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Product Innovation Management: Towards a Constructive Guide

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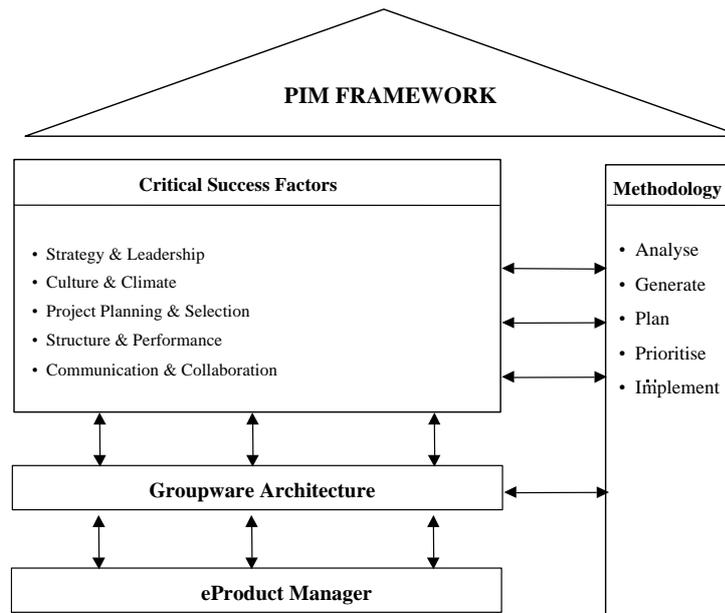
1. Introduction

Manufacturing companies rely heavily on successful new product innovation to maintain profits. Moreover, research indicates that new products will account for a greater percentage of profits in the future (Crawford, 1996). Cooper (1998) contends that companies who fail to excel at developing new products will invariably disappear in the future. However, product innovation is a risky and expensive endeavour, which results in many products being aborted in the development cycle or failing after introduction. According to Liberatone and Stylianou (1995) most of the ideas that enter the new product development process fail to become commercial successes. They believe that only about 14% succeed. Harris and McKay (1996) also point out that while many companies have upgraded their product innovation process, development output is far from being maximised. This indicates that the product innovation process is neither very well understood nor effectively managed within most companies. In other words, there is some anxiety about the ability to stimulate, generate, control and steer new ideas and translate ideas into tangible products and services. Product innovation is more than simply coming up with good ideas. It is the process of developing them into practical use. Therefore, the real challenge in product innovation is not just coming up with good ideas but in making them work technically and commercially (Tidd et al, 1997; Rosenfeld and Servo, 1990). To this end, product managers must effectively manage a portfolio of innovations throughout the development process. Moreover, they must develop consistently above average performances, across several metrics, spanning critical areas of product innovation. These include:

- Capturing the voice of the customer and translating it into product concepts.
- Selecting the right projects and matching competencies.
- Minimising rework and concentrating on value added activities.
- Delivering products more swiftly to the market.
- Achieving greater revenue impact from new products.

The goal of our research is to understand why most organisations find it so difficult to develop and launch innovative products effectively. By doing this, we hope to gain a deeper insight into the complexities of product innovation management in order to address the high failure rates of new product introductions. The underlying objective is to provide insights into how businesses manage their research and development (R&D) and new product portfolios and to ascertain what the top performers do differently. We hope to advance management practice in all of the functions involved in the process of product innovation by developing theoretical structures as well as practical techniques. The aim of this paper is to introduce a new approach to product development, which we call Product Innovation Management (PIM). Product Innovation Management is a model that is grounded in research and based on best practices. It aims to help manufacturing enterprises improve their ability to select new product winners and to

effectively manage their product innovations throughout the development process. The research consists of; understanding product innovation; identifying critical success factors for product innovation management; creating a product innovation methodology and finally; developing a groupware architecture from which a web enabled software



prototype is developed. This framework or model is illustrated in figure 1.

