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Developing a Self Assessment Audit to Support Product Innovation Management

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Abstract

Product innovation is critical to the success of most design and manufacturing enterprises. It is widely recognised that effective co ordination, organisation and management affects product innovation success rates. Self assessment audits can help managers and decision makers ascertain whether they are incorporating best practices in their product innovation processes. This paper presents a new approach to managing product development activities based on our research which, centres around the Product Innovation Management (PIM) model. From this, a product innovation scorecard is developed. This scorecard enables organisations to measure their performance in terms of product innovation management against best practice. It provides an overview of a company's strengths and areas for improvement with regard to product innovation management, highlighting those areas that require attention. In this view, it serves as a checklist for product innovation management. The product innovation scorecard is presented and tested using case study analysis.

Keywords: Product Innovation Management, Self Assessment Scorecard, Innovation Audit

1 INTRODUCTION

Successful product innovation is lauded to be critical to the growth and prosperity of most design and manufacturing enterprises (Patterson 1998; Cooper and Kleinschmidt 1996; Wheelwright and Clark 1992). With such a close link between product innovation performance and the organisation's overall success, managers and decision makers must ensure that this process is well managed and successful. However, product innovation is a risky and uncertain endeavour in terms of amounts at stake and the high probability of failure. Research indicates that a very high proportion of new product ideas fail commercially in the market place (Liberatone and Stylianou 1995). In recent years, much has been written about the product innovation process. In particular, there is large body of literature available, which attempts to identify the critical success factors for product innovation. According to McQuarter et al (1998) many of the factors identified relate to coordination and management issues. While a superior product with a unique selling proposition may create an opportunity for success, exploiting it often depends on effective management and deployment of

organisational resources. However, Baets (1998) found that management processes are poorly understood by most managers. It appears that they do not adopt a holistic or multi disciplinary view of their business. Improving the product innovation process is not about quick fixes but rather it is about recognising true symptoms, identifying their cause and then applying the appropriate treatment or remedies (McQuarter et al 1998). Therefore, the implementation of product development best practices can best be viewed as a journey (i.e. continuing process improvement) rather than as a destination. However, Patterson (1998) notes that determining the effects of management decisions in the product innovation process poses a particular challenge to manufacturing enterprises because the outcomes, or consequences, of those decisions typically do not become evident until long after the decision has been made. This is because there is often a significant time lag between when the decisions were made and the outcomes of those decisions that the details that have determined the current state of affairs are lost.

An organisation's ability to survive and function successfully partly depends on the information

available to its managers. They must be equipped with relevant, timely and accurate information in order to make effective decisions. In particular, the role of information relating to performance, whether for use within the organisation or for external stakeholders, is a key factor in determining commercial viability. Concerns are now being raised in the business environment over how best to measure an organisation's performance. Innovation audits can help managers and decision makers improve their product innovation process (Patterson 1998; Chiesa et al 1996). They assess whether the conditions necessary for innovation are in place and the degree to which best practice is used. The use of innovation scorecards provide an overall assessment of the practices adopted with respect to best practices and enables decision makers to identify whether or not the required managerial processes and practices are in place (Chiesa et al 1996). This paper presents an audit specifically designed to facilitate product innovation management. It is based on our research, which centres around the Product Innovation Management (PIM) model. PIM addresses managerial best practice and organisational mechanisms through which product innovation is organised, coordinated and managed. 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. This paper introduces the concept of product innovation management, discusses performance measurement and self assessment and identifies and groups critical success factors for Product Innovation Management. A product innovation audit, or scorecard, is then developed based on this best practice which enables enterprises to determine whether the conditions necessary for innovation are in place and the degree to which best practice is applied. This scorecard enables managers and decision makers to get overview of their company's strengths and weaknesses with regard to product innovation management, highlighting those areas that require attention. In other words it serves as a checklist for effective product innovation management. The scorecard is tested using case study analysis. The scorecard at present is a draft version and will be completed after further tests and analysis with industry.

2 PRODUCT INNOVATION MANAGEMENT

Product innovation is a continuous and cross functional process involving and integrating a growing number of different competencies inside and outside the organisational boundaries. Simply put, it is the process of transforming business opportunities into tangible products. In order to increase the success rates in this process, product innovation activities must be guided by corporate strategy. They should be based on a realistic business concept, concrete objectives and a systematic procedure. New product ideas should be generated by various people, internal or external, systematically evaluated and then integrated into the overall business plan. Product Innovation

Management (PIM) is a new approach to managing product development projects. It is a model that is grounded in research and based on best practices. PIM aims to help manufacturing enterprises improve their ability to select new product winners and to effectively manage their product innovations throughout the development process.

Product innovation projects can range from continuous, incremental product changes (such as minor iterations) to major radical change (such as the development of a new core product). With this in mind, the design process can be classified into four different types. These are; routine design, redesign, innovative design and creative design and are illustrated in figure 1.

