

An analysis of innovation management systems' characteristics

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Abstract

The purpose of this study is to establish an approach to analyze the characteristics of the product innovation management systems in companies. In order to clarify the characteristics of the innovation management system, structure and activities of management system should be analyzed. For this purpose the basic elements and their relation to the innovation management system are extracted and the basic model and items to be investigated are proposed. Investigations have been performed in Finnish companies according to the proposed model. The effectiveness of the proposed approach is discussed. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

The purpose of this study is to establish an approach to analyze the characteristics of the product innovation management systems in companies. In order to achieve a competitive advantage in the market the establishment of an effective product innovation management system is the most important management need for every manufacturing enterprise.

In general, innovation means results of an activity to produce something new or a different way of doing things. Today there are many different

kinds of innovations: product innovations, process innovations, technological innovations, market innovations, management innovations, system innovations, organizational innovations and financial innovations [1–4]. In this study we concentrate on product innovations. Many researches have clarified the difference between innovation and invention. Invention is an idea or a concept for a new or improved device, product, process or system [1,2]. Invention becomes innovation when it is practically implemented or used, fulfilling a certain goal [3]. Innovation is an economic implementation of an invention [2]. From a company's point of view product innovation comes about when a new or improved product is in the market and succeeds there well to fulfill the company's goal for it. One of the most important goals of a company for innovations is to produce competitive

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advantage in order to make it possible for the company to survive in future [4].

Product innovation management, which includes new product development, product improvement and R&D management, has its own characteristics according to the background of the enterprise, strategic policy, management organization, technology and product climate. Moreover, from the international viewpoint, the cultural and social environment, and the economic situation of the market and the country affect the product innovation management. In order to clarify the characteristics of the product innovation management systems in companies, their structure, activities and requirements should be analyzed. For this purpose the basic elements and their relation to the product innovation management system were extracted (Fig. 2) and the basic input–output model (Fig. 3) for product innovation management was proposed. Based on a basic model we determined items and questions to be investigated. The activities of the product innovation management, the product development process, technology management and influence of the strategy on the development process were the points mainly investigated.

As a result of this study, a new approach of investigation, questionnaire and interview items, were proposed on the basis of co-operation between Finnish and Japanese researchers. These tools were then applied in an investigation of Finnish companies. The effectiveness and problems of the developed approach were examined.

2. Previous studies on innovation management systems

Many researchers and companies have investigated innovation management systems from different points of view. Sneeep has studied innovation management from a theoretical perspective [3]. From the macrosystem point of view innovation management is classified into several hierarchical levels in Hübner's report [5]. The main company level functions were discussed in our earlier co-research report [6]. Knut Holt has clarified the product innovation process in his book [7]. The need assessment process has been analyzed based

on the fusion concept by Muramatsu et al. [8]. Von Hippel has highlighted the user as a source of innovation [9]. Kondo [10] and Kohno [11] discuss the role of new technology management from the strategic point of view and the function of strategic management in their Japanese book. Piippo and Tuominen [12] have studied strategy based selection of new product development projects to introduce innovations that are the most beneficial for a company.

In this study we examine product innovation management systems at the company level. According to Ichimura and Ishii [13] the purpose of product innovation management is the promotion of effective new product development and the timely improvement of current products in line with company policy. Based on studies mentioned in the chapter above, we can say that product innovation management system should take the customers' needs, competitive situation, company's objectives and strategies as well as technological possibilities together into account in a systematic way. This is discussed in more detail in Section 3. According to Sneeep, innovation management is an ability of people – who are involved in, for example creation or development of new products – to direct and control the factors that drive these processes, and the pattern through which these processes proceed [3].

Results of simultaneous comparative studies on innovation management and product development have recently been published. Takahiro Fujimoto [14] has compared product development in automobile industry between Japanese automakers and Western makers. This study emphasizes capability building and competition as drivers for the success of product development. Michael Song and Mark Parry have executed a cross-national comparative study of new product development processes between Japan and the United States. They built an extensive conceptual model based on marketing and management literature and tested the model using data from 788 Japanese and 612 American new product development projects. Song and Parry tried to find similarities and differences between new product development processes in Japanese and US firms. We have started and implemented our study independently and at the same time. In

the future it would be interesting to compare our approach and results with Song's and Parry's study. In our study we concentrate on electronics industry.

Many companies in Finland have issued their own particular process model for product innovation management or product development management. Fig. 1 shows the product development management model of Neste corporation (biggest petrochemical company in Finland) [15].