Figure 1: The Product Innovation Management Framework

The PIM framework was developed with the requirements of industry in mind while, at the same time, employs best management practice currently in use in high performing companies. Consequently, the focus of this framework is placed on achieving an optimised balance of internal execution effectiveness coupled with an ability to meet and exceed customer expectations. Such a perspective enables organisations to be better able to respond to changing customer requirements. The PIM framework adopts a portfolio perspective to product innovation management. In the past, emphasis has focused on managing the single individual project in isolation and insufficient attention has been paid to the aggregation of these projects. More recently, publications have pointed to the need to better manage the portfolio or suite of projects (Cooper, 1998; Harris and McKay, 1996; Clark and Wheelwright, 1995). According to Tatikonda (1999) companies are now realising that a key element of product innovation success involves employing a platform or family perspective when planning and executing product development projects. In general, most firms will work on a portfolio of innovations, some of which will represent incremental developments and improvements on existing and proven products while others will focus on more radical innovations. While different firms put together different portfolios, most will have a combination of low risk, short-term projects and high risk longer term ones. Ideally, a company should have a portfolio of products whose life cycles overlap. This guarantees continuity of income and growth potential.

2. Critical Success Factors Model

Product innovation success is clearly multidimensional. However, an organisation's characteristics can have a significant impact on product innovation. Astute changes in the work environment, can make substantial increases in product innovation possible. Therefore, if organisations wish to encourage product innovation they must explore the range of identifying factors. We have identified and grouped five critical success factors or enablers for effective product innovation management. These are; (a) Strategy & Leadership; (b) Culture & Climate; (c) Planning & Selection; (d) Structure & Performance, and finally (e) Communication & Collaboration. Each of these categories is briefly introduced below.

- **Strategy & Leadership:** The presence of an explicit new product strategy is lauded to result in more positive performance. To this end, a product strategy should define the aims and objectives of the product innovation effort in relation to the organisation's overall strategy. It should specify market arenas as areas to focus on and formalise the necessary structures for implementation. Leaders have a significant impact on product innovation initiatives. This is because the power to make, and implement decisions, are concentrated in the hands of a few, key, leading individuals in an organisation. They drive innovative practice at all levels of the organisation. A leader's role is to create a vision and effectively communicate this by setting clear objectives.
- **Culture & Climate:** Culture is a primary determinant of innovation. Possession of positive cultural characteristics provides an organisation with the necessary ingredients to innovate. Culture, climate and innovation are intimately linked. Culture can be described in terms of values, norms and beliefs while climate can be considered in terms of policies, practices and procedures. Research indicates that it is possible to create an organisation that has an appropriate culture to enable knowledge creation, transfer and reuse. This is achieved by developing a culture of openness and sharing, by motivating and engaging people and embedding knowledge management activities in the day to day business processes, internal systems and structures.
- **Planning & Selection:** A rationally planned product innovation effort is imperative for success. This is particularly important when project teams are not co-located. Such pre-development activities enable team members to anticipate problems in advance and bring conflicts to the surface earlier in order to speed up the innovation process and facilitate the integration of new technologies. Project selection involves deciding if an idea should be rejected, deferred or accepted for further processing, and if so what priority it should be given. The purpose of doing this is to establish the best possible basis for making decisions regarding the processing of ideas and proposals for new and improved products. The screening process helps to eliminate projects that require extensive resources but are not justified by current business strategies. It also helps to prioritise projects so that efforts can focus on the critical few.
- **Structure & Performance:** An organisation's structure and performance have been identified as a critical success factor for knowledge based work and thus product innovation. Traditional centralised, inflexible models have become increasingly uncompetitive and are being replaced with a flatter, organic and co-operative architecture. Furthermore, organisations are beginning to reorganise reporting lines and organisational structures not around traditional tasks or functional departments, but around communities of practice. Work teams are emerging as the dominant organisational component of the new economy. In terms of measuring and managing performance, most companies still use traditional performance measures, which in many instances are inappropriate indicators of success. Performance indicators should be developed which demonstrate the value of knowledge to the organisation by monitoring its contribution to the bottom line and valuing it as an intellectual asset.
- **Communication & Collaboration:** Product innovation is a knowledge intensive process. It can be described as an information transformation process where information is gathered, processed and transferred in a creative way. The right information must be made available to the right place, at the right time, and in the right format. Therefore, communication is a vital and basic necessity for product innovation especially when team members are geographically distributed. Improved communication created by adequate use of technology will influence the decision making process and the way in which consensus is reached. Moreover, communication among the project group and with outsiders stimulates the performance of the development teams. Thus, the better project members are connected with each other and with key outsiders the better the performance of the development team.

