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Abstract

Review of several important aspects of product innovation

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REVIEW OF SEVERAL IMPORTANT ASPECTS OF PRODUCT INNOVATION

PROJECT REPORT

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ABSTRACT

This report is mainly a literature review on several important aspects of product innovation: innovation sources, innovation process, innovation success factors, innovation strategies, innovation management, innovation speed, and innovativeness. To last aspect, some comments are added.

EXECUTIVE ABSTRACT

To compete successfully , firms must rapidly introduce new products and maintain a steady flow of innovation.

As one of the important sources of innovation, customer's needs continue receiving much attention. "Lead users" are proposed to be the focus center of marketing research for high technology new products. Combining user need or need pull source and technology push source is the coupling source model or dual-drive strategy. One scholar, Rothwell, called the technology push model, need pull model and coupling model as the first, second and third generation of innovation process. He also points out the fourth generation--integrated model involving simultaneously elements of R&D and prototype developed and manufacturing and so on. And, he predicted the fifth generation--the systems integration and networking model (SIN). Besides innovation sources and processes, innovative idea generation process is studied and some valuable points have been put forward.

Many factors leading to new products success have been identified. Among the frequently cited are product unique and superiority, top management support, good market knowledge and strategy , good communication and coordination, and so on.

Innovation strategy and innovation management are receiving

more and more attention. Many aspects that need to be considered during new product development have been listed out.

Innovativeness or degree of newness of new products was studied by another two scholars. They concluded that highly and low innovative products do well, but moderately innovative products fare poorly. There seem to be some points that need more study to make conclusion and many related aspects need to be considered .

Being fast innovator has emerged as an important factor for innovation. To compete successfully , firms must rapidly introduce new products. Many ways have been recommended to increase the speed to market.

CONTENTS

INNOVATION OF NEW PRODUCTS

A main requirement of surviving and growing firm is new product development or innovation [1]. Especially speaking, the success , future growth, and prosperity of many manufacturing firms depends on their ability to introduce new products [2]. To compete successfully, firms must rapidly introduce new products (new products lines or improvements to existing lines) and must maintain a steady flow of innovation [3,4].

The innovation here means industrial technological innovation which as a process includes: the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first use of a new (or improved) manufacturing process or equipment. Industrial innovation does not include only major (radical) but also minor (incremental) technological advances. And, the successful commercialization of technology involves considerably more than just technological change activities. That is, technological innovation can be accompanied by organization innovation, marketing innovation, production innovations, and commercial/marketing innovations [5].

INNOVATION SOURCES AND INNOVATION PROCESSES

I. Innovation sources

Literature has identified some sources of innovation. One study listed out eight potential sources of innovative opportunity[6]. They are:

customers,

population demographics,

industry and market structures,

incongruities,

process needs,

the unexpected,

new knowledge,

new technology.

1. Customer needs

Recently, researchers continue to emphasize the importance of the source of customers.

It is pointed out that accurate understanding of user need is essential for successful product innovation [7]. Not properly identifying consumer needs is a primary problem in the new product introduction process. Many innovations fail because the

relationship between the innovation and the consumer is ignored in the search for state-of-the-art technology. The solutions seem to lie in , besides innovative thinking and risk-taking, more targeted marketing and an ability to figure out what people truly want in a product [8]. Besides, firms should keep with consumer trends [10].

In a competitive marketplace where affluent buyers exercise exceptional levels of consumer choice , only the firm that seeks out customers, studies and analyzes their behavior, and molds every element of its marketing strategy to their wants can hope to succeed in the long term [1].

Firms that innovate effectively and consistently have a superior understanding of the needs of the user of the intended product and ascribe greater importance to sound functional marketing [1].

The key to successful new product development is sensitivity to the marketplace. The following consumer research techniques can help strengthen the flow of information from the customer to the firm:

1) Review marketplace trends, assessing the possible or probable impact and the timing associated with them.

2) Use qualitative research that can provide insight into users' needs, stimulate innovation, and expose customers to new technology and potential product applications.

3) Use problem detection to identify problems that consumers

have with current products and recognize opportunities for product innovations.

