Study on New Product Development:

Based on the Process Innovation of Organization

ETUDE DU DEVELOPPEMEMNT DE NOUVEAU PRODUIT :

BASÉE SUR LE PROCESSUS D'INNOVATION DE L'ORGANISATION

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Abstract: The global pressures of modern market are placing an ever-increasing emphasis on the rapid development and introduction of new products. In view of the importance of new product development to the survival and development of enterprises, this paper proposed how process innovation effects the new product development in organization by developing a theoretical model based on the mechanism discussion between them. Based on the methods of factor analysis, correlation analysis and data mining, using IMSS database, an empirical analysis has been done and the theoretical model is proved to be true. At last, this paper gives a case study by represents the research project on DaGang Company. A number of organization deficiencies in the new product development process are identified and proposals based on concurrent engineering subsequently are adopted which enhances the effectiveness of this process.
Key words: Concurrent engineering, New product -development, Organizational innovation, Process innovation

Résumé: La pression globale du marché moderne met l'accent de plus en plus sur le développement rapide et l'introduction de nouveaux produits. Etant donné l'importance du développement de nouveaux produits pour la survie et le développement des entreprises, l'article présent examine comment le processus d'innovation influe le développement de nouveau produit dans l'organisation en développant un modèle théorique basé sur le mécanisme de discussion entre eux. Basée sur les méthodes de l'analyse de facteurs, l'analyse de corrélation et l'extraction des données, en utilisant la banque de données IMSS, une analyse empirique a déja été effectuée et le modèle théorique est prouvé correct. Enfin, l'article donne une étude de cas qui réprésente le projet de recherche sur l'Entreprise DaGang. Bon nombre d'insuffisances d'organistion dans le processus du développement de nouveau produit sont identifiées et des propositions fondées sur l'ingénierie simultanée sont adoptées qui amélioreront l'efficacité de ce processus.
Mots-Clés: ingénierie simultanée, développement de nouveau produit, innovation organisationnelle, processus d'innovation

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1. INTRODUCTION

Increasingly fierce global competition coupled with customers' demand for higher-quality products and delivering in shorter times is forcing manufacturing organizations to adopt radical approaches to new product development. [3] The ability to reduce the time from product conception to introduction in the marketplace now is a prime source of competitive advantage. [4] Manufacturing organizations approach to new product development is a major obstacle to reducing leading times. New product development is not only the core competence but also the basic of survival and development to enterprise. [5] Generally speaking, an emergence of new product always freshen up the organization even the whole industry. [6] To face up the fast-changing of customers' demand and the shorter life cycle of product, almost all the organizations need attach a great importance to new product development.

A review of available literature shows that there is a large amount of information available describing practices for how new products should be introduced. Companies are therefore faced with a large amount of information highlighting principles that are supposed to help improve processes and increase the chance of introducing successful new products. [7] There is still, however, and imbalance between information specifying whether the process innovation could affect the new product development?[8] If so, what needs to be done and how to tackle the problems associated with implementing of process innovation? The practical implications of how to implement idealized new product development principles and incorporating them into an effective business process have therefore not been adequately addressed. This paper describes a reference model which helps address to answer the question and then providing the support organization to the process innovation by a case study.

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2. A THEORETICAL MODEL FOR PROCESS INNOVATION AND NEW PRODUCT DEVELOPMENT

2.1 Model building

Process innovation in organization addressed to the reform started out from customers' demand to the end of valuable product and service created by organization, [9] which includes activity, decision, information and material streams. [10]

2.1.1 Process innovation--- the ability of production technology

Highly expectations and demands are placed on the ability of production technology in process innovation which emphasized full use of information technology and the organic composition with labor (such as CAD and CAM), [11] redesigned the business process to settle the conflict between dispersal and concentration by information technology, to reform the process form serial into parallel, further to batch and share the information [10]. Above abilities provide a technical support for new product and assuring the successfully held of the research and development. It is also covers to a market opportunity in terms of its technical feasibility and matching of customer needs with technical capabilities.