This section presented a critical success factors model for effective product innovation management. Each of these categories identify factors, which facilitate product innovation in organisations and must be effectively managed to enhance product innovation. They are a synthesis of best practice in the key areas for product innovation and useful to support the management of the product innovation process.

3. Creating a Product Innovation Methodology

By following a structured approach to developing product innovation, an organisation increases the likelihood of success (Pugh, 1990). Therefore, if an organisation has a clear understanding of what it is doing and why, and if it has an established mechanism in place to initiate and undertake innovation, development can happen quickly and predictably. Where such infrastructure is not in place, it has to be put in place for each initiative. This slows down the reaction time of individuals and organisations, and may limit the success of the project, as there is no pattern to follow and the process has to be re-invented each time, thereby the results are not always predictable. The goal of a product

innovation methodology is to identify and integrate the most valuable and successful ways to plan and develop new products. It ensures that an organisation is focused on where it wants to be in the future. Each method consists of a set of steps to be accomplished, and each step has various considerations, based on experience that are intended to make the step successful. While a methodology does not provide an organisation with all the answers, it does provide a framework on which they can develop and define their own innovation processes. The PIM methodology provides a structure, through which organisations can manage and co-ordinate their development process. The five stages in the methodology are; (a) Analyse Environment and Identify Opportunities; (b) Generate Innovations and Investigate; (c) Plan Project and Select Sponsor; (d) Prioritise Project and Assign Teams, and finally; (e) Implement Product Innovation Plan. These stages are illustrated in figure 2.