4) Examine , with structure studies. the benefits and product characteristics that consumers want,

5) Leverage brand heritage to overcome marker resistance [11].

2. Lead users

In the relatively slow-moving world of many consumer products,, new models rarely differ radically from their immediate predecessors. Therefore, even the "new " is reasonably familiar, and the typical user can thus play a valuable role in the development of new products. In contrast, in fast-moving fields such as high technology, the experience of ordinary users is often rendered obsolete by the time a product is developed or during its projected commercial lifetime. For such industries, von Hippel proposed that "lead users" are essential to accurate marketing research [12].

The term "lead users" refers to users whose current strong needs will become general in a marketplace months or years in the future. Since these users are familiar with conditions that lie in the future for most others , they can serve as a needs-forecasting laboratory for market research. They also can furnish new product concepts and design data. Lead users´ familiarity

with future conditions puts them in a position to provide accurate data on needs related to those conditions. Lead users can be incorporated into marketing research through a 4-step processes:

1) identify an important market of technical trend,

2) identify lead users who lead that trend in terms of experience and intensity of need,

3) obtain and analyze lead user need data,

4) test these data on ordinary users [12].

The lead user method for developing concepts for needed new products is built around the idea that the richest understanding of needed new products is held by a relatively small number of users. It is possible to identify the lead users and then draw them into a process of joint development of new product concepts with manufacturer personnel. In the application described in an article, the lead user method was found to be much faster than traditional ways of identifying promising new product concepts as well as less costly. It also was judged to provide better outcomes by the firm participating in the case [7].

Lead users are often better sources of new product ideas than manufacturers. To spur innovation, von Hippel advises companies to move beyond reliance on traditional research and encourage lead users to experiment with their products. For example, manufacturers should design product prototypes modularly to make it easy for customers to rearrange parts and discover new

uses [13].

3. Dual drive strategy

Traditional wisdom regarding new products says that a company should be either market-driven or technology-driven. While that approach worked fairly well in the past, people now want a market drive and a technology drive at the same time. In the dual-drive approach, every new product project, before it gets under way, has the dual direction of a specific market and a specific technology that will be employed to identify a solution to the problem [14].

A dual-drive strategy can help management resolve 5 major problems: 1. friction, 2. slowness, 3. high costs, 4. excessive involvement of upper managements, and 5. poor products. While dual drive is an easy concept to accept , it is difficult to implement because it is a totally new way of thinking about new products and requires the acceptance of important, unmet customer need before undertaking extensive research and development (R&D) . It requires a thorough study of the identified need. If the firm lacks the required technology, dual drive demands that it be acquired [14].

Besides technologies and customers, the firms should also pay attention to the environment and its implications for marketing, the trend in cost reductions in many companies, and ideas from departments other than marketing [10].

II. Innovation process

Rothwell [5] reviewed the process related to recognizing innovation sources as five models or generations of innovation process,. He traced developments in the dominant perceived model of industrial innovation from the simple linear 'technology push' and 'need pull' models of the 1960s and early 1970s, through the 'coupling model' of the late 1970s to early 1980s, to the 'integrated' model of today. He also wrote that recent developments indicated the possibilities attainable in the proposed 'strategic integration and networking ' model.

The first generation--technology push: simple linear sequential process, emphasis on R&D. The market was a receptacle for the fruits of R&D.

The second generation--need-pull model: simple linear sequential process, emphasis on marketing. The market was the source of ideas for directing R&D. R&D had a relative role.

The third generation--coupling model: sequential, but with feedback loops, push or pull or push/pull combinations, R&D /marketing interface. The adoption of the coupling model essentially reflected a catching up of theory with practice, i.e. the coupling model was a more realistic if still oversimplified, conceptualization of actual innovation processes in firms.

The fourth generation or integrated model marked a shift

from considering innovation as a predominantly sequential process, with developmental activity shifting from function to function (R&D to prototype development to manufacturing, etc.), to considering innovation as a parallel process involving simultaneously elements of R&D and prototype development and manufacturing and so on , emphasizing an integration across the R&D/manufacturing interface and on closer collaboration with suppliers and leading edge customers. This model represents a close approximation to actual global best practice to-day.