2.1.2 Process innovation--- the ability of production organization

The ability of production organization is very important in process innovation which could increased the supervision and management of production and operation by using advanced, scientific and reasonable term of organizing methods such as swings manufacturing, process centralization and outsourcing. The scientific organization and management will set a fine platform for new product development. [12]

2.1.3 Process innovation--- the flatten of organization structure

An important function of process innovation is to simplify the organizational structure and to increase working efficiency through flattenning the structure of

[9] Joseph Ofori-dankwa, Scott D. Julian. (2001). Complexifying organization theory, illustrations using time research. Academy of management review, 3,415-430

[10] Lowenthall, Jefrey N. Reengineering the organization, A step-by-step approach to corporate revitalization. Quality progress, 2004, 5, 31-40

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[12] Randall L. England. (2002). From knowledge management to strategic competence, measuring technological and organizational Innovations. Journal of product innovation management , 1 ,105-106

organization by way of disposing the excess links and shearing the redundant employees.[13] The flat structure is convenience for organization to communicate with both the inside and outside environments, meanwhile, the proper delegate to employee will arouse the scientific research passions and further to set up an united corporate culture.

2.1.4 Process innovation--- the direction of customers

To satisfy the customer's demand, carrying on the new product development oriented to the market, keeping to attach importance to sale service and combining the market needs with performance of enterprises are the basic aim of the process innovation.[14] This section represents the triggering of the new product development and project initiation which associate new product development with corporate and business strategies. Procedures involve the analysis of the marketplace to ensure that a company responds effectively through the development strategic of new products.

2.1.5 Process innovation—the improvement of performances

The old terminal and the new jumping-off point of process innovation are the performance improvement, The indicators of performance were always consisted by fast research and development, cost reduction, higher flexibility etc, which cannot be separated from the ability of production technology, the ability of production organization and flatten organization structure.[15]

Based on the analysis above, a model, which is a simplified representation, is built and manipulated as this: the process innovation in an organization could improve the new product development, as graphically depicted in Fig.1.

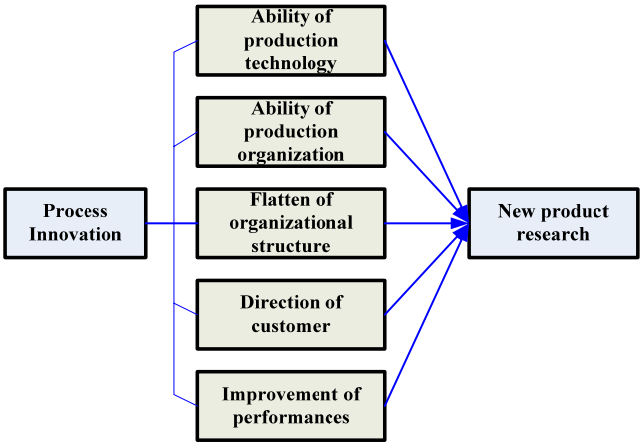

Fig.1 The theoretical model

2.2 Model verifying

2.2.1 The introduction of IMSS database

IMSS (International Manufacturing Strategy Survey) has sponsored by Chris Voss (Commerce College of London) and Per Lindberg (Chalmers University) in1992, this investigate holds every four years, this investigation holds every four years and it aimed at to study the various manufacturing strategic from different countries based on their special politics, economy and culture background. This questionnaire is consisted by four parts:

- ✧ Strategic, target and cost
- ✧ Current manufacture
- ✧ Manufacture activity
- ✧ Manufacture performance

IMSS investigation involves 474 manufacturing enterprises form 14 nations, and the distribution as shown in Tab.1.