The mission, strategic intent, core competencies and business goals control the whole management process. The first actual phase of the management model of Neste is called product development management phase. In this phase, the goals for product development and appropriate measures are set. The output of this phase is competition strategies for new product projects. The commitment and involvement of all the persons who will participate in the development is essential for the success of the following steps.

In the next phase, customer groups and their needs and demands are clarified. It is also necessary to pay attention to environmental requirements, legislation and standards in this phase. Competition also plays a vital role in determining development needs and projects as results of this phase. The next, product and technology planning phase, carries out actual research and development projects as well as preparation for manufacturing and logistics. The last phase, market planning, introduction and follow-up take care of sales and marketing planning as well as launch decisions. Continuous systematic follow-up is important in order to be able to improve the products quickly and promote the whole development process.

In this research we compare the product innovation management models of companies in electronics industry in order to clarify the characteristics of their innovation management systems. Due to the confidentiality requirement of some

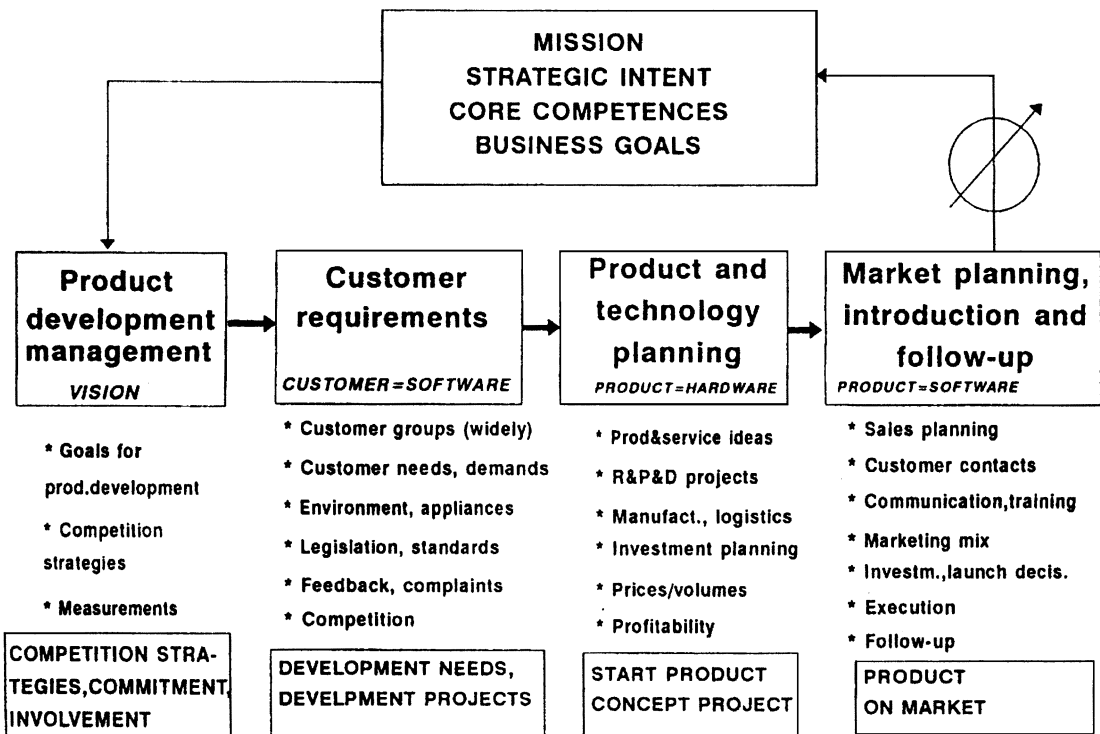


Fig. 1. Product development management model of Neste Corporation.

pieces of information we describe the companies interviewed in Finland as A, B and C. They all are from electronics industry.

3. Basic model of product innovation management

In order to be able to develop innovations a company must have an innovation management system that

- takes the customers' needs, the company's strategies as well as technological opportunities and the company's resources into account,
- determines the goals for the innovation process based on these factors and
- manages and controls the different phases of the innovation process based on these factors.

Fig. 2 shows our basic concept of product innovation management. It is based on the fusion model developed by Knut Holt [16], which Muramatsu et al. [17] as well as Ichimura et al. [6] have put forward. According to the fusion model, the innovation process could start after it has been found out that technological opportunities provide feasible solutions to fulfill customer needs or that there is a need for a technological solution. So the fusion of customer needs and technological opportunities are a prerequisite for the innovation process. Critical success factor studies of innovation management have revealed that it is necessary to pay close attention also to the company's goals and strategies. Thus also the fusion of the company's goals with the customers' needs and technological opportunities are prerequisites for the innovation process.

