A product design process model that can redefine business strategies

D-B. Luh National Cheng Kung University, Taiwan

Abstract

Manzini pointed out that “traditionally, ideas follow organizations; in the future, organizations follow ideas.” In a highly competing business environment, a company’s innovation capability defines its sustainability and good new product ideas are a key ingredient to company success. Industrial design deals mainly with new product development, in which innovation ideas are central. Designers view themselves as idea creators. But, why should future organizations follow the ideas proposed by designers? If designers’ ideas are to be followed by organizations, then a different design process thinking that can redefine company goals or suggest different business strategies is necessary.

As a response, a business centered design process model is proposed, which consists of five steps: (1) Identifying new product ideas with attractive design potential from a user’s viewpoint, (2) Selecting appropriate company goals as design goals from a business perspective, (3) Defining new product concepts to reach the desired goals from a customer’s standpoint, (4) Specifying key design elements for less development efforts from a producer’s prospect, and (5) Translating design elements into physical entities or products. For verification, a product design workshop class taught by the author was employed. From students’ works, it can be asserted that the new procedure can be feasible and effective in developing new products that can meet market satisfaction and redefine business approaches. For illustration, a redesign work done by a student is demonstrated as an example. For further verification, theoretical analyses are conducted, resulting in supportive conclusions.
A product design process model that can redefine business strategies

A need of new design process thinking
New product development (NPD) is essential to all business organizations. The new product may be tangible objects or intangible services. A good new product can not only increase market shares and profitability but also lead to new business opportunities and establishment of new core competence. New product derives from innovative ideas. “What is a good idea worth?” According to Robert Cooper (1986: 67), the answer is “everything.” In a fast changing business competition environment, idea quality largely defines company success. Manzini (2001: 2) pointed out that “Traditionally, ideas follow organizations; In the future, organizations follow ideas.” Since innovative ideas are precious, business organizations should adapt themselves to cope with challenges from NPD works. “To ensure the leadership of tomorrow,” said Lew Platt, former chairman of HP (Tushman and O'Reilly 1998: 274), “we are willing to give up everything we have achieved today.”

Industrial design deals mainly with innovations or new product ideas, which are a key ingredient for company success. Designers, of various kinds, view themselves as idea generators or creators. If Manzini’s notion can be sustainable, then designers should be leaders in NPD works or in business organizations. This can be true because designers know how to define and develop new products with a strong focus on target customers and can foresee the scenario in which new products will be used. With a good sense of market and a comprehensive perspective on new product works, designers should be able to propose quality ideas for organizations to follow.

However, the reality shows a different story. In many NPD projects, designers are basically followers or downstream workers. Due to their inclinations of making changes to existing systems, designers are often seen as troublemakers. In addition, high-ranked managers or decision makers are largely from engineering or business backgrounds, rarely from design. All these facts reveal that designers remain distant from being quality idea initiators or managers. How come and why?

To answer, two fundamental questions should be explored in depth. The first one deals with the goals and strategies that drive design processes. As a rule, new product projects are proposed based on company goals or needs. Following predefined project objectives, design goals and strategies are developed and accordingly design processes are activated. Company success is mainly determined by business performance, which can be achieved if and only if new products can be satisfactory to target markets. This rationale is basically from a product designer’s point of view. From a business management perspective, only through appropriate business goals and strategies can company success be attained. Since both paths can reach business success, then what is the relationship between goals and strategies of design and those of business? If the concept of “organizations follow ideas” is right, then a capable design process should function to define business goals and strategies, or even company goals. Yet, none of existing design processes do.

The second question concerns the adopters who buy new product ideas. Generally, there are two types of idea adopters - intermediary and end. Development of an idea from abstraction (concept) to reality (product) undergoes two major steps. First, it must be attractive to a producer or company. In order to be an invested project, the value of an idea should be conveyed in terms of business benefits or company goals. Otherwise, an idea remains an abstraction. Secondly, it must be appealing to its potential customers and target users. Without compelling reasons to buy, an idea stays away from commercialization. Products that can meet market satisfaction are successful developments, which can contribute to business success and company prosperity. Essentially, both
producers’ and customers’ needs are equally important and should be well taken care of. In terms of NPD procedures, company needs are prior to customer needs and producers are the first layer of idea adopters, hence with higher priorities for adoption decisions. If the notion of “organizations follow ideas” stands, then the ideas proposed by designers must show reasonable attractiveness, in meaningful ways, to both the intermediary and the end idea adopters. Nevertheless, almost all industrial designers are educated to be user-centered, with a strong emphasis on needs of the end idea adopters. As a result, the value of an idea, or of a new product design, is often measured by user benefits or customer satisfaction, less meaningful to business management.