The fifth generation innovation process , the systems integration and networking model (SIN) , represents a somewhat idealized development of the integrated model but with added features. It represents a process of the electronification of innovation with an increased use of expert systems as a developmental aid. Simulation modelling partially replacing physical prototyping, linked supplier/user CAD systems as part of a process of co-development of new products , and closer electronic product design/manufacturing links.

Rothwell pointed out that not only is technology itself changing rapidly, but current indications are that the innovation process is changing also; it is becoming more efficient, faster and more flexible and it is using a new electronic toolkit.

III. Idea generation process

A ready supply of new ideas is essential to effective product development.

The effectiveness of a new product development program depends on the quality of ideas that are produced. However, in spite of its importance, many companies do not pay sufficient attention to the idea generation stage in their development programs. One factor that may have led to this situation is the fact that the topic of idea generation has not been featured in the marketing literature as much as the other stages in the development process. Not only have the techniques for idea generation been inadequately described, but few research studies have been attempted to evaluate the techniques. A comprehensive study of sources and techniques used to generate ideas for new products revealed that there appears to be a strong relationship between the number of techniques used by a company and the number of successful products developed by that company [16].

Psychologists have developed many ways to stimulate the creative flow of ideas. Several are useful for product development, including: 1. successive abstractions, 2. analogy, 3. wishful thinking. 4. nonlogical stimuli, 5. reversals, 6. role playing, 7. lists, and 8. input-output analysis [4].

A new computer-based method to generate ideas for new

products is characterized as an external brain. It utilizes public data banks such as Dialog to search for all publications that link a root idea and words such as idea, innovation , and novelty. Then, the contents of each publication can be examined at leisure. The method is demonstrated with 2 hypothetical cases. It is claimed that the external brain will generate a large number of concepts in a short time at low cost. It is able to link knowledge from otherwise unrelated disciplines and can be used selectively. Drawbacks are that much of the information may be irrelevant and that it cannot print out the total text from an identified source. It is capable of connecting existing concepts in new and unexpected ways, but it cannot provide entirely new ideas [17].

Skillful new product specialists can unlock a client´s or consumer´s inherent creativity through techniques developed in clinical and consumer psychology. These specialists are often seen as having special powers that enable them to think up unique products. The reality is that specialists struggle like anyone else to come up with that winning idea. However, specialists do possess a deep understanding of consumers, which is developed through carefully listening and an ability to help clients´ rearrange what they know in a different , creative way. Some recommendations for generating ideas are to :

1. make people feel comfortable so a viable working alliance can be formed,

2. break out of the normal patterns of thinking.

Unlike logical thinking , creative thinking in groups needs the goodwill, uncritical support conducive to risk taking , the humor of the participants, and the insight to know that there can be more than one right answer [18].

To encourage new product innovations and growth, some companies adopted successful processes. For example, Strabco fosters 2 basic concepts:

1. systematic creative thinking or incremental innovation,.
2. original thinking or radical innovation.

Major breakthroughs at the company come from original thinkers, while most ongoing improvements come from the systematic thinkers. The company has discovered that original and creative thinkers each require their own systems of management. Stranco's incremental innovators respond to assignments and follow-ups . These employees can be managed by involving them in problem definition and milestone establishment through weekly technical meetings. Meanwhile, radical innovators respond to challenges and puzzles. Their management requires the removal of such normal restraints as budgets and time pressures and the establishment of an environment of trust and respect through internal sharing sessions [19].

Some companies, such as Flow International Corp., have adopted innovative approaches to involve employees in the idea-generation process. Anyone at Flow who comes up with a convincingly good idea for a new product is given seed money to

start a spin-off company [20].

Some researchers explored main steps involved in developing new products. For instance, 3 basic steps were listed out by Peterson : 1. Obtain ideas, 2. determine which ideas are practical , 3. test them for acceptance in the marketplace [4].