In our concept, there are three main directing forces in the innovation process: the company's managerial goals and strategies, the customers' needs and requirements and technological opportunities. The company's managerial goals and strategies are influenced by the background of the company, the economic situation of markets and countries as well as the social and cultural environment. Competition in the market has an impact on all the factors in our model. If the innovation management system of a company works well and directs the innovation process properly, the result

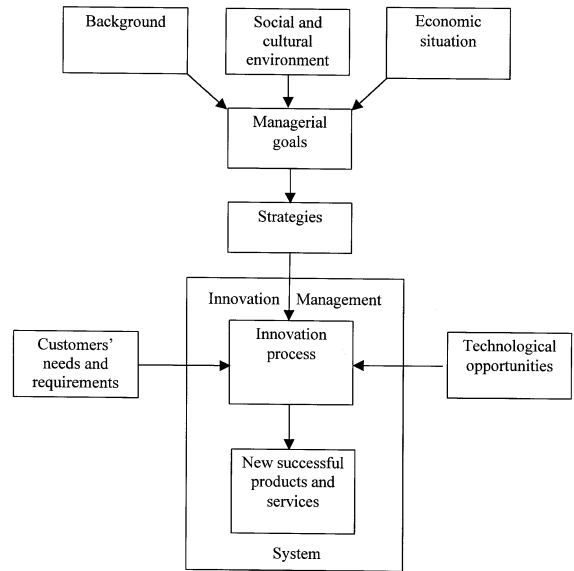


Fig. 2. Basic concept of product innovation management.

of the innovation process is a new successful product or a service.

The product innovation management system should ensure that all the driving forces of the innovation process are taken into account, the goals for innovation process based on these forces are set and the innovation process based on the set goals is managed. On the basis of the basic concept of product innovation management we have mapped and determined the required inputs and outputs of innovation management system. Fig. 3 illustrates the required inputs and outputs of the product innovation management system. In the figure the competitive situation is described individually because it is vital input for the product innovation management system.

In order to be able to manage the innovation process effectively, the innovation management system must be able to determine the right solutions for the outputs illustrated in Fig. 3. The innovation management system must determine the right products or characteristics to be developed and describe proper goals and levels for development. Timing is also a vital element of the product innovation management system. If the company develops products too early it might face financial

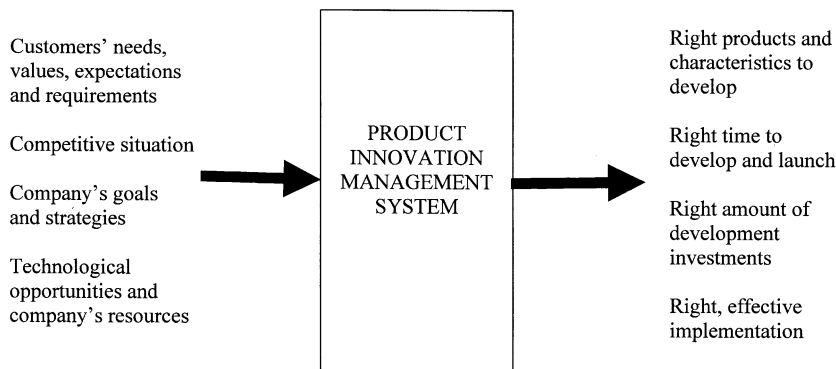


Fig. 3. Required inputs and outputs of successful product innovation management system.

problems. If it develops products too late it might stay behind its competitors. The right amount of development investments also has significant importance for the success of the innovation process. If a company invests too little for product development it is difficult for it to reach the development targets and be able to compete with its competitors. If a company invests too much it loses its cost competitiveness. The fourth important outcome is a proper, effective implementation of the innovation process in which all the above factors are taken into account.

The results of the innovation process are influenced by the quality of the determined outputs of innovation management systems in a multiplicative way. In order to get good results of the innovation process the quality of all the required outputs of the management system should be on a proper level. If one output of the management system is totally wrong ($= 0$) the company cannot get successful products or services from its innovation process, even if other outputs are correct.

The innovation process has traditionally been seen as a chain from basic research via applied research to development projects and new products [18]. The innovation process is not so straightforward in practice. Many processes have loops and some basic research results never become innovations. The fusion between opportunities produced by different phases of research and needs is a vital part to start and guide the innovation process. The innovation process adds the economic dimension

to the technical results [2]. Innovations therefore involve a series of interrelated scientific, technological, organizational, financial and commercial activities. Fig. 4 illustrates the product innovation process as an elemental phase model. This elemental innovation process does not try to illustrate how the real innovation process proceeds, but helps to check that proper management tasks have been taken care of in different phases of the product innovation process. Before the actual product design phase, strategic directioning and need assessment should be taken care of. In real life part of the steps of the elemental innovation process overlaps and there are some loops between the phases.

