Table 2: Recommended Practices for Continuous Learning Process (cont.)

External Linkage Supplier interface for new product lines requiring unique product / process technology	• Search for and negotiate with reliable suppliers (process machines, packaging materials and machines, food ingredients, and raw materials). Collaborate with major suppliers and let suppliers' R&D work with company R&D on new projects for both product and process innovation. • Build trust, create negotiation power, and cooperate with a few major and reliable suppliers, especially those in emerging technology or specialty food ingredients in which suppliers have more expertise. For this type of new product, suppliers' technologists should be able to take part in the new product project team.
External Linkage Supplier interface for new product lines applying existing technology	• Build trust, and cooperate with a few major and reliable suppliers. Transfer some part of NPD activities to supplier to work on, especially those concerned with suppliers' specialties or basic research (e.g., flavor selection, improvement of product properties such as texture, stability, separation etc.). • Have suppliers' technologists take part in some product / process development (e.g., let suppliers' specialists come to demonstrate and show benefits on how to apply their technology to company's products).
Continuous learning process	• Should have clear corporate policy concerning sharing of knowledge about product, process, and market between mother company and subsidiaries or divisions, between R&D / marketing / manufacturing. • Each project team should communicate extensively and focus on the same or similar product lines in order to increase the efficiency of the accumulated learning process. • Company should continue to innovate new products and processes to adapt to its environment, especially customers and technology.

As the process continues, it helps develop expertise both in marketing and technology to enhance the success rate of the next NPD cycle. Moreover, continuous NPD activities can always keep the organization abreast with current market needs and changing technology and environment, which feeds into benefits for existing products also. Ability to draw upon the knowledge pool helps cut the

cost of NPD investigation and speeds up new product projects. Not only does the company become better at NPD for products which fit the market well and can be manufactured efficiently, it gets more efficient at being more competitive.

This, of course, is how NPD should work in the food processing industry. Our model does not say much about the mechanisms needed to achieve this continuous cycling and recycling of information. Our interviews in Thailand suggest that there are several effective ways to build parts of the model, and also that some ways of organizing NPD do not work. Table 2 offers a few guidelines based upon the Thai context. Certainly, further research is needed into practical ways to get information and keep it flowing. The marketing, R&D, and manufacturing functions must grapple with specific mechanisms to make continuous learning in NPD work. The model simply shows them what must be considered, companies must develop specific implementation to be effective for specific context.

CONCLUSION AND RECOMMENDATION

In order to run this learning process, companies must continue to develop new products and processes to adapt to changing customer requirements and technology. The model shows customer information circulating through and contributing to NPD knowledge. Synthesis of these two moves companies towards new products appropriate to target customers. Similarly, information about technology feeds into R&D and manufacturing, and cycles through NPD and existing products. Poorly managed NPD breaks the information flow and results in discontinuous or unreliable learning. Product, process, and market information is lost without many strong linkages to ensure the information flow.

Internal Linkage: NPD requires participation by many functional specialists, which creates interdependencies and a need for cooperation. Flow of accumulated knowledge, experience, and information from R&D, marketing and manufacturing play an important role in NPD. Accumulated knowledge of existing products and how they were developed can contribute to future NPD. Information transfer within the project team should be able to reduce uncertainty about user needs, technology, and required resources.

Linkages and information sharing among R&D subsidiaries are higher if they focus in similar product lines and corporate policy concerning interaction are clearly defined. Companies which excel in their ability to apply experience and know-how about the product, process, market, and management into similar new product lines gain strong competitive advantage. Companies with successful NPD should be able to define the linkage mechanisms which coordinate inter-functional interaction across the full spectrum of organizational activities. They should be able to design a management process to encourage linkage and information transfer within these functions. They should also continually seek to improve the efficiency and effectiveness of this process.

External Linkage: Key issues for new product success are that the organization should be customer focused, allow more customer involvement in the NPD process, and build customer links into the NPD process. R&D needs to use focus groups to identify a few potential prototypes which best address customer preferences. This helps cut development and marketing research costs. Marketing also uses focus group and other techniques that help structure product definition and guide market launch plan.