Michaels reported that the chances of successfully introducing a new product or service can be increased by using a systematic approach to product development. Eight steps to follow for new product development are: 1. idea generation. 2, screening and analysis ,3. development and testing 4, pricing , 5. market test, 6. short- and long-term market forecasts, 7. marketing plan, and 8. product introduction . Initially clear product development objectives should be developed [21].

Langs introduced three ways for a manufacturer to develop new products : 1. Absorb a product line through merger or acquisition. 2. Purchase a new product on a private label basis. 3. Develop a new product from scratch, with the assistance of the manufacturer's research, production, and marketing departments. The third alternative is the best choice [22].

INNOVATION SUCCESS FACTORS

In some previous studies, a total of 140 factors associated with new product success were identified[ ].The following 5 attributes were found to be of exceptional importance in new product success: 1. an open-minded, supportive, and professional management, 2. a good market knowledge and strategy, 3. a unique and superior product that clearly meets customer wants and needs, 4. good communications and coordination, and 5. proficiency in technological activities. Most of these variables are within company control. It is suggested that managers need to set up a continual process of renewal and exploration that can combine both experience and proven research factors and direct this into appropriate change [15].

Kuczmarski listed out the most frequently cited factors leading to a new product's success: how it satisfies an intense consumer need, its fit with the company's internal strengths, its technological superiority, and the degree of top management support that it receives [24].

In another study, the major determinants of industrial innovation performance identified are: 1. organizational and strategic factors, including general management's support, business-project fit, and research and development

(R&D)-marketing interaction, 2. R&D and production factors, including experience and synergy effect, product superiority, and patent protection, and 3. market and environmental factors, including degree of competition and market growth [23].

Gupta and Wilemon identified 4 major areas that affect the performance of the new product development process : 1. senior management support, 2. early integration of functional expertise, 3. availability and management of resources, and 4. an organizational environment that supports teamwork [9].

Rothwell [5] discussed several general features of success factors:

1. Success is multi-factored. Success is a matter of competence in all functions , and of balance and coordination between them, and not of doing one or two things brilliantly well.

2. Generalisability of success factors0: The success factors are more or less common to all industries, although their rank order or importance can vary from sector to sector.

3. Success is "people centered". Innovation is essentially a "people process" and simply attempting to substitute formal management techniques for managerial talent and entrepreneurial flair is not a viable option.

INNOVATION STRATEGIES AND INNOVATION MANAGEMENT

New product development strategy has become critical in an increasingly difficult and competitive business environment. Increasingly, corporate competitive success is hinging on the effective management of innovation.

Innovative companies show 3 key characteristics: 1. They focus on customer value. 2. They innovate across all their functions and up and down the business system with their suppliers and distributors. 3. They have higher output, doing more, faster, and more often. To build innovativeness, there are 5 steps a company should take. First, it should diagnose its situation to assess whether, why, and where there is an innovation problem. Next, management should determine how innovation should fit into the overall competitive strategy. The next 3 steps - building special skills, creating a cross-functional approach, and managing the innovation process - should be taken in parallel [25].

Corporate managers must take a fresh look at how they are managing new products and overcome their reluctance to innovate. Corporations should develop a new product 'blueprint' and provide new product 'architects' with the tools, incentives, and freedom to build new products. Firms also should have a clear

understanding of: 1. who is responsible for new product development, and 2. performance-based compensation programs that encourage innovative thinking and action. New product development should be considered a separate business function [26].

Peters pointed out that there is much evidence to suggest that the significant breakthroughs in products and services will come neither via orderly plans nor from the right company at the right time. Companies need t begin with the most of radical of the innovation strategies: forcing the market into the company. A self-generating strategy for obsoleting oneself from the inside includes taking such steps as licensing the firm's most advanced technology and selling off old winners to force dependence on the new. Companies can also take proactive approaches to address marketplace innovation, such as respecting small markets and conducting joint development projects with leading customers and vendors. Firms should track new product sales as a share of sales, pay for share-of-new-product sales, and use time as the principal business performance measure. Today's firms are not organized for innovation. Firms should get flat and lean quickly, grant true autonomy to divisions, create co-located, joint-function teams, and instill a project orientation everywhere [27].