4. Outline for proposed interview questions

On the basis of the concept of innovation management (Fig. 2), the model of the product innovation management system (Fig. 3), the elemental product innovation process (Fig. 4) and earlier studies of product innovation management we established the items and questions to be investigated in our interviews in order to clarify the characteristics of innovation management systems in Finland and Japan. Table 1 shows the outline of questions for the interviews. The goal of these questions was to clarify the interviewees' practical working tasks and the flow of information in their organizations in an open and truthful manner. A detailed semistructured form for the interviews

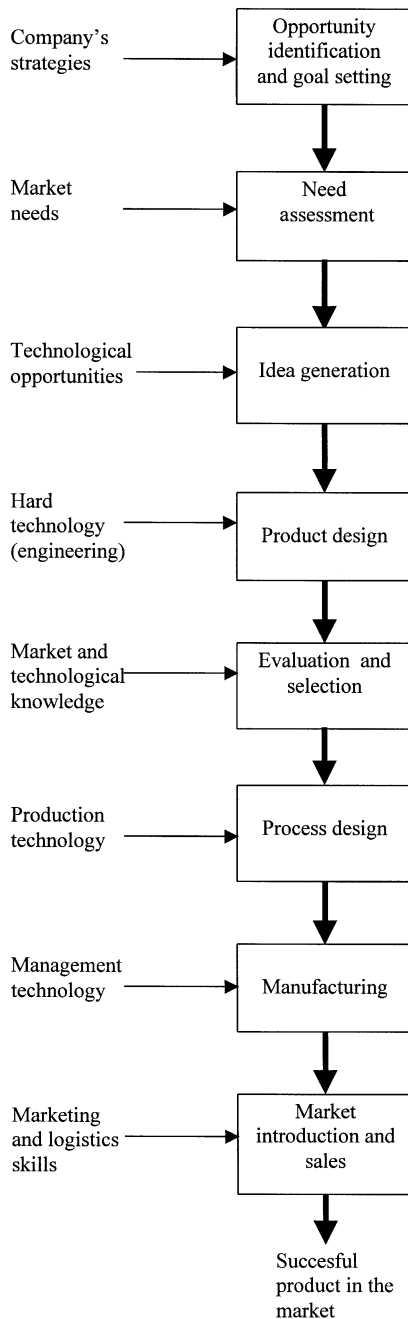


Fig. 4. Elemental innovation process.

was developed. With the help of the form same basic questions were asked from every interviewed person from every company but more detailed questions were asked based on the expertise of the

interviewed persons and the systems of the companies. The results of the interviews in the Finnish companies are described in Section 5.

5. The results of the investigation

The proposed interview tool was applied in three companies in Finland. We interviewed all the people from one company at the same time. Between two and four people from each company participated in the interviews. The interviewed people were senior R&D and business managers. The results of the interviews are summarized in Table 2.

Product development and international trade are critical success factors for all the interviewed companies. They have invested clearly more to R&D than average Finnish companies. Companies A and B are parts of bigger corporations. Companies A and C consider good customer knowledge as their core capability. Company B emphasizes technical capabilities. The descriptions of the fields in Table 2 from “strengths and core capability” row down to row “how to decide the amount to invest” are directly described based on the interviewed persons’ answers. Driving force of product development in company A is customer satisfaction and profitable growth in companies B and C. Fast development cycles have a great impact on product development in company B and founders values in company C. Selection of proper areas and best courses of direction to go are the biggest management problems for companies A and C.

All the interviewed companies have formal, systematically described models for product innovation management or product development. We analyzed these models based on the received written company documents and our interviews to clarify answers for the points “process model ...” down to “fusion of users’ needs and technology” in Table 2. These process models consist of phases with different tasks and checking or decision points. Company A has a process model, which includes four reviews. One review is for predevelopment and three of them are for product development and design. Company B divides the product creation process from R&D perspective into

Table 1
Outline of questions for interviews

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- (1) Personal tasks and role, in how one is connected to product development.
 - (2) Image/opinion of the product development, marketing, sales, strategic planning staffs' general capabilities, and ability to serve other departments and the customer.
 - (3) The critical success factors of the company in pursuing to serve the customers.
 - (4) The conditions for successful innovation activity in the company.
 - (5) The strengths, weakness, problems and development goals of R&D.
 - (6) The driving forces, factors, persons and systems that direct product development.
 - (7) The flowing of information when products are defined and developed.
 - (8) The links of product development to strategic planning.
 - (9) Goal setting for product development and the selection of R&D project.
 - (10) Assessment of a competitive situation.
 - (11) Assessment of customer needs for product development purposes: organization, habits and ways of action, systems.
 - (12) Measurement of R&D.
 - (13) The (computerized) systems that support product development.
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research, advanced development, and product development and post development. Product development management consists of one pre-development phase, a screening and business analysis phase and six development phases. Company C describes the product development process as a model that consists of four pre-development phases and six development phases.