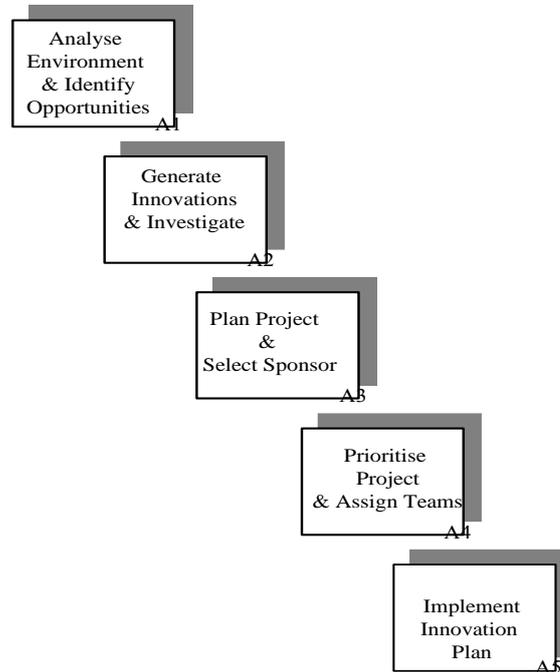


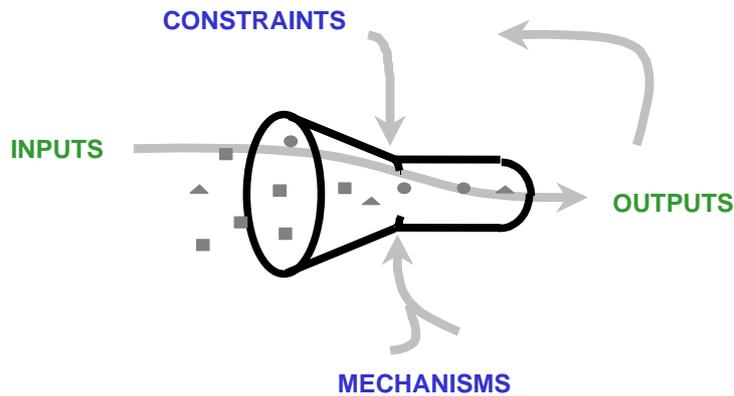
Figure 2: The Product Innovation Management Methodology

4. Developing a Product Innovation Management Architecture

The Product Innovation Management (PIM) architecture incorporates a groupware process that aims to encourage a systematic approach to product innovation management. It is designed specifically for product managers wishing manage numerous product innovation projects simultaneously. The main objective of the PIM architecture is to enable an inclusive approach and maximise the effort and resources that are expended on product innovation. The PIM architecture enables a dynamic framework for stimulating and capturing abstract ideas and translating them into concrete functional specifications and ultimately successful projects. It also considers both proactive and reactive problem resolution. The goal is to help generate, collate and integrate disparate pieces of information (i.e. complaints, requirements, ideas and problems) and translate them into successful product specifications. The PIM architecture allows innovations to be synthesised, filtered and prioritised taking into consideration the organisations' goals, requirements and constraints. It is built around the product innovation funnel. As figure 3 illustrates, the funnel adopts a systems approach. In other words it considers inputs, outputs, mechanisms and constraints.

- **Inputs:** Inputs consist of contributions to the system. They include such things like market stimuli that can inspire, provoke and encourage idea generation and thus potential new product concepts. Inputs also incorporate ideas (i.e. potential new product concepts), problems (i.e. engineering change requests and warranty analysis). These in turn are investigated and can turn into new product projects, which contain deliverables and schedules.

- Outputs:** Outputs consist of the product or result of the system. In this instance, a project is the outcome of an effort. Elements of a project include critical specifications such as project priority, project status, person responsible, schedules and exception reports. The projects performance (i.e. results) are also outputs of the PIM system. This helps to ascertain whether the project lead to the results envisioned. It includes trend graphs and



balanced scorecards.

Figure 3: The Product Innovation Management System

- Constraints:** Constraints are limitations, or restrictions, to the product innovation management system. Elements such as the organisation's requirements (i.e. customer requirements, conformance requirements, corporate requirements, employee requirements etc.) strategic thrusts (i.e. leadership, policy, resources, processes etc.) and measures of performance (i.e. time, cost, quality, environment etc.) will constrain the system. In other words, all projects must align with the organisation's strategies, measures and requirements.
- Mechanisms:** Mechanisms also constrain the PIM system. They relate to how the organisation is organised in terms of teams and models. For example, the organisation's people (i.e. competencies and skills) equipment (i.e. machines and tools) methods (policies and procedures) will also constrain the adoption and/or implementation of a new product idea and/or project. From this, a more comprehensive product innovation management architecture is developed. This is illustrated in figure 4.5.