Wind et al suggested that to enhance its chances of success, new product development should:

1. encompass both internal and external efforts,

2. focus on entire product-service-financial offerings and their ability to meet the needs of target market segments,

3. employ an interdisciplinary perspective,

4. recognize the needs and required benefits of all relevant stakeholder,

5. integrate commercialization plans into the development process,

6. manage a balanced portfolio of efforts,

7. include strong leadership and top management support,

8. use a global perspective,

9. allow for flexibility,

10. reduce development time,

11. encourage the generation of ideas,

12. evaluate product performance under dynamic market conditions, and

13. improve new product forecasting models [28].

It is necessary to have a new products blueprint and strategy to guide the flow of new ideas to their launch. Such a strategy should include an estimate of development expenditures for at least 3 years, estimated human resources, and desired 3-year revenue targets for new products [29].

There is not anything inherently wrong with short-term focus, as long as it is not the only focus. Companies have to be encouraged to look 3-5 years ahead [10].

One research results [2] indicate that new product performance is linked to 2 key dimensions of strategy: 1. the choice of target markets, which includes the domestic market, proximate export markets, or world export markets, and 2. the scope of the product design and development effort, or the development of products designed to meet domestic versus international requirements. Underlying the research is the thesis that an international orientation gives better results than a domestic focus in product innovation; industrial products that are developed for world applications and are targeted at export markets will have more success.

To properly integrate industrial marketing research and new product innovation, 4 basic problems must be remedied: 1. appropriate and full utilization, 2. substance and approach, 3. timing and uncertainty, and 4. integration with other functions [30].

The cost of introducing new product generations is rising dramatically in many technologies. New challenges for product development call for innovations in the very process of innovation. Although there is no single configuration for development that is optimal for all companies, the 3 approaches that have proven valuable are product architects, centers of excellence, and alliances. Product architects coordinate development across a product group to ensure that uniformity is maintained in the common components. Centers of excellence are

based upon the concept of the division of research and development resources on the basis of distinctive competencies. An alliance for product development can be categorized by the type of interaction: 1. the ongoing vendor-customer relationship, 2. alliances formed to share costs and risks, and 3. alliances based on complementary skills [31].

Rinholm [32] pointed out that despite the significant barriers posed by externally based, market-driven factors, many top executives fail to realize that there is a whole host of internal barriers that can prevent the generation, development, and introduction of new products and services. Less than sufficient attention, understanding, and support can undermine new product and service development and stop innovation in its tracks. Possible internal barriers include:

1. overbearing development processes or systems,
2. nonexistent development processes,
3. inadequate management attention and time commitments,
4. risk-averse attitudes,
5. shared functional support and resources,
6. unsupportive corporate culture,
7. unclearly defined and communicated direction and goals,
8. short-term focus and budget constraints,
9. emotions and politicking, and
10. unreasonable financial screening criteria.

The failure of a new product or service puts a devastating drain on a company's financial, material, and human resources. The chances of successfully introducing a new product or service can be increased by using a systematic approach to product development. Eight steps to follow for new product development are: 1. idea generation, 2. screening and analysis, 3. development and testing, 4. pricing, 5. market test, 6. short- and long-term market forecasts, 7. marketing plan, and 8. product introduction. Initially, clear product development objectives should be developed. New product failures are often the result of incorrect decisions made in the early stages of the development process. Failures are also common in companies that concentrate on product development that fits their own needs, rather than market demand [21].

Bedides the results of theoretical studies, some valuable experience of a particular company needs attention, too. Lester Krogh [33], vice-president of research and development, has outlined several management strategies for encouraging innovation among 3M employees: 1. Issue a challenge. 2. Grant autonomy to divisions. 3. Offer shared access to technologies. 4. Seek many uses for a technology. 5. Allow researchers time to work on their own projects. 6. Offer a separate career track for innovators. 7. Exhibit patience in nurturing projects. 8. Have respect for others' ideas. 9. Show a constructive attitude toward failure. 10. Maintain an atmosphere of open

communication. The patience and management support techniques created through the culture and tradition of 3M are the key to making the system work. The acceptance of failure, without penalizing the people involved, has been an important counterpoint to the exploitation of successes.