The external interface with suppliers is also important for new food products. In Thailand, the food industry itself is not a major source of technology, but is mainly only a technology user. Supplier technology plays major role in NPD, especially in cases where innovations require more advanced process or product technology. However, Thai companies should not rely completely on supplier technology, which was developed for a mass customer base, not an individual company's needs. Food companies should try to become somewhat more technology driven by investing more in R&D, using the continuous learning approach. Proprietary knowledge in product or process technology would allow them to extend their competitive advantages beyond marketing into technology.

This model of information flow for continuous learning in NPD was developed by analyzing what is happening in the food processing industry of Thailand. Nevertheless, most of the model is probably relevant to the industry in other countries, especially countries that rely heavily on technology transfer rather than own technology development. The model may need to be modified to account for development of truly new product or process technology. Then, the knowledge base of current technology will be somewhat less useful, and perhaps there would be a much larger role for a knowledge base about how to manage true innovation. But Thailand does not have a high level of "new-to-world" food product development.

Certainly, also, companies would need to learn how to implement the guidelines outlined here. Nevertheless, the model seems to give some useful guidance on thinking about information sources, information flows, and parts within the company and NPD teams which should be linked into the information network. If sources are left out, flows are broken at some point, or some critical element of the NPD team is left out, the continuous learning cycle breaks down, and NPD suffers.

Making sure all elements are accounted for, in whatever way works best for a specific company, helps upgrade the quality and efficiency of NPD, and makes the company more competitive in increasingly demanding food markets.

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Dear Dr Speece

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I am pleased to advise that your article will be published in the next issue of the British Food Journal. If in the meantime you have any queries please do not hesitate to contact us.

Thank you for your interest, and I hope you will consider the British Food Journal for publication of future articles.

Yours sincerely

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CONTINUOUS LEARNING PROCESS IN NEW PRODUCT DEVELOPMENT IN THE THAI FOOD PROCESSING INDUSTRY

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CONTINUOUS LEARNING PROCESS IN NEW PRODUCT DEVELOPMENT IN THE THAI FOOD PROCESSING INDUSTRY

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. 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).

INTRODUCTION

New product development (NPD) is a key issue to food processing companies of the developing world. The food industry in the modern world is characterized by rapidly changing consumer tastes (e.g., Sloan 1988; Tyler 1998). Addressing changing tastes with new products is essential in maintaining customer loyalty, so that good NPD becomes a key factor in competitiveness. Companies that do not keep up with market changes by offering new products will lose out. In particular, if the multinationals are stronger in NPD than local companies, this could give them an important edge in competition for the modern Asian consumer.

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. We investigate this in Thailand's food processing industry, where we compare NPD in local and multinational companies (MNCs). 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 (e.g., APFI 1994).

We did find that generally, MNCs organize NPD more effectively, but that some Thai companies do conduct NPD similarly to the MNCs. However, even among MNCs and well managed Thai companies, there were still problems integrating information. Some companies cited examples of new product failures that could have been avoided with more careful attention to information available from marketing or manufacturing. Thus, we propose a model to show how food companies can think about information flows for continuous learning in NPD.

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" (p. 202). 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.

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.

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 thorugh 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.

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).

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.

As the process continues, it helps develop expertise both in marketing and technology to enhance the success rate of the next NPD cycle. Moreover, continuous NPD activities can always keep the organization abreast with current market needs and changing technology and environment, which feeds into benefits for existing products also. Ability to draw upon the knowledge pool helps cut the cost of NPD investigation and speeds up new product projects. Not only does the company become better at NPD for products which fit the market well and can be manufactured efficiently, it gets more efficient at being more competitive.

This, of course, is how NPD should work in the food processing industry. Our model does not say much about the mechanisms needed to achieve this continuous cycling and recycling of information. Our interviews in Thailand suggest that there are several effective ways to build parts of the model, and also that some ways of organizing NPD do not work. Table 2 offers a few guidelines based upon the Thai context. Certainly, further research is needed into practical ways to get information and keep it flowing. The marketing, R&D, and manufacturing functions must grapple with specific mechanisms to make continuous learning in NPD work. The model simply shows them what must be considered, companies must develop specific implementation to be effective for specific context.

