewhat. Getting production or product technology directly from suppliers cannot give sustainable competitive advantage in much of the Thai food industry, because competitors could easily acquire similar technology if they wished to buy it. Where production or product technology is more complex, it may give advantage, because not all companies have the capabilities to implement it. In such cases, we found closer collaboration with suppliers, such as in extrusion technology for many snack foods, or nutritional science for health foods. This pattern was also present in MNCs, but with them, higher competence in the technology by the mother company often reduced the need to collaborate with suppliers.

The degree of collaboration also depends on management's concept of where competitive advantage comes from. OEM manufacturers especially, but also other companies who view their main advantage as efficient manufacturing, sometimes collaborate less, believing that process technology is the basis of their competitive advantage. Some companies also have proprietary technology in the form of product formulations / recipes, and they do not collaborate as readily on NPD. Companies which believe that their main strengths lie in marketing tend to be more open to collaboration, even though they still require substantial levels of trust before they will start working closely with suppliers.

The most successful R&D in Thai companies often plays an integrative role. It works well by combining externally obtained technology and innovations with manufacturing expertise and knowledge of market, resulting in new products which have potential in Thailand. Food manufacturers concentrate on very applied R&D for specific products. They rely on suppliers for basic research in the properties of various food ingredients, processing equipment for specific product requirements, or packaging materials and packaging process machines necessary for the new products. Competitive strategy depends on expertise in this integrative function, not innovation. Some food companies, usually MNCs, invest more in basic research so that they can compete not only with products, but also with proprietary technology. Some have expanded vertically to become food ingredient suppliers.

Consumer knowledge: In our interviews, R&D personnel often claimed that information was not transferred well from marketing to R&D. This was related to the inefficient NPD organization and information flow noted above. It led to poor product definition and caused R&D to develop prototypes which did not correspond to real market needs. Some food companies usually overlooked the importance of directly measuring consumer attitudes toward new products or concepts. They did sometimes measure response to objective attributes such as appearance, size, shape, or package, but rarely pursued more qualitative issues such as sensory evaluation or assessment of product personality.

Companies with stronger market positions and more effective NPD were more sophisticated at integrating marketing research into the NPD process, and paid more attention to such subjective measures, as well as measuring response to objective product attributes. As the NPD project develops a prototype, marketing conducts more research to determine response to an actual physical product, and

evaluates refinements of other product aspects. Marketing also estimates market potential, outlines a marketing plan, and forecasts sales. Figure 1 shows a simplified summary of marketing research's integration into NPD in many MNCs.