According to one study by Cooper[5], the strategies leading to high innovatory performance are characterized by the following "dimensions":

An aggressive technological orientation: having a strong R&D orientation and being proactive in acquiring new technologies.

A venturesome , offensive innovation program that is viewed as a leading edge of corporate strategy.

A market-oriented program, featuring strong user linkages and a significant effort directed towards identifying user needs coupled to a proactive search for new product ideas.

The development of products with marked differential advantages which meet customer requirements better than competitive products and had a marked impact on customers.

The employment of sophisticated technologies that have a high degree of synergy with the firm´s technological and production resource base.

A relative diverse new product program yielding products and end uses not necessarily closely related to each other, but in potentially large, high need, growth markets.

The author concluded, "what we witness is not a single strategy, nut a packet of strategies that differentiated these high performers from the rest of the firms. A marriage of technological prowess, a strong marketing orientation, the search for a differentiated advantage , and a willingness to accept risk appears to be the key to a high performance program.

Successful corporate strategies have a number of key elements. Rothwell discussed them [5]:

Inter-firm integration(networking):

Innovation increasingly derives from a network of companies interacting in a variety of ways. The end product frequently embodies tangible and intangible inputs from other companies,

Networks can vary in form and content. Increasingly, vertical upstream disintegration in large firms is being accompanied by strategic integration between major companies and their primary suppliers, including increased collaboration during product development. A further trend has been the considerable increase in collaboration at the preinnovation stage.The most marked trend has been in the area of strategic technology based alliances and other forms of arrangement involving technology transfer.Strategic technology alliances have been particularly prevalent in newly emerging technologies and can help partners to capitalise on mutual complementarities.

Technology strategy:

Technology strategy is a central and pervasive ingredient in

the concept of an enterprise. Technology must play a central role in strategic planning, which addresses the fundamental questions of how to establish a sustainable competitive advantage and how to ensure the survival of an enterprise.

The cumulative nature of technological know-how emphasizes the need for strategies to enable firms both to build resources in existing core areas of technology and to access newly emerging technologies.

Technological leads are a sources of market leadership and monopoly profits only when the firm has an appropriate exploitation strategy coupled to the cultural and organizational flexibility and adaptability necessary for strategy implementation.

INNOVATIVENESS AND RE-DEIGN FOR RE-INNOVATION

The impact of product innovativeness on success/failure of new products had been an overlooked dimension until Elko Kleinschmidt and Robert Cooper made investigation.

They investigated the role and impact of product innovativeness by an analysis of 195 new product cases from 125 industrial product firms[34]. The sample included 123 successes and 72 failures [35]. A U-shaped relationship between product innovativeness and 2 key measures of profitability , success rate and return on investment, was found. Of the 9 factors known to be drivers of new product success, 5 were significantly and strongly related to product innovativeness. Highly innovative products do especially well in terms of measures such as: 1. success rate,, 2.overall success as gauged by profitability, 3. domestic and foreign market shares, 4. opening new windows of opportunity, and 5. meeting sales and profit objectives. Non-innovative products are a close 2nd to highly innovative products on the other performance measures. Moderately innovative products fare poorly.

Three categories of innovativeness were developed for the study. These are:

Highly innovative products , consisting of

new-to-the-world products and innovative new product lines to the company.

Moderately innovative products , consisting of new lines to the firm, but where the products were not as innovative (that is, not new to the market); and new items in existing product lines for the firm.

Low innovative products , cases consisting of all others: modifications to existing products; redesigned products to achieve cost reductions; and repositioning.

The results: The success rate was greatest for highly innovative products: 78% successful. Success rates were almost as high for low innovative products as well (68%). The success rate dropped dramatically to 51% for the moderately innovativeness products,

A similar U-shaped pattern was evident for ROI . This time, highest for low innovative products (124%) followed by highly innovative products (75%), but dropping to a mean ROI of 31% for moderately innovative products.
Domestic market shares were high for both highly innovative and low innovative products (about 40% share). but shares dropped to 28% for the middle, moderately innovative group.