Tab.1 The investigation distribution table

Country	Frequency	Percentage (%)
Argentina	14	2.95
Australia	40	8.44
Belgium	19	4.01
China	30	6.33
Denmark	38	8.02
Germany	32	6.75
Hungary	58	12.24
Italy	60	12.66
Ireland	32	6.75
Holland	14	2.95
Norway	51	10.76
Spain	20	4.22
Sweden	19	4.01
England	47	9.92
Total	474	100.00

[13] Elias Sanidas (2004). Technology, technical and organizational innovation---economic and societal growth. Technology in society, 1, 67-84

[14] Eric T.G. Wang (2006). Group cohesion in organizational innovation: An empirical examination of ERP implementation. Information and software technology, 4,235-244

[15] Alstyne Marshall Van (2006). The state of networking organization, A survey in three frame works. Journal of organization computing, 3, 12-14

The questionnaire is designed by the professors from internationally and are well-known in manufacturing strategy area and the professional knowledge they have could guarantee every problem scientifically, meanwhile, the questionnaire would be translated into different native languages by expertising in all investigate countries and the investigation always requests the tallest manager to fill the questionnaire, for only he could be familiar with the whole strategy of enterprise. In addition, most questions in questionnaire used five point methods, which guarantee the answer's scientificality and convenience for further statistical analysis, we checked every questionnaire to ensure the wrong data couldn't be involved in the next step on the research.

2.2.2 Factor analysis

As an important statistical analysis method, factor analysis is aimed to speculating on the internal relationships of many variabilities, by using of few imaginary variables to explain the basic database structure. This research will use factor analysis to extraction a few common factors which could representative most information indicators on the process innovation and the new product development from the IMSS database, which will set the foundation for the further correlation analysis.

2.2.2.1 Factor analysis of the process innovation

Eight indicators which respond to the process innovation have been selected from IMSS database, which are: flexibility manufacture systems, CAD, CAM, integrated manufacture systems, swings manufacturing, process centralization, outsourced, e-commerce, delegate to employee, data management systems, network, service, customer support, environment and healthy, cost, delivery speed, time of product faces market, advance time for product. The coefficiency of KMO is 0.685, it is shown that these eight indicators exists high relativity are suitable for factor analysis, and the factor analysis results are shown in Tab.2.

2.2.2.2 Factor analysis of the new product development

Three indicators were selected which respond to the new product development from IMSS database, which are: the ability of production technology, the ability of production organization, flatten organization structure, market-oriented strategy and improvement performances. The coefficient KMO is 0.752, it also shown that the three indicators exists high relativity and the factor analysis result are shown in Tab.3.

Tab.2 The result of process innovation factor analysis

Indicators	Component				
	Ability of production technology	Ability of production organization	Flat organization structure	Direction of customer	Performances
Flexibility manufacture systems	0.685				
CAD	0.578				
CAM	0.921				
integrated manufacture systems	0.651				
Swings manufacturing		0.558			
process centralization		0.772			
Outsourced		0.625			
E-commerce		0.338			
Delegate to employee			0.887		
Data management systems			0.620		
Network			0.528		
Service				0.951	
Customer support				0.652	
Environment and healthy				0.425	
Cost					0.854
Delivery speed					0.658
Time of product faces market					0.475
Advance time for product					0.654

Tab. 3 The result of New product development factor analysis

Indicators	Component
	New product development
Design quality	0.669
Manufacture quality	0659
Ability of New product development	0.886

2.2.3 Correlation analysis

The results of Pearson correlation analysis are:

1.The ability of production technology to New product development =0.652

2.The ability of production organization to New product development =0.352

3.Flatten organization structure to New product development =0.541

4.Market oriented strategy to New product development =0.771

5.Improvement performances to New product development=0.475

2.2.4 Analysis of the empirical research findings

Through the factor analysis this paper predigests the related indicators from twenty-one to six as: product research, the ability of production technology, the ability of research, flatten organization, market oriented strategy and improvement performances. Correlation analysis shown that process innovation has positively with the other five factors (as shown in Fig.2). It indicates the market-oriented strategy and the ability of production technology are of the most significance on new product research, and the effect of flatten organization structure, ability of production organization seems a little stronger than improvement performances, which means the theoretical model has been proved to be true.