From the above analyses, it can be posited that to cope with future challenges in new product works, a new design process thinking is needed, which requires designers:

1. To put an emphasis on business performance and company needs in design goals;
2. To integrate design solutions into business strategies or company goals;
3. To view both companies and customers as substantial idea adopters, and;
4. To express design values or new product idea benefits in business terms.

With clearly specified business goals and strategies, most existing design processes are effective in delivering incremental innovations, characterized by marginal benefits and low risks. However, in current and future business competitions, radical ideas, frequently associated with high profitability and risk, have increasing influence on the success of a business, the fate of a company, or the prosperity of an industry. Yet, most design process models are impotent in, or less capable of, dealing with radical innovations, for they often involve redefinition of business strategies or company goals.

In light of the significance of radical ideas, this paper proposes a new design process model that can implement the essential design process thinking listed above and function to turn incremental ideas with marginal benefits into radical ones with great profitability and strategic advantages.

**The new model**

As an answer to the two basic questions, a business-centered product design process model (briefly as “new model”) is introduced, which consists of five major steps: (Figure 1)

![The proposed design process model](image)

**Figure 1: The Business Centered Product Design Process Model**

Step (1): Identifying attractive ideas from a user’s viewpoint:

Through conventional user observation techniques and design analysis methods, innovation, or product improvement, ideas can be easily perceived. Ideas may be generated and adopted internally or externally (Dean 1968). To identify potential ideas, an effective screening model is necessary. Product success is mainly defined by end users. Hence, users’ perspectives are a focus at the outset.
Since this paper concentrates on design process model and a screening model proposed by the author (Luh 2000: 1-20) can be effective for more innovative ideas in early development stages with an emphasis on end idea adopters’ viewpoints, new product project evaluation and selection issues are not addressed herein.

Step (2): Selecting desired company goals as design goals from a business perspective:
In general, new product projects are driven by company goals, which may fall into one of the following eight categories (Thomas 1999: 14.44): (1) establishing long-run competitive advantages, (2) reinforcing or changing strategic direction, (3) enhancing corporate image, (4) improving financial return, (5) increasing research and development effectiveness, (6) improving utilization of production and operations, (7) leveraging marketing effectiveness, and (8) effectively utilizing human resources. For easy selection and portfolio management, a “benefit matrix” tool (Luh 2001: 370-381) is introduced to help designers to align their efforts with company needs in early design phases. (Figure 2)

![Figure 2: Strategic Goals and the Benefit Matrix](image)

According to an idea’s development potential or innovation attributes, goals that can be attained and attractive to a company are chosen as design goals. This step is most critical. Because once design goals are specified, the space that an idea can be strategically developed lessens.

Step (3): Defining new product concepts to reach design goals from a customer’s standpoint:
This step can also be described as “positioning new product ideas.” This procedure further reduces the design space by providing designers with clearer market pictures about the new ideas in development. Markets are driven by life patterns, which can be expressed in form of circles. People in a same life circle share similar values or needs. From intimacy to strangeness, four basic life circles can be identified - personal life, family life, work life and non-direct life. Through which, a “life hierarchy” model (Luh 1996: 88-91) is established, which can be applied to represent market types. Personal life, for instance, indicates the market type that new products are essentially made for personal uses, with closest relationships with the end idea adopters. Non-direct life refers to the market type that new products have least or no direct connections with the general public. Pencil is a product example for the former market type and power loom is another for the latter.

As a rule, the more mature (or less innovative) the technology a new product employs, the more likely its market type can be targeted at the core circle (personal life), which denotes the largest market base. Normally, radical ideas are associated with advanced technologies, new product categories, new markets, or shifts of life circles. Targeting at a different life circle implies creation of a new product category. With the general market evolutionary pattern (non-direct -> work -> family -> personal), an idea’s market type can be positioned, strategically.