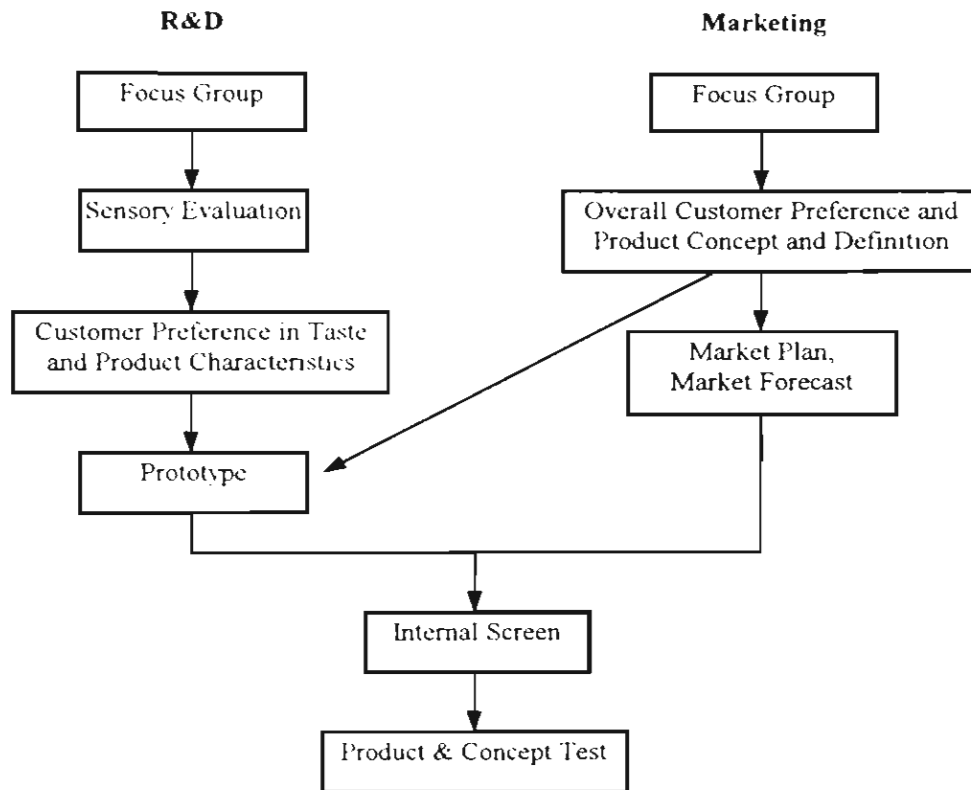


Figure 1 Customer interface for prototype development and market planning

A simple example of such integration can be seen in a snack food company which has accumulated substantial marketing research knowledge about potato chips. It routinely conducts sensory tests by using a series of focus groups in various age groups for sensory tests. R&D tests potential new product ideas, and records results for use also in future projects. This knowledge of flavor and taste profiles for various age groups helps reduce prototype development by eliminating unacceptable combinations. Different segments prefer different combinations of taste and form (ruffled, ridged, or flat chips). Using such data, NPD develops fewer prototypes which are unacceptable to the target segment.

Still, prototypes are tested by marketing to confirm that the target segment likes them, often through additional focus groups to explore product perceptions. MNCs are more likely to have in-house researchers to direct such research. The big Thai companies which do it are more likely to contract to local marketing research companies, but in either case, participants in the focus groups for both sensory tests and perceptual mapping are usually recruited from outside the company.

Another MNC cited a failure because it was not very careful to integrate consumer research into the NPD process. It had come up with a soy protein substitute-milk powder which was very sound nutritionally, and substantially cheaper than genuine milk powder. The target market was low income Thai mothers. However, the company neglected detailed marketing research on price perceptions related to products which the mothers would feed to their children. After introduction, it became apparent that, while low income mothers generally shopped for price when buying food for themselves, they wanted top quality for their babies. They did not believe the lower priced soy milk powder could be as good as more expensive genuine milk powder, and they did not buy it.

Besides R&D and marketing, sales (usually a separate division in most Thai food companies) should also give information concerning customer feedback (marketing channels more than consumers), market trends, and competitors activities. According to our survey, the sales function normally does not take part in the NPD process until the latest stage, by which time it is difficult to make any changes. However, sales personnel are close to channel members, and should be involved early in the NPD process, so that channel concerns are considered (Figure 2). This infrequent involvement of sales in NPD sometimes leads to problems,

especially in short life cycle food products such as fresh bakery products, many snack foods, confectionery and ice cream products.