3. A CASE STUDY OF PROCESS INNOVATION AND NEW PRODUCT DEVELOPMENT

3.1 The original process of new product development

3.1.1 The original developing process of DaGang Company

DaGang Company is a business engaged in the communication equipment, as Fig.3 shown: the whole process of new product development can be obviously categorized as many independent stages which have to be done step by step and the program couldn't start until its preorder task has been accomplished. Meanwhile the new product development process operated as a circulation, since the output which comes from the pre- stage bobbed up a problem along with it brings to the following stage, the imperfect product will amend to drop back to the former stage, if the problem couldn't be settled in this way, process will investigate all the stages which have experience previous, until the root of problem have been explored and get a perfectly solution.

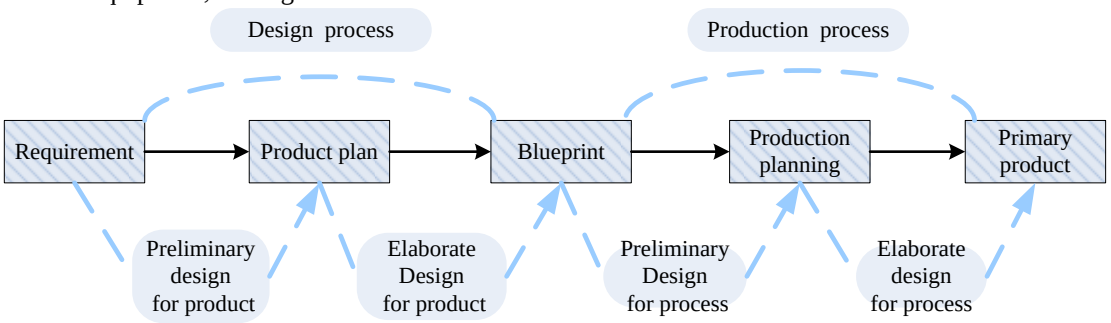

Fig.3 The original process of new product development

3.1.2 The defects of the developing process in DaGang Company

31.2.1 Long life cycle

The sequential engineering release system encompassed several functional departments, and each signed its approved of each engineering release. Both the design manager and each of the modification coordinators kept manual records of the state of each release. Therefore, the volume of changes, coupled with other duties, meant that an engineering releases took significantly longer than was necessary. This adversely affected product development cost and resulted in delayed introduction of a new product, possibly resulting in market share losing.

3.1.2.2 Conflicts among departments

Each department regarded its system requirements as paramount, with scant regard for other departments' needs, leave the requirements of priority alone to the company as the whole, and the production control department's goal was a production schedule that would result in efficient utilization of the manufacturing facilities, whereas the sales department's goal was to maximize order intake. Therefore, the sales department, under pressure to generate additional sales, sometimes would bypass documented procedures so as to secure orders.

3.1.2.3 The irregular produce

There was a problem of coordination and synchronization of the transmission of information from the various functional departments to the shop floor, and the terminology used to refer to a particular process or document was different in each department. When departments operate independent of each other, commonality of terms in not critical; but for systems encompassing the whole company, this anomaly leads to confusion.

3.1.2.4 High cost

To ensure the quantity of new product development, as set forth, the problem and mistake must be revolved feedback and amended to pre-stage which causes the high cost without doubt.

3.1.2.5 Low satisfaction

Because of the complicated and hierarchy of organization structure, the information and communication allover the company always severe shortage, after a multi-level report and approval, the market information which is collected by sales staff cannot be accurate, timely and reliable and be able to convey to the department of new product development.

3.1.2.6 The irresponsible staff

One department' staffs were largely unaware of the processes and procedures used in other departments and the general attitude was "just do my job, what happens after that is not my concern.

3.2 The process innovation to new product development based on the concurrent engineering

Concurrent engineering is an influential reform in the engineer and management fields today, which emphasis on co-operation and is aimed to reduce errors by the rationally distribution of resources in process.[16] To reform the process innovation of new product development, the following tactics can be adopted.