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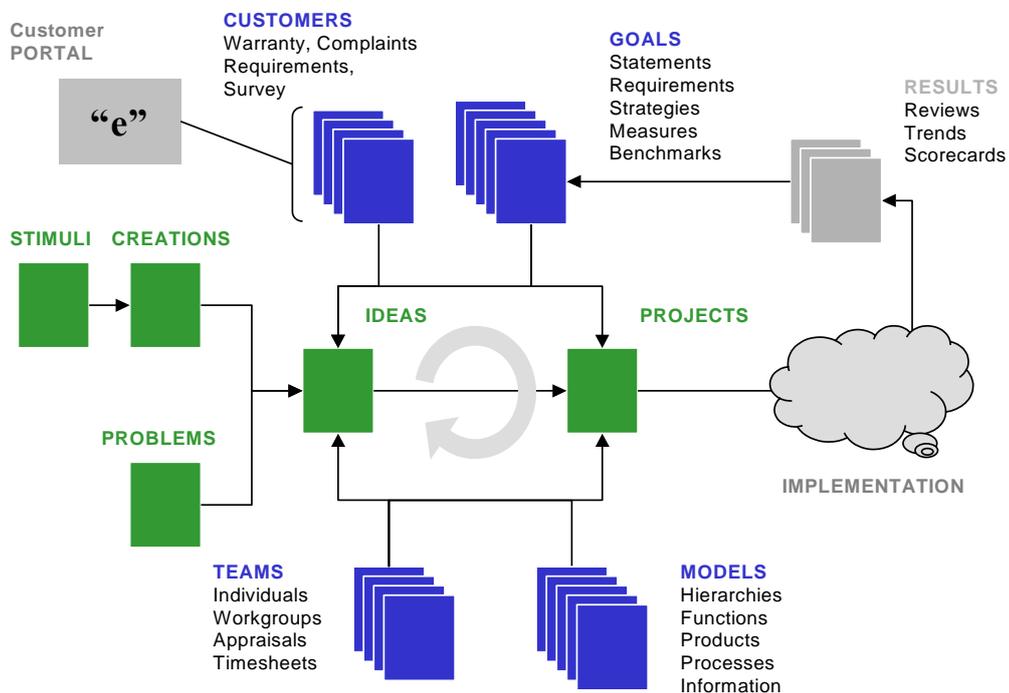


Figure 4: The Product Innovation Management Architecture

The diagram presents a holistic view of the product innovation process. The left hand side of the diagram concentrates on the idea generation stage of the product innovation process. Stimuli (i.e. environmental scanning, gap analysis) and other techniques such as failure mode and effect analysis (FMEA) are used to facilitate proactive idea generation, which in turn helps to identify creations or potential opportunities for new product development. The groupware architecture also incorporates a facility for reactive problem resolution (i.e. problems). These innovations (i.e. ideas and problems) may represent small-scale redesigns or product enhancements, as well as ideas for next generation product innovations. The architecture also incorporates stage gate functionality. In this view, the output from one stage or phase of the innovation process undergoes screening or filtering before it proceeds to the next stage. Screening refers to the process of testing whether concepts should be developed into products. It can include risk analysis, financial metrics, concept testing, and portfolio analysis. Therefore, innovations can be either dropped immediately, amalgamated into others, filtered or developed further.

Innovations that lead to continuous improvements can be addresses immediately by the individuals or teams concerned. Innovations that require more substantial resources continue on until they become constrained by a number of important factors such as customer requirements, organisations goals, teams available to work on the project and the resources necessary to finance and support the project. Projects, which fit with these constraining factors, are deemed viable and eventually progress to the planning stage where the project is prioritised, a sponsor appointed and resources assigned for implementation. At this stage the project follows the typical process of project management where effective techniques such as gantt charts and scheduling are used to support these activities. The project can be evaluated using tailored scorecards at key stages of its implementation and these results are used to influence the continuous development of the organisation's goals and strategies. There are seven elements or modules in the PIM architecture that support an integrated product innovation process namely; (a) customers; (b) goals; (c) stimuli; (d) innovations; (e) teams; (f) projects and finally, (g) results. Each of these modules is presented and discussed in more detail below.