Step (4): Specifying key design elements for less development efforts from a producer’s prospect:
Based on attributes of competing products in target markets, key components of new product design are analyzed and further defined. The “product stratification” structure (Luh 2001: 479-486) can be employed as an analytical framework for specifying design focus, which has four components: senseware, humanware, functionware, and systemware.

Senseware indicates concerned product appearance factors that are associated with the attitudes or perceptions of an adopter towards a product. Humanware refers to product-human interface that enables people to manipulate a product efficiently, effectively, comfortably and/or safely. Functionware infers product constituents, together or as a part, which can generate major functional quality of the product or provide essential service for the adopters. In many circumstances, a product is merely a subsystem to a larger system (keyboard, for instance) and the larger system is supported by an infrastructure, an even bigger system included in an environment. Systemware represents the conglomeration of the larger systems with which a product is involved.

Generally, the development pattern of new products with innovative technologies can be briefed as follows: Initially, establishment of technological standard is central and design efforts concentrate on systemware constituents (basic system) or functionware components (core technology), depending on the wholeness of a product in development; As technologies improve, product paradigm becomes pivotal and design endeavors shift to humanware factors (usability); With emerging market segmentation, design attentions move to senseware elements (aesthetics). With the product evolutionary pattern, design focus can be consensually agreed by NPD participants for facilitating teamwork and synergy.

Step (5): Translating design elements into physical entities or products:
When both the company’s needs and those of the target customers are met, i.e., the idea in design shows significant benefits to both the intermediary and the end idea adopters, the process moves on to the last step to deliver real products. Otherwise, the process may choose to go back to the first step to re-select ideas for development, or to the second step to redefine design goals that are more appropriate for further development based on the key design components specified.

For projects entering into the last design procedure, new product ideas become increasingly concrete and design elements are specified to a great extent, ready for implementation. Through a standard design implementation process, i.e., laboratory verification of theory or design concept, demonstration of application, full-scale or field trial, and commercial introduction (Starling 1988: 532-533), abstract ideas can be smoothly translated into real products.

A product design example
To demonstrate how the new model can work, a product design case is employed as an example. This case is merely one out of many in the product design workshop class (Spring 2001) taught by the author at the department of Industrial Design, National Cheng Kung University, Taiwan. Sophomore students were asked to play as in-house designers for famous companies they chose. Each one of them was required to apply the new model to redesign a simple product with which he or she is familiar.

The student work that redesigned the glue stick product by 3M company is selected for illustration. Due to limited space, details of the design work and concerned processes are omitted herein. Since most redesign projects are highly confined by predefined company goals and/or business strategies, the design goals initially set for each design work were basically specified as “operation utilization” and/or “human resource utilization” in terms of the eight strategic goals.
Through conventional behavioral observation techniques and design analysis methods, a key problem for design improvement is identified: users do not know when the glue will be used up, i.e., uncertainty about glue consumption. (Table 1)