3.2.1 Setting up the organizational structure based on concurrent engineering

Concurrent engineering requires mechanisms for integrating the activities of the manufacturing organization. Bureaucracies provide a hierarchical structure, which acts as a good integrating mechanism while time is not a critical factor and the external environment is stable. This is because the degree of uncertainty of information is low and decisions can be made in advance of their execution. Thus, the number of conflicts that require passing up the hierarchy for resolution is low and within the processing capacity of the organization. As environmental uncertainty increases, so does the number of decisions referred up the hierarchy. Eventually, these decisions exceed the origination's ability to process them, leading to information overload.

The inter-departmental and multipurpose groups are the basic organizational structures for new product development in DaGang company, which consisted of staffs coming from various department including design, material, production etc.In this organization, almost all the constraint conditions during the process of research will be took into account and the communications will keep flowing, during the research of new product, the group consisting of eight to twelve staffs can be assigned to the small and simple task,[17] however, more concurrent groups will be start up to be responsible for the large and complex projects, meanwhile, a superior leading group can be built to coordinate these groups working co-operation.[18] Thereupon the organizational structure in DaGang Company can be described as three layers: superior leading group, middle tempo group, and bottom professional group, as depicted in Fig.4.

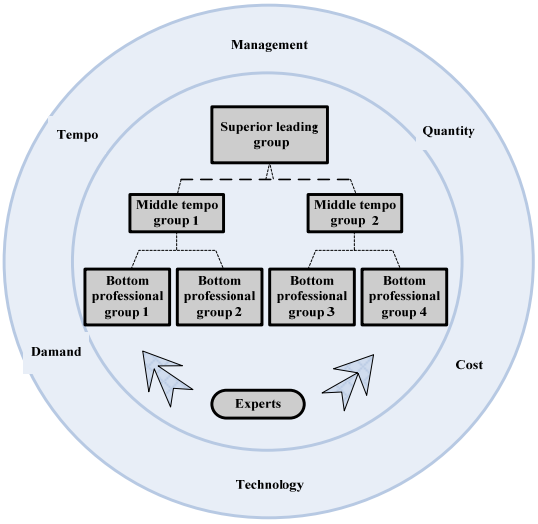

Fig.4 The organizational structure of concurrent engineering

[16] Chu, T. H,Lee C. H (1999). CIM Management in system manufacturing center, Concurrent engineering seminar, 5, 73-82.

[17] Liau, J. S., Young, R. E, O'Grady (2004). Combining process planning and concurrent engineering to support printed circuit board assembly, Computers engineering, 5, 615-629.

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3.2.2 Rebuild the process of new product development

In order to help tackle the problems of rapidly changing technology, increasing competition and changing customer needs, product development should be structured in an effective and manageable new product development process. This new process of product development based on concurrent engineering will try to escape from the separation of design and manufacture , avoiding the isolated procedures which follow one another with responsibility being passed on until a product is eventually produced and introduced into the marketplace, beginning with spans the entire development life cycle of a product and a market-triggered new product opportunity, achieving the realization of this opportunity through the design, manufacture, and introduction of a commercially successful new product into the marketplace. The new product development process incorporates many diverse elements including market analysis, concept design, detailed design, production, product distribution, and direct customer involvement. In order to be effective, this new process needs to mould all these aspects into a unified and efficient process, while carefully managing the risks involved in introducing technology-based innovation, products and processes.