Company A tries to promote the integration between goals of certain product development project and business strategies with the help of program agreement. Still, it has no formal steps for this purpose in its process model. Company B considers the integration in the first pre-phase of its model. Company C utilizes feasibility study for this purpose that is executed before the first actual development phase.

6. Conclusion

In our paper we propose an approach and questionnaire for comparative product innovation management research in order to clarify the characteristics of product innovation management systems in companies. Based on the basic concept of innovation management and a product innovation management system model we have formed an extensive list of points to be clarified. The concept and input–output model have helped us to form a thor-

ough list of questions that are essential when trying to clarify the problems of product innovation management and making it more effective.

With the help of the questionnaire we interviewed people in three Finnish companies and we are going to use the questionnaire for company interviews in Japan to complete our study. We received formal product innovation management models from every interviewed company. With the help of the models and the results of the interviews we can reveal some characteristics of the innovation management process of the interviewed companies individually. We will try to find a connection between the companies' process models and their approaches as well as their strengths and weaknesses. For this purpose it is necessary to make more individual interviews in the investigated companies.

In order to accomplish a good fusion between customer needs and technology there should be a clearly stated customer needs assessment phase or task as well as fusion task in the product innovation management process to determine clear requirements for the product to be developed. The integration of the goals of product development projects with business strategies should be explicitly and systematically taken care of in the very early phases of the innovation management process and there should be a formal phase for this in the product innovation management process. The

Table 2
Summary of the results of interviews executed in Finland

Company	A	B	C
Type of product	Industrial	Consumer durables	Industrial
Turnover of company 1995	USD 140 M	USD 4000 M	USD 100 M
Number of employees	950	10000	700
Share of international sales	99%	Over 90%	95%
Strengths and core capabilities	Understanding of customer process	Technical capabilities, open-mindedness	Skillful R&D personnel, good at customer relationship, deep customer knowledge
Success factors of product development	Understanding of customers' need – specialized company	Skillful R&D personnel, process structure of R&D, value based management	Technology leadership, best products, connections with end users
Driving forces of product development	Customer satisfaction – problem solving	Profitable growth, fast development cycles, management of complexity	Founder's values, profitable growth in company level, ambition in individual level
Most important features of the product	Human interface, user friendliness	High quality, design, easy to use, novelty, logistics	High quality and technical performance
Biggest problems in product development	Decide what to do and what areas to go to	Fast growth	How to decide best course, compatibility problems with different systems
Organization structure for development	Teams	Teams	Teams
Goal setting approaches and tools	Portfolio analysis	Budgeting, road mapping	Budgeting
How to decide the amount to invest	Based on available funds	Strategic opportunities, road mapping	Quite fixed amount based on earlier years
Process model for product development management	Phase model with 1 pre-development decision point and 3 development phase decision points	Phase model with 1 pre-development checking point and 6 development phase checking points	Phase model with 4 pre-development phases and checking points and 6 development phases and 10 milestones (under development)
Fusion of strategy	With program agreement, no formal steps in the process	In the first pre-phase of the model	With business feasibility study before first development phase checking point
Fusion of user's needs and technology	Market, technology and own know how analysis in the first phase	Parallel process	In the first specification phase
Approaches for needs assessment	Personnel discussion, customer panels	Market research methods, user studies	Personnel discussion
Approaches for competitive analysis	Together with development projects, no systematic tool for estimating competitive edge of new product	Systematical analysis for technology competitiveness	Together with development projects, no systematic tool for estimating competitive edge of new product
Proposal system	Formal proposal system	Invention proposal system, Patent system	Idea bank (under development)

goals of the projects should describe their role in the overall business and the wanted contribution for business strategies. In many cases, the wanted contribution is described only at the whole product development function level, not at the project level.

The interviews in Japanese companies, comparison of the cases and clarifying the individual and common characteristics remain tasks for future studies. Thus, a more general model will be proposed in the future.

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