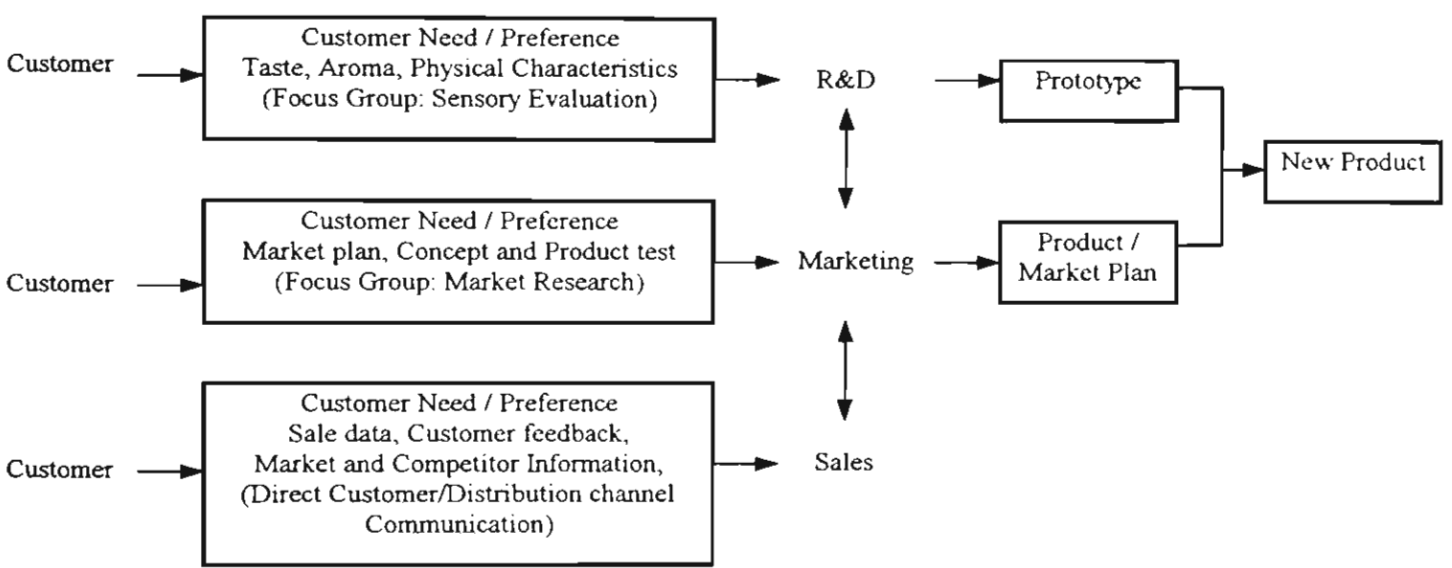


Figure 2 Customer information feed back for NPD process

For example, many Thai retailers dislike new food products which require special treatment such as refrigeration or heating. One confectionery manufacturer cited a new chocolate-coated biscuit product, which failed because it required refrigerated transport and refrigeration in the retail store. Retailers had little refrigerated space, and did not want to bump more standard refrigerated products to give this new one space. Wholesalers who normally carried refrigerated products rarely carried this product category, and wholesalers who carried the product category did not normally have refrigeration. Though consumers may have accepted the product, managing the distribution became a huge problem.

THE CONTINUOUS LEARNING PROCESS MODEL

From this look at NPD in Thailand's food processing industry, the need for continuous learning is evident. Companies which have mechanisms for learning and for information flow about what they learn have more effective NPD processes. When some vital piece of information from the market, distribution channels, or manufacturing fails to reach NPD for consideration, there are often problems. Once the problem is encountered and solved, or when information is gained which helps avoid the problem in the first place, such information must remain in the knowledge base for future NPD projects to build upon. From this analysis, we propose a model of how NPD should work.

Marketing must provide knowledge of what is happening in the market place. It should participate in developing and screening new product ideas / concepts, and it should be able to outline a marketing plan right at the beginning of the NPD process. R&D needs to know the potential market impact before it commits resources to the project. Manufacturing should also be involved early. While it might have somewhat less to contribute to development of product ideas / concepts, it should certainly begin to evaluate production feasibility as soon as there is a concept, rather than wait until after prototypes have been developed. R&D must be aware of the production line impact of whatever specifications and standards it proposes. R&D in food NPD becomes the integrator of accumulated customer (both consumers and channels) and technology knowledge (Figure 3).