Foreign market shares were greatest for highly innovative products (23%) followed by shares for low

innovative products (19%). Moderately innovative products fared the worst with 11% foreign market share.
On average, highly innovative products scored the highest on the overall success rating measure . Low innovativeness products were next, but moderately innovative products were rated the lowest.

Not surprisingly, highly innovative products scored the highest in terms of opening up new windows of opportunity for the firm--new product windows and new market windows. What was a surprise is that moderately innovative products were rated worse than low innovativeness products on these two dimensions.

Highly innovative products were most likely to meet both sales and profit objectives, with low innovativeness products close behind. Moderately innovative products fell far behind.Differences in above success measure between the three groups--low, moderately and highly innovative products-- were statistically significant.

These dramatic and consistent patterns lead to provocative conclusions and also raise questions about the impact of product innovativeness on performance:

The U-shaped relationship is strong, striking and statistically significant . High innovative and non-innovative products do far more better than the large group of products in the middle --the moderately innovative.middle-of-the-road

products.

"This relationship holds across a wide variety of different measures of performance. In short, this is not a chance occurrence, nor is the relationship dependent on the nature of the performance gage used. The relationship is universal."

Their study really shed light on the complex and potentially conflicting role of product innovativeness on success and other measures of new product performance. Yet, the impact of innovativeness is a new topic, so further exploration is needed. For example, the above study based the conclusion on the analysis of all data of many industries, putting them together without differentiating among industries. If the data from each industry is analyzed respectively, might a different relationship pattern result? If so, the above U-shaped pattern cannot hold or even misleading for those areas which have different patterns.

It has been demonstrated by Kleinschmidt and Cooper that product innovativeness does have a central and surprising role and impact in new product success. This topic deserve further study. At present, the writer suggests to collect new product data from many industries and analyze them respectively to examine the relationship patterns.

In practice, firms should be cautious in using the innovative patterns resulting from the above study. New product projects should be chosen by considering many factors, not only innovativeness. One of the most important factors is the

customers' needs.

To survive, companies must keep the needs of the customers as their focus.

The impact of product innovativeness on success/failure is related to many other factors, flexible manufacture requirement and accelerating new product development requirement being among them. These two factors are related to timing which is critical:

Whether a company is launching a new product or upgrading an existing one., the time it takes to develop and deliver the product to the customers may be the most critical factor of the companies' success.

Being first to the marketplace with a new product will give the firm about 50% more business than the next competitor, all else being equal.

Sometimes, timing requirement might prefer moderately innovative products to highly innovative ones.

According to the literature, many other points related to innovativeness of new products need to be considered. The following are some of them.

Schlossburg pointed out that general economic, corporate, and market conditions have left little time, money, or patience for any organization to develop completely new products. There

have been many substitutes for new products, particularly in the last 2 years [39].

Internally developed new products represent a powerful path to growth. The most successful type of new product is often the truly innovative one rather than a line extension or minor improvement. However, managers tend to avoid the risk-taking that leads to innovation for many reasons, including inadequate funding and risk-averse settings [29].

Innovation process is effectively completed when a new product is launched on to the market place. In many sectors of industry , however especially those in which product lifetimes are long, market introduction is followed by an extended period of post-launch improvements, a process Rothwell and Gardiner call "re-design for re-innovation." [5]

Since user requirements rarely remain static and because market segmentation can occur , it clearly is important to sustained competitiveness that products continually are improved and modified and that related variants are introduced.

Rothwell et al found that leading product innovators engage in old product development as well as in new product development in order to achieve a balanced program of rejuvenation. Leading innovators ensure that at least 50% of their current sales come from product updated in the last 5 years and at least 10% from

completely new lines introduced in the last 5 years.

It is held that more radical innovations require new organizational forms.

Rothwell pointed out that continuous improvement of existing products enables new models to be produced incorporating only a relatively modest degree of change. The Japanese have been particularly adept at this process and the limited changes involved in progressing across generations has facilitated manufacturing start-up of successive models [5].

INNOVATION SPEED

During the last six years or so the importance of being the fast innovator has energed as an important factor for corpoorate strategic consideration.