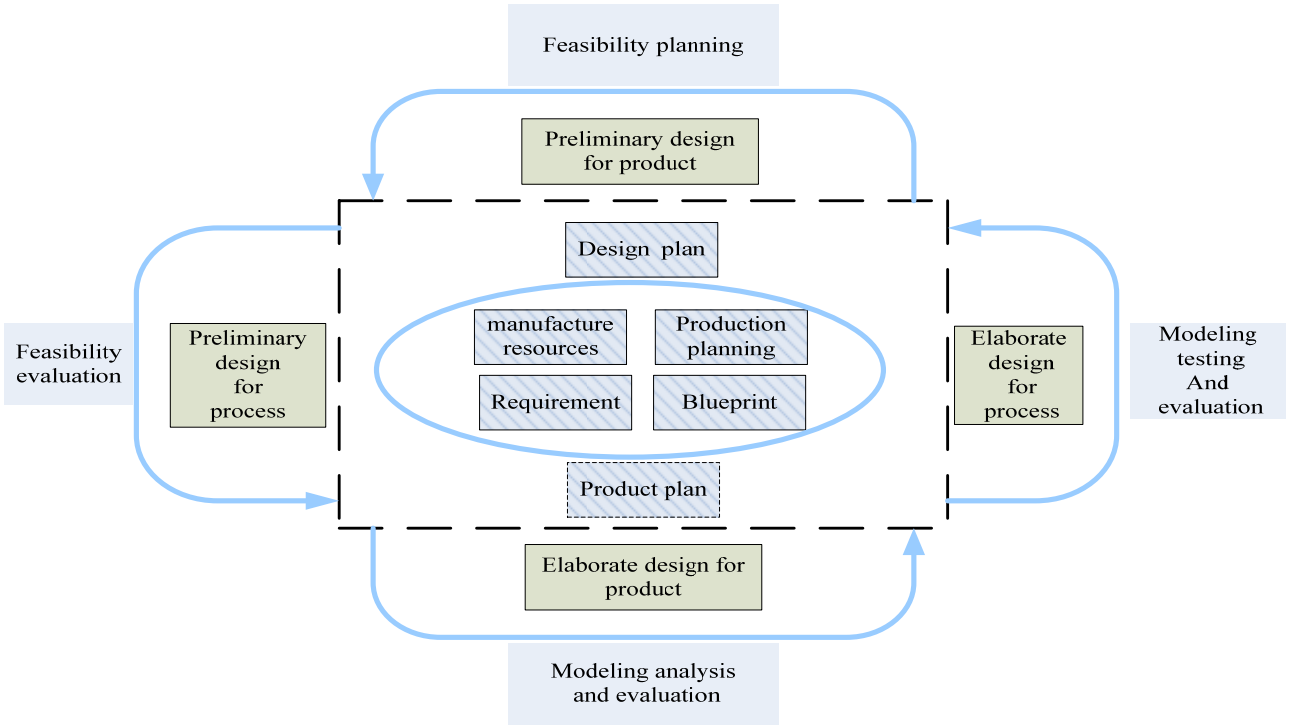

Fig.5 The concurrent engineering process of new product development

In view of the importantance of IT technology, a model setting system can be used to DaGang Company's new product development, expecting it will reduce the redundant and useless activities then concurrent the crucial links to increase the working efficiency,[19] and the following ones are the most important items to the process:

1st. How does the research and design affect on the process of new product development?[20] How to ensure the reliability of it?

2nd. How to arouse the creativity of staff into the process of decision-making?[21]

[19] Prasad, Biren (2006). Concurrent engineering fundamentals-integrated product and process organization, Prentice Hall, New Jersey, 5, 89-97.

[20] Prasad, B, (2004). Toward definition of a concurrent product design, development, and delivery system, Concurrent engineering, 5, 56-72.

[21] Tsuda, Y (2005). QFD models for concurrent engineering development processes of automobiles, Concurrent engineering: research and applications, 5, 89-95.

3rd. How to analysis the interior and exterior environments and help with the decision-making on new product development and development？

The new product development process based on the concurrent engineering can be shown as Fig.5.

4. CONCLUSION

On observing how the process innovation affects the new product development in organization with the mechanism discussion between them, this paper develops a theoretical model and verifies it by empirical analysis---process innovation could improve the new product development performance in organization. The result shows the key effective factors of process innovation are market-oriented strategy and ability of production technology. Based on it, this paper tries to discuss the whole process of new product development not only redesigning the process of operation but also, further to research the organizing method and the working pattern through a case study. With the reference model validated, further research can be undertaken to support to the process innovation applications in new product development.

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