### Table 1: A Redesign Example Applying the New Design Process Model

<table>
<thead>
<tr>
<th>Design process</th>
<th>Iteration 1</th>
<th>Iteration 2</th>
<th>Iteration 3</th>
<th>Iteration 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial goals</td>
<td>Operation utilization and human resource utilization</td>
<td>Operation utilization and human resource utilization</td>
<td>Operation utilization and human resource utilization</td>
<td>Operation utilization and human resource utilization</td>
</tr>
<tr>
<td>Key design problem</td>
<td>Glue consumption uncertainty</td>
<td>Glue consumption uncertainty</td>
<td>Glue consumption uncertainty</td>
<td>Glue consumption uncertainty</td>
</tr>
<tr>
<td>(1) Potential idea</td>
<td>Visible glue consumption</td>
<td>Concise shape and “lure” for next purchase</td>
<td>Concise icons and “lure” for other (new) products</td>
<td>Collectible toys and platform for major cartoon figures</td>
</tr>
<tr>
<td>(2) Strategic goals</td>
<td>+ competitive advantage + R&amp;D effect</td>
<td>+ corp. image + marketing</td>
<td>+ competitive advantage + R&amp;D effect</td>
<td>+ corp. image + marketing</td>
</tr>
<tr>
<td>(3) Market position</td>
<td>Work life mainly</td>
<td>Work life + family life</td>
<td>Personal life + family life</td>
<td>Personal life (global markets)</td>
</tr>
<tr>
<td>(4) Product element</td>
<td>Humanware basically + senseware + humanware</td>
<td>Humanware + senseware + humanware</td>
<td>Senseware + humanware</td>
<td>Systemware mainly</td>
</tr>
<tr>
<td>Design benefit</td>
<td>End idea adopter</td>
<td>Save trouble + save money + more choices + collectible toys</td>
<td>+ entertainment + enjoyment</td>
<td></td>
</tr>
<tr>
<td>Emergent problem</td>
<td>Complicated in manufacturing</td>
<td>Less meaningful to individuals</td>
<td>Design skills and complexity</td>
<td>Management complexity</td>
</tr>
<tr>
<td>Design decision</td>
<td>Next iteration</td>
<td>Next iteration</td>
<td>Next iteration</td>
<td>Step (5) Realization</td>
</tr>
</tbody>
</table>

### Iteration 1
Focusing on the key problem, an improvement idea that inserts a colored glue component in form of a power consumption icon is proposed. This idea can make glue consumption visible and gain extra strategic effect: competitive advantage (the process technology for the tinted core). Since the new design can be effective in enhancing work efficiency and considerable current products are consumed at workplaces, the market type of “work life” can be appropriately positioned for the new idea. To reach the predefined design goals, current product appearance may remain. Uncertainty about glue consumption is essentially a perception or usability problem. Concentrating design efforts on humanware improvement is reasonable.

Examining its potential benefits, the new design can save trouble for users and remind customers of preparing a new one in advance; the producer can receive patent protection and gain competitive advantage. Nevertheless, production cost concerns require further design efforts for simplification in manufacturing.

### Iteration 2
To solve the emerging problem, a betterment idea is suggested. A battery shape (Figure 3) is applied to the glue component design, which can greatly ease manufacturing complexity and reduce production cost. In addition, a brief promotion message (“lure”), such as “50% off for next purchase,” can be printed on the stand where a glue component sits. These ideas together can help enhance R&D effectiveness and contribute to maintaining or increasing financial returns, two different strategic goals not specified in the beginning. The “lure” idea can help to lock customers in and to attract the market type of family life, for money-saving is a critical factor in their decision-making. Besides, it adds new elements for senseware design.
In terms of idea benefits, the new idea can save some trouble in use and some money in purchase for the users, and can economize production cost and gain a tool for customer loyalty for the producer. With the lure element, customers are likely to purchase another glue stick product before or after one is used up. Sales volume may increase positively. It is a better idea. But, is it the best?

Since products can be strategic tools, better financial performance should be anticipated. It is possible if further design endeavor is granted. Noticeably, although the new idea can target family users, the battery icon is less meaningful, or attractive, to the most frequent users in a family – school children - who use it for their homework regularly.

**Iteration 3**

To deal with the new issue, two design changes are suggested (Figure 4): replacing the battery icon with two comic figures and promoting all concerned products by the company (other stationery products by 3M in this case). The former design change has multiple advantages: (a) The product becomes more attractive to young customers (less instrumentalism); (b) It provides new tools (comic figures) for customer loyalty; (c) It facilitates to double the sales volume (either ends can be faced up); (d) It adds entertainment ingredient (interesting transformation process) while retaining good usability, and; (e) It may lead to faster consumption speed and higher purchase amount (curiosities for figure transformation and for “promotion lottery”). Additionally, the latter design change may contribute to promote sales of associated offerings and to enforce brand loyalty.
Obviously, the new design can enhance corporate image and change strategic directions, two new design goals not previously defined. With properly designed comic figures, the market type of personal life can also be targeted, suggesting a much greater market base or profit space. Design focus shifts from humanware improvement to senseware creation. Benefits for both types of idea adopters are multitudinous and multivalent.