Industrial competitiveness can be evaluated in many ways, but for high-tech firms no measure is more important than that of getting new products into their relevant markets ahead of the competition. Especially for companies with technology-driven products, where technological obsolescence compounds with problems of head-to-head competition, speed-to-market is an essential factor for survival. As the last few years have seen more international competition for many US companies, there have been numerous alarms calling for increased attention to this aspect of corporate competitive behavior. The development of an organizational capability for accelerated new product development presents formidable management challenges, so there is a pressing need for managers to understand implementation issues in some detail [40].

Successful companies in a global economy must rapidly introduce new products (new product lines or improvements to

existing lines) by collapsing their product development times. Elements are identified that are important to product introduction lead time:

1. full-time rather than part-time team participation appears to facilitate speedier product development;

2. using single sources from the start and having the important vendors of the group sitting in with the team on its meetings can quicken the project's pace and effectiveness;

3. the project needs a knowledgeable team leader who can devote sufficient time to plan, manage, and monitor the project [3].

Technological familiarity moderates the relationship between speed of development and the cognitive problem-solving orientation of both project leaders and project teams. For many firms, remaining competitive requires that they not only develop products rapidly, but that the products themselves contain new, unfamiliar technology. Companies can meet this need by relying on the cognitive problem-solving orientation of the project leader. In cases where the firm can pursue more familiar technologies, the team can be relied on to pursue an innovative orientation toward product development. The results suggest that there is no one best orientation on the part of project leaders or their teams [41].

A time-based innovation strategy for rapidly turning new technology into new products or for quickly making incremental

improvements in existing products will be adopted by companies seeking a competitive advantage in the 1990s. Traditionally, clear boundaries have been maintained between the functional stages in the product cycle in manufacturing organizations, often resulting in a need for redesign. Approaches to product development and improvement that view manufacturing organizations as a system include: 1. early involvement manufacturing, 2. concurrent engineering, and 3. design for manufacturability and assembly (DFMA). Fortune magazine reports that the use of DFMA, which uses a cross-functional team approach to development and improvement, has reduced new product introduction time by 50%-75%. The early input of manufacturing and assembly people makes it easier to identify time-, labor-, and material-saving measures, eliminating lengthy delays for redesign and clarification [43].

Success increasingly centers on how fast and how well a company can get its products into a market segment. One way firms can get a product to market faster is to form a strategic partnership with a new product development (NPD) company. Such a partnership can create a synergy in which the total effect is greater than the sum of the 2 organizations, giving the marketer the opportunity to achieve strategic, competitive advantage. Successful alliances will be the key to US competitiveness in an environment of shortened product life cycles, narrower markets, and intense offshore competition.

Amongst the factors contributing to the shortening of time to market are intensifying competition and the rapid rate of technological change[5].

Rothwell [5] reviewed a number of factors which have been identified as influencing speed to market:

Adequate preparation, "building platforms for change" : careful project evaluation, analysis and planning and, centrally, gaining commitment, understanding and support from those who will be involved in the project. It additionally involves adequate training.

Efficient indirect development activities: indirect activities such as project control , project administration and general coordinating activities can comprise up to 50 percent of total project time.Clearly actions that render these activities more efficient have significant potential for reducing development times.

Adopting a more horizontal management style with increased decision-making authority at lower levels.

Efficient upstream data linkages and inter-company liaison: involving primary suppliers at an early development stage and giving then increased responsibility for design. quality control and delivery.

Use of integrated teams during development prototyping.

Modifying the development process. Of particular importance is the replacement of initial physical prototyping by simulation

models based on research data. Expert systems are also being employed to shorten development times.

Incremental improvement strategy. Continuous improvement of existing products enables new models to be produced incorporating only a relatively modest degree of change.

Carry over strategies:the use of significant elements of earlier models in the most recent designs.

Designed-in flexibility: the creation of flexible (robust) design which subsequently are stretched into a design family of variants.

Fuller organizational and systems integration (OSI). It aims to minimize the number of reporting layers.

Fully developed internal data based.

As a general point, companies adopting time-based strategies appear to make considerable use of CAD as a primary development tool.

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