CONCLUSION

In order to run this learning process, companies must continue to develop new products and processes to adapt to changing customer requirements and technology. The model shows customer information circulating through and contributing to NPD knowledge. Synthesis of these two moves companies towards new products appropriate to target customers. Similarly, information about technology feeds into R&D and manufacturing, and cycles through NPD and existing products. Poorly managed NPD breaks the information flow and results in discontinuous or unreliable learning. Product, process, and market information is lost without many strong linkages to ensure the information flow.

Internal Linkage: NPD requires participation by many functional specialists, which creates interdependencies and a need for cooperation. Flow of accumulated knowledge, experience, and information from R&D, marketing and manufacturing play an important role in NPD. Accumulated knowledge of existing products and how they were developed can contribute to future NPD. Information transfer within the project team should be able to reduce uncertainty about user needs, technology, and required resources.

Linkages and information sharing among R&D subsidiaries are higher if they focus in similar product lines and corporate policy concerning interaction are clearly defined. Companies which excel in their ability to apply experience and know-how about the product, process, market, and management into similar new product lines gain strong competitive advantage. Companies with successful NPD should be able to define the linkage mechanisms which coordinate inter-functional interaction across the full spectrum of organizational activities. They should be able to design a management process to encourage linkage and information transfer within these

functions. They should also continually seek to improve the efficiency and effectiveness of this process.

External Linkage: Key issues for new product success are that the organization should be customer focused, allow more customer involvement in the NPD process, and build customer links into the NPD process. R&D needs to use focus groups to identify a few potential prototypes which best address customer preferences. This helps cut development and marketing research costs. Marketing also uses focus group and other techniques that help structure product definition and guide market launch plan.

The external interface with suppliers is also important for new food products. In Thailand, the food industry itself is not a major source of technology, but is mainly only a technology user. Supplier technology plays major role in NPD, especially in cases where innovations require more advanced process or product technology. However, Thai companies should not rely completely on supplier technology, which was developed for a mass customer base, not an individual company's needs. Food companies should try to become somewhat more technology driven by investing more in R&D, using the continuous learning approach. Proprietary knowledge in product or process technology would allow them to extend their competitive advantages beyond marketing into technology.

This model of information flow for continuous learning in NPD was developed by analyzing what is happening in the food processing industry of Thailand. Nevertheless, most of the model is probably relevant to the industry in other countries, especially countries that rely heavily on technology transfer rather than own technology development. The model may need to be modified to account for development of truly new product or process technology. Then, the knowledge base

of current technology will be somewhat less useful, and perhaps there would be a much larger role for a knowledge base about how to manage true innovation. But Thailand does not have a high level of "new-to-world" food product development.

Certainly, also, companies would need to learn how to implement the guidelines outlined here. Nevertheless, the model seems to give some useful guidance on thinking about information sources, information flows, and parts within the company and NPD teams which should be linked into the information network. If sources are left out, flows are broken at some point, or some critical element of the NPD team is left out, the continuous learning cycle breaks down, and NPD suffers. Making sure all elements are accounted for, in whatever way works best for a specific company, helps upgrade the quality and efficiency of NPD, and makes the company more competitive in increasingly demanding food markets.

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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.