Nevertheless, the former design change requires introduction of different design talents, development of complex process technologies, and establishment of new marketing channels, to name the most significant ones. All of which may result in increase in cost. To solve or ease the accompanied difficulties, further design effort is necessary.

**Iteration 4**

If the comic figures can be appropriately designed, the new product can be a collectible toy in a sense. Hence, it can be employed as a platform for promotion of cartoon figures by all major entertainment companies, serving multiple clients while sharing development costs for the expensive process technology.

Since all potential client companies are well established and have strong marketing networks, the new design thinking can not only enhance marketing effectiveness for products by the producing company but also solve the needs for design talents and for building new channels. Individual customers can be targeted and market space can be expanded globally. To gain the new business opportunity, systemware design becomes a focus. Benefits of the new idea are numerous and there is no major shortcoming (management complexity may be one, but easily solvable), suggesting that the design process may precede to the last step for realization.

From the design example, it can be posited that the new model is able to focus on business performance and company needs, integrate design solutions into business strategies or company goals, consider needs of various idea adopter types, and communicate design values in business terms. The four design ideas in the example can be seen as four design strategies for four new products, or as four strategic tools for a new business strategy, or as a series of business strategies (from short-term to long-term) for a new corporate strategy. Hence, the new model can also be seen as a process model for strategic planning.
Theoretical analyses

Basically, Step (1) is a typical idea screening process and Step (5) a standard idea implementation process, requiring no emphasis. The ones in between are core design processes, deserving further exploration. Through which, the relationships between goals and strategies of design and those of business become clear. First, business goals are subject to company goals, which can be defined, or developed, through the benefit matrix tool, and the eight generic company needs are ultimate goals for any design activities. Secondly, key elements of strategy (direction, timing, and extent) are already embedded in the core design processes, enabling design strategy to function as business strategy. With the benefit matrix, design goals that can satisfy company needs can be defined, providing concerned participants with a clear direction for development of new product project and for synergy. Through the life hierarchy, a new product idea can be timely positioned to meet dynamic market needs. By using the product stratification, the extent of change that needs to be made to a new product can be revealed and design efforts can be concentrated for effective implementation.

Technology, aesthetics, and business are three essential elements in Industrial Design works. Examining the development history of which, two professional education approaches ("engineering" and "marketing") are characteristic. The engineering approach integrates aesthetics into technology, centering on the sciences and techniques for mass production. Fundamentally, designers are trained to be engineers solving manufacturing problems. New products are seen as problems in a sense. The marketing approach introduces aesthetics into business, focusing on the knowledge and skills for mass consumption. Designers are prepared to be stylists, whose tasks are mainly for market segmentation and product promotion. New products are viewed as marketing tools. Intrinsically, both approaches obey predetermined company goals or align with current business strategies.

If designers’ ideas are to be followed by organizations, then a product design process that can redefine company goals or suggest different business strategies is necessary. By comparing the two design approaches, a strategic ingredient of the new model becomes distinct. (Table 2)

<table>
<thead>
<tr>
<th>Table 2: Comparisons of Major Design Approaches in NPD Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Orientation</td>
</tr>
<tr>
<td>Design goals</td>
</tr>
<tr>
<td>Design effort</td>
</tr>
<tr>
<td>Designer role</td>
</tr>
<tr>
<td>Main concern</td>
</tr>
<tr>
<td>Design focus</td>
</tr>
<tr>
<td>NPD driver</td>
</tr>
<tr>
<td>Major NPD Process</td>
</tr>
<tr>
<td>Design strategy</td>
</tr>
<tr>
<td>Product</td>
</tr>
</tbody>
</table>

Typically, the engineering approach focuses on problem-solving activities. From an abstract product idea to its physical outcome, solutions for identified technological difficulties, i.e., design strategy, are most critical in its NPD process. Essentially designers are engineers concentrating, in relative terms, on process models. Normally, the perspective of a producer drives the NPD process. For designers applying the engineering approach and in terms of the redesign example, the design
process is likely to be ended at the second iteration, resulting in a better design in usability and manufacturability at most.