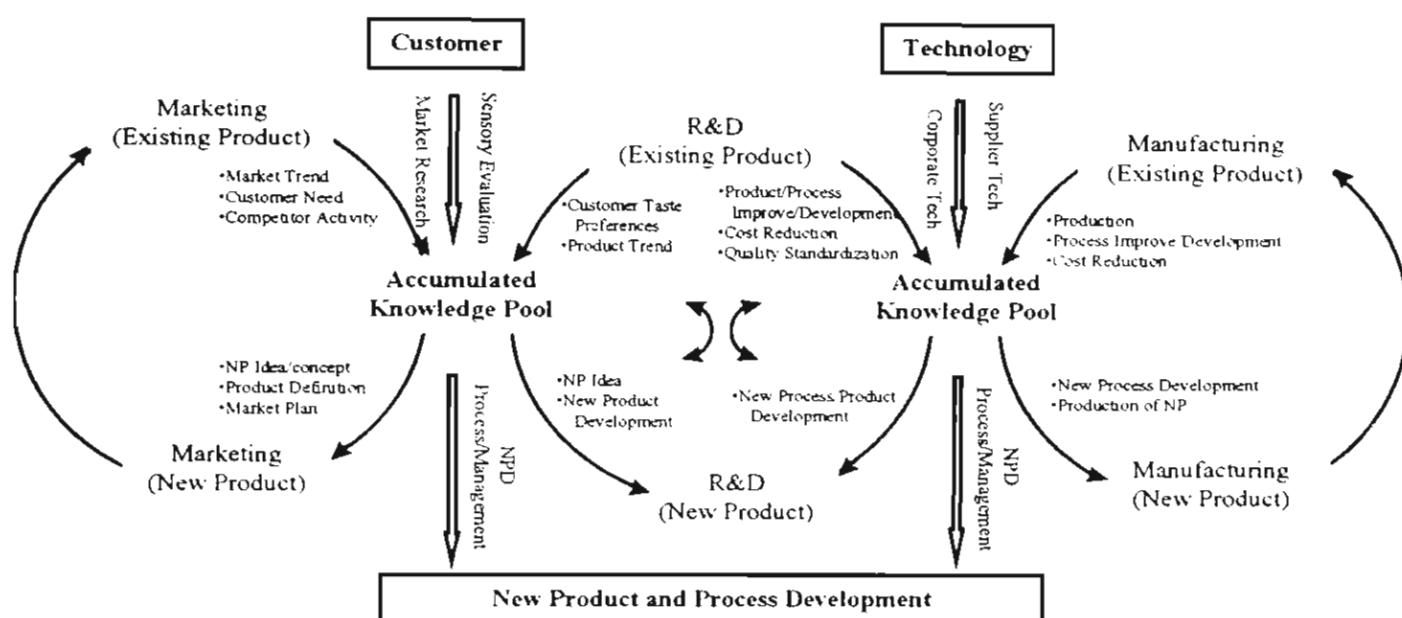


Figure 3 The continuous learning process model for NPD

Customer accumulated knowledge: Knowledge concerning customer needs and taste preferences can be obtained through marketing research and sensory evaluation. Information about markets, customers, and competitors can be compiled by market studies and experience (including that of the sales force) with existing products. Such information includes sales data, new product trends in Thailand and worldwide, preferences and changes in eating and shopping habits, and customer feedback. Marketing can use the pool of knowledge, together with project-specific market studies, create or evaluate new product ideas / concepts, define concepts in more detail, and develop preliminary marketing plans. R&D can use this knowledge pool and additional project-specific sensory tests to create new product ideas and develop prototypes. Accumulated knowledge can help NPD formulate new products which address real customer taste preferences, and help reduce the number of experimental formulations during prototype development.

Technology accumulated knowledge: Knowledge concerning technology and know-how in product and process innovation are related to recipe development, process and production technology, manufacturing know-how, skills and management. This accumulated knowledge is obtained mainly from suppliers, manufacturing's experience in existing products, business partnerships, and consultants. Local Thai R&D should work closely with other functions to evaluate appropriate technology being used for NPD, and should be able to evaluate new product entry strategies, such as licensing, franchising, joint venture, or acquisition. R&D's knowledge in product and process improvement, standardization, and cost reduction of existing products can be applied for future new product and process development. Manufacturing uses the knowledge and know-how in manufacturing technology and management of existing products for future process development and manufacturing in similar product lines where technology needs are similar.

The flow of customer and technology accumulated knowledge is like a loop moving from existing products to new products, and bringing in external knowledge. After launch, new products become existing products. They contribute to accumulated knowledge when their successes and failures are analyzed, and help guide the next NPD cycle. The loop from marketing passes through R&D, as does the loop from manufacturing. Not only does this ensure that the knowledge base in these two other functions contains R&D input, but R&D also plays a pivotal role in making sure that marketing and manufacturing share information. R&D, marketing, and manufacturing use the continuously growing knowledge pool via the NPD process to develop, manufacture, and commercialize more new products.

Table 2: Recommended Practices for Continuous Learning Process

Activities	Recommendation
Internal Linkage	• Key functions, especially R&D, marketing, and manufacturing should participate and provide resources and information concerning NPD. • Marketing and R&D should provide customer knowledge by using their experience and information obtained from market and consumer research. • R&D and manufacturing should provide technology knowledge by integrating their experience with corporate and vendor technology in product / process technology, quality standardization, manufacturing issues, and product / process improvement. • Gatekeeper should collect information about market and competitors' new products worldwide, together with samples and product trends. Information and samples are then distributed to each product group or subsidiary. • Frequent meetings and high degree of informal communication among project teams. • Product definition (product, concept, target, positioning) is clear to R&D, and market launch plan is precise according to survey market data.
External Linkage Customer interface	Apply two way customer interface (figure 1 and 2). • Marketing should use project based focus groups to obtain information about overall customer preferences, target customers, product definition, positioning, and market forecast. Sales reps should provide marketing with sales information and customer feedback, which are integrated into marketing plan. • R&D should use focus groups routinely in sensory evaluation to better understand customer preferences in taste and product characteristics, which can help in developing substantial new products and reduce the number of prototypes. • This two way information will be integrated together to develop product definition (product, market concept, target customer, positioning), market launch plan, advertising and promotion.