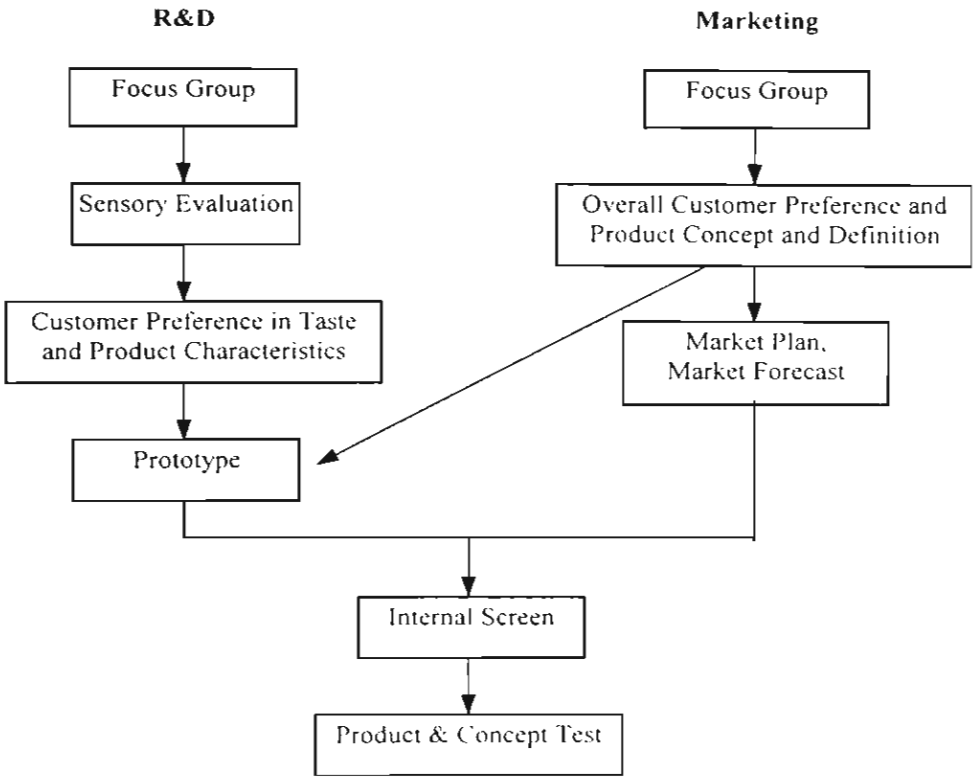

Figure 1 Customer interface for prototype development and market planning

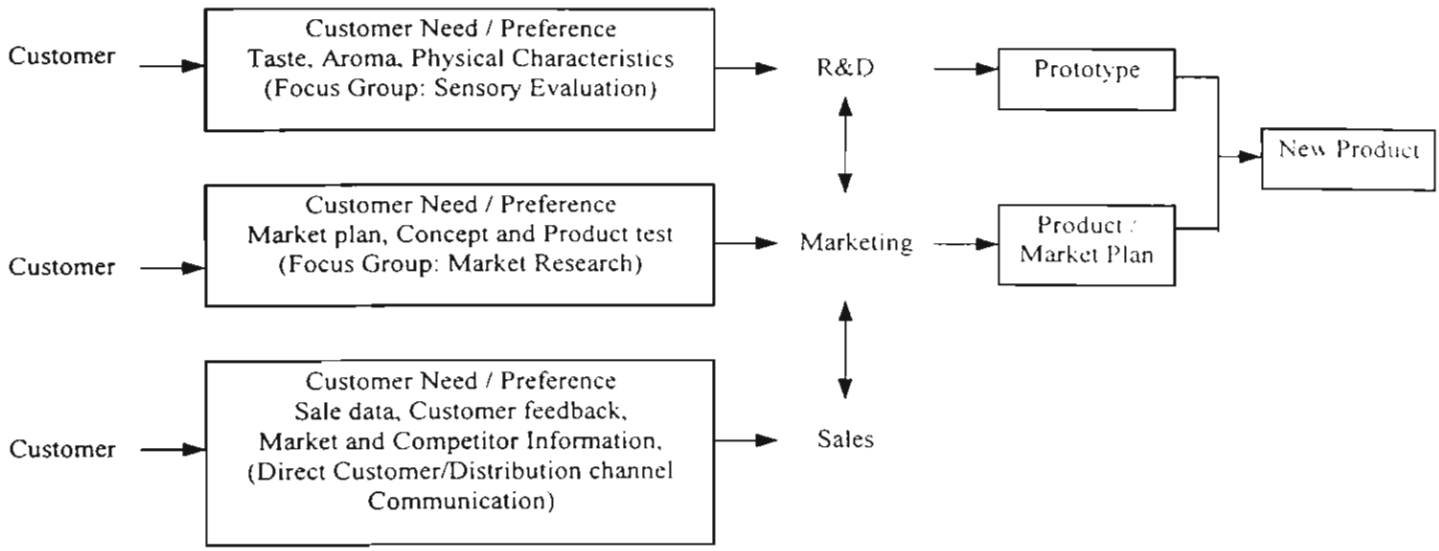

Figure 2 Customer information feed back for NPD process

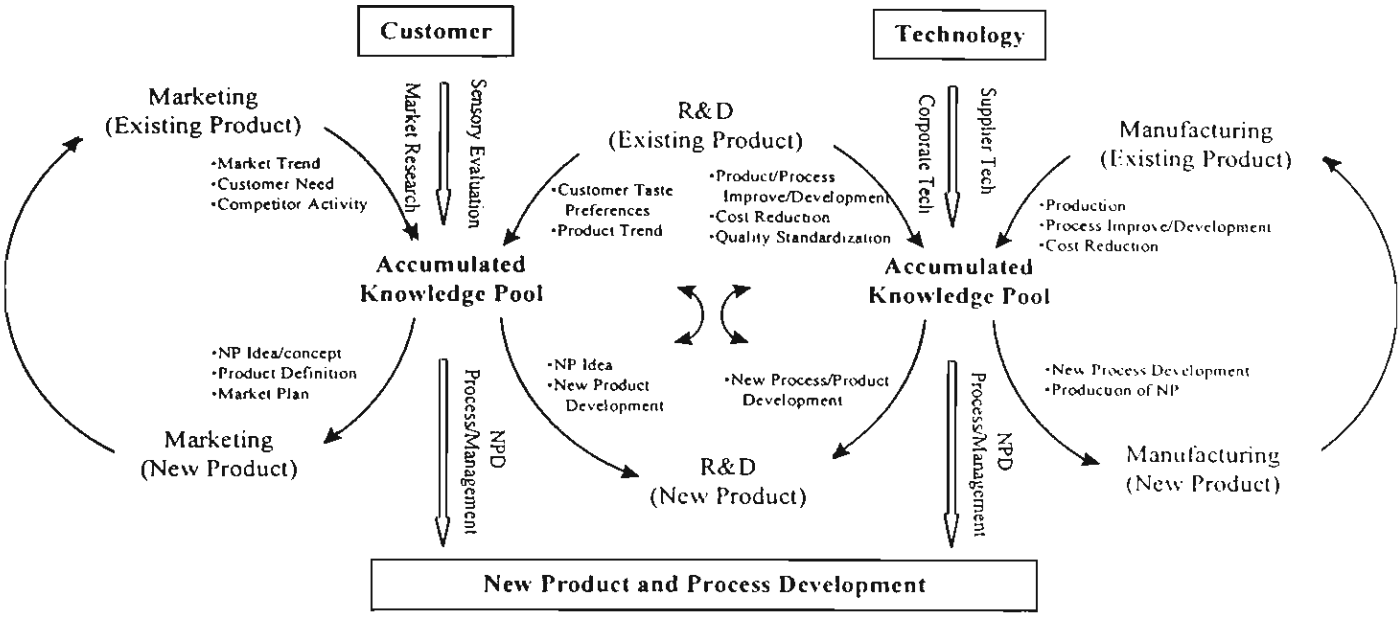

Figure 3 The continuous learning process model for NPD

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.

Table 2: Recommended Practices for Continuous Learning Process (cont.)

External Linkage Supplier interface for new product lines requiring unique product / process technology	• Search for and negotiate with reliable suppliers (process machines, packaging materials and machines, food ingredients, and raw materials). Collaborate with major suppliers and let suppliers' R&D work with company R&D on new projects for both product and process innovation. • Build trust, create negotiation power, and cooperate with a few major and reliable suppliers, especially those in emerging technology or specialty food ingredients in which suppliers have more expertise. For this type of new product, suppliers' technologists should be able to take part in the new product project team.
External Linkage Supplier interface for new product lines applying existing technology	• Build trust, and cooperate with a few major and reliable suppliers. Transfer some part of NPD activities to supplier to work on, especially those concerned with suppliers' specialties or basic research (e.g., flavor selection, improvement of product properties such as texture, stability, separation etc.). • Have suppliers' technologists take part in some product / process development (e.g., let suppliers' specialists come to demonstrate and show benefits on how to apply their technology to company's products).
Continuous learning process	• Should have clear corporate policy concerning sharing of knowledge about product, process, and market between mother company and subsidiaries or divisions, between R&D / marketing / manufacturing. • Each project team should communicate extensively and focus on the same or similar product lines in order to increase the efficiency of the accumulated learning process. • Company should continue to innovate new products and processes to adapt to its environment, especially customers and technology.