The marketing approach is inherently customer- or user-centered. In addition to solving technical problems, issues on product positioning in selected markets, i.e., product strategy, are also crucial to designers. For products with matured technologies, designers are often seen as stylists focusing on product models. Opinions from the end idea adopters drive the NPD process. For designers employing the marketing approach, the design case in example is less likely to proceed to the fourth iteration, due to pre-determined business strategies and company goals.

The new model is business-centric. Design goals and associated business models evolve while design processes proceed. Designers are strategists in essence, concentrating on strategic performance for maximal benefits. Both the producer’s concerns and those of the users drive the NPD process. However, unlike existing design process models and design evaluation systems, in which producer concerns are over emphasized and placed up-front in the process, the new model equally values both types of concerns and alternatively introduces them, starting with a users’ and followed by a producer’s. Theoretically, such arrangement is able to reach higher success probability in new product development (Luh: 2000).

According to studies by various scholars (Maidique and Zirger 1984: 192-203; Montoya-Weiss and Calantone 1994: 397-417), success factors for NPD can be approximately divided into two groups: process-related attributes (controllable factors) and selection-related attributes (less controllable factors). The process-related factors capture the nature of the new product success and how the project is undertaken. Eleven factors are concluded most critical, briefly: (1) a unique superior product, (2) a strong market orientation, (3) sufficient predevelopment works, (4) sharp and early product definition, (5) focus and sharp project selection decisions, (6) quality of execution, (7) the correct organizational structure and climate, (8) planning and resourcing the launch, (9) the role of top management, (10) speed, and (11) a multistage, disciplined new product process. The selection-related factors describe the new product project process and its situation. Five elements are identified as most crucial, namely: (1) market potential, (2) competitive situation, (3) product life cycle (PLC), (4) synergy or leveraging core competence, and (5) familiarity. Of the two sets, process-related factors have by far the strongest influence on new product success.

In terms of the process-related factors, the new model is strongly market-oriented and a multistage, disciplined new product process. It can directly help to form early product definition, to suffice predevelopment works, to provide focus for project selection decisions, to generate a unique superior product, to increase overall NPD speed, to shape an organizational climate for successful NPD, and indirectly facilitate enhancement of the quality of execution, to plan and resource future launch, and to influence the role of top management in project evaluation and selection.

In terms of the selection-related factors, the new model can be applied to estimate market potential. In addition, the life hierarchy obeys PLC principles and can be used as a strategic tool for advantageous competitive positioning. The product stratification can help identify key design elements for less design effort and greater project familiarity. The benefit matrix provides a comparison basis for design goals in various natures, which help leverage core competence.

Above all, the new model furnishes with the function of redefining company goals and/or business strategies, a unique and powerful characteristic never seen in existing approaches. Evidently, the business approach is most advantageous and the new model is superior in many aspects.
Conclusions
From above discussions, it can be asserted that the business-centered design process model emphasizes business performance and company needs in design goals, integrates design solutions into business strategies, balances perspectives among various idea adopter types in new product development works, and expresses design benefits in business terms. Through the redesign example of 3M glue stick, the new procedure can be verified as innovative, feasible, and advanced in comparison with other approaches, and the following conclusions can be drawn:

(1) The new method can be a useful and effective tool for developing new product ideas that future organizations might seriously consider to follow.
(2) Defining business strategies or company goals should be one essential and critical activity in design processes.
(3) The new process demonstrates a different design logic that refreshes the way that design is viewed and valued.
(4) The new system introduces useful tools (benefit matrix, life hierarchy, and product stratification) for strategy making (direction, timing, and extent, respectively).

In general, new product projects are driven by company goals, which can be reached via business strategies. Design goals and approaches should therefore be aligned with business goals and associated strategies. Business orientation and strategy-centeredness are a key development thinking that all design approaches should follow. Designers are strategists in this context and strategists are normally ranked at higher levels in an organizational structure. However, current industrial design education and associated professional training do not prepare, or aim to prepare, designers to be strategists. As a result of adopting conventional approaches, designers are largely positioned as product engineers or stylists, remaining in lower status in a new product development team. To promote Industrial Design, to enhance quality and effectiveness of new product development, and to improve overall performance of any business organization, reorientating educational goals of Industrial Design and redefining designers’ professional roles are not only necessary but also urgent in the new era.
References