- **Customers:** The customer's module deals with customer relationship management. It is used to capture the voice of the customer so product developers can incorporate these requirements into their product designs and effective solutions. This module incorporates tools to elicit customer requirements, such as Kano questionnaires and feedback mechanisms such as complaints and warranty analysis. It provides a link to all relevant players in the supply chain.
- **Goals:** The goals module deals with the strategic planning stage of the product innovation process. This is where the direction for the company's product innovation endeavours is identified and communicated so that all projects can be aligned with the strategic direction of the organisation. This module incorporates the operation's mission and vision, product innovation charter, strategies and performance measures. It permits everyone in the company to participate in the process it as it facilitates brainstorming and group decision making.
- **Stimuli:** This module enables external market stimuli to be captured, gathered and recorded so that potential opportunities can be identified. More specifically, it enables employees to scan the external environment for new events that may have an impact on the way the product innovation process operates. This feature is effective in installing in all knowledge workers the attitude of being on the lookout for opportunities and weaknesses in the current way of working.
- **Innovations:** This module facilitates idea generation as well as problem identification. While concept generation tends to be spontaneous and creative, software tools can facilitate this process. For example, databases of idea associations can help product managers trigger new product features or ideas. They also help structure formal ideation and problem solving definition for the user. This feature empowers everybody to participate in idea generation and facilitates the cross fertilisation of ideas.
- **Teams:** This module facilitates the effective co-ordination of team activities by organising and prioritising tasks, activities and deadlines. It can use an organisation's existing e-mail system to disseminate new or updated information and regular status reports between team members so everyone has access to complete, accurate and timely information. A performance review tool is also included in this module which incorporates skills,

competencies and progress. It enables reward and appraisal systems to be linked to participation levels which can increase motivation towards change.

- **Projects:** This module permits the entire team to share project information effectively. It also enables project managers to structure workflow and schedules, and to respond promptly and effectively to unplanned changes. It provides easy access to schedules, resource allocation information, and activity status information for all projects. This facility also provides the integration that enables managers throughout the firm to see how other schedules and events impact other projects underway. Managers can be aware of disrupted schedules and take steps to manage their individual projects effectively in response.
- **Results:** This module deals with performance measurement and evaluation. It helps to ascertain whether the product development plans lead to the results envisioned. This is difficult because the relationship between actions and results is quite often tenuous especially when the time elapsed between implementation of the action and the occurrence of results is considerable. The performance of the product development system must be measured to allow optimum control and to build a knowledge base to enhance the design of individual projects. This feedback loop allows the organisation to develop a corporate conscience by learning from its experiences.

The elements or modules in this architecture act as functional requirements to a software prototype called eProduct Manager. eProduct Manager is a web enabled portfolio management tool developed to encourage a systematic approach to product innovation management. It is designed specifically for product managers wishing to co-ordinate numerous product development projects simultaneously. It identifies the key elements of the product innovation process and integrates them effectively. It also aims to help users understand the concepts involved in product innovation management (PIM). In other words, eProduct Manager (a) provides an instrument to enable the effective identification and measurement of performance parameters and (b) provides a common language and methodology for engineers and managers to implement an optimised process for effective product innovation management. The prototype incorporates a stage gate facility which allows innovations to be synthesised, filtered and prioritised taking into consideration the organisation's goals, requirements and constraints.

5. Conclusion

In today's dynamic environment, it is becoming increasingly apparent that the survivors in this new era will be those companies who are rigorous in their pursuit of innovation, in order to develop and deploy new products more efficiently, effectively and profitably. It is also increasingly clear that the only way to achieve this goal is to actively manage the innovation process. In order to do this, managers must develop and provide the appropriate infrastructures and support systems. By understanding the process and factors that facilitate product innovation, organisations can increase the likelihood of developing an appropriate environment for innovation. This in turn will help minimise their failure rate and maximise their chances of successful product innovation. This paper introduces a new model called Product Innovation Management, which aims to facilitate the management of new products in a research and development environment. It is developed with the requirements of industry in mind while, at the same time, employs best management practice currently in use in high performing companies. The Product Innovation Management framework consists of; (a) a critical success factors model; (b) a comprehensive implementation methodology and; (c) a groupware based architecture.

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