- **Routine design:** In general a pre-established plan for the solution exists for this type of design
- **Redesign:** Redesign deals with minor iterations or modifications to the original design in order to improve its performance or incorporate new requirements
- **Innovative design:** In this instance, new variables or features are introduced which are somewhat similar to the existing variables and features
- **Creative design:** Here new variables or features are introduced which do not resemble an existing design

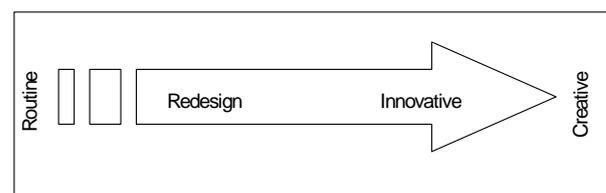


Figure 1 Typology of Design Types

Consequently, the PIM model incorporates many different types of new product development projects. Such projects can range from small scale product changes (such as minor iterations) to larger more radical changes (such as the development of a new core product). Therefore, PIM may incorporate the following types of product development projects;

- New to the world
- New to the organisation
- New product line
- Product line extension
- Product enhancement

In the past, emphasis has focused on managing the single individual project in isolation of others and little attention was paid to the aggregation of these projects. More recently, research highlights the need to better manage the portfolio or collection of projects (Cooper 1998; Harris and McKay 1996;

Clark and Wheelwright 1995). Companies are now realising that a key element of product innovation success involves employing a platform or family perspective when planning and implementing 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.

3 PERFORMANCE MEASUREMENT

Performance measurement plays a crucial role in product innovation (McQuarter et al 1998; Chiesa et al 1996). It is the process of measuring an activity's efficiency and effectiveness. A performance measurement system is not simply concerned with collecting data associated with a predefined performance goal or standard. It is an overall management system involving prevention and detection aimed at achieving conformance to either internal or external customer requirements. Performance indicators provide organisations with the necessary information to make intelligent decisions. They are recognised as an important element of all continuous improvement programmes. Performance indicators do not simply describe what has happened; they influence what will happen, as they provide information for decision makers. In this view, a well designed performance management system is a strong tool for controlling business objectives. Measurement can be used to achieve objectives through targeting the processes that support company objectives. However, measuring the wrong things in the wrong area or at the wrong level in an organisation can prompt an inappropriate response and affect the ability to achieve company objectives. In other words, by measuring the wrong things an organisation is encouraging employees to do the wrong things. This is particularly evident if the measurement influences employees pay. Such an activity will pull the organisation further from their corporate objectives.

Traditionally manufacturing performance measurement has been confined to cost performance, which typically drove manufacturing executives to manage the process of producing optimal unit costs, while generating as few negative variances from standards as possible (Maskell 1991). As global competition has intensified, enterprises found that traditional performance measurement systems were unable to account for the changes occurring in the business environment, and that the performance measures were not supplying the enterprise with the information it required to compete. This has forced companies to derive new (or contemporary) performance measurement systems that reflect the changes occurring in the business environment. Cost based

measures are no longer the only basis for decision making in the company. These contemporary performance measures are based along other competitive dimensions and can be grouped into one of the categories illustrated in table 1.

Maskell (1991) identifies a range of characteristics that can be attributed to such contemporary performance measures. These are;

- They are directly related to the manufacturing strategy.
- They primarily non-financial measures.
- They change over time, as needs change.
- They are simple and easy to use.
- They are intended to foster improvement rather than just monitor.

Effectiveness	Is the NPD process conforming to customer requirements?
Efficiency	Is the process producing the required output at minimum resource cost?
Quality	Does the product meet customers requirements and expectations?
Timeliness	Is the unit of work done correctly and on time?
Productivity	Is the value added greater than the value of labour and capital?
Safety	Does the finished product conform to safety standards? Is the working environment a safe place for employees?
Innovation	Does the product innovation process incorporate new technologies?
Environment	Is the product designed for disassembly?

Table 1: Performance Measurement Categories

4 SELF ASSESSMENT

Self-assessment involves a comprehensive, systematic and regular review of an organisations activities and results referred against a model for business excellence. In other words, it is a systematic approach to evaluating the current performance of a system, process or activity. Self assessment is powerful diagnostic tool, which enables organisations to achieve business improvement and world class standards (McQuarter et al 1998; Chiesa et al 1996). The self assessment process not only enables management

to draw on existing knowledge, but also to apply it in a structured manner to their own priorities and concerns (McQuarter et al 1998). The adoption of a self-assessment process has been found to result in a wide range of benefits. Notably self assessment provides:

- A rigorous, robust and structured approach to business improvement.
- A technique to review, focus and accelerate the rate of continuous improvement.
- A means to achieve consistency of direction and consensus on improvement plans.
- A Link to integrate continuous improvement, business goals and business plans.
- An opportunity to promote and share best practice internally as well as against other organisations.
- A means to integrate various innovative initiatives into normal business operations.
- A mechanism to focus and prioritise improvements to where it is most needed.
- A means of measuring progress over time through periodic comparisons.
- A way of involving employees at all levels to provide ownership and motivation for continuous improvement.

The process of self-assessment involves the identification of strengths and opportunities for improvement as the basis of improvement plans. However, programmes for management improvement cannot be carried out successfully without a step by step system. This system should be organised, orderly and rational if change is to become embedded in the enterprise. By following a structured approach to performance improvement, an organisation increases the likelihood of success. 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 improvement, change 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 self-assessment methodology is to identify and integrate the most valuable and successful ways to plan and implement performance improvement. It ensures that an organisation is focused on how it wants to move to a future state. IDEF0 models are used to illustrate the improvement methodology. This technique is specifically designed to enhance communication by using diagrams based on simple box and arrow graphics. Activities are described in terms of their inputs, outputs, controls and mechanisms. This helps the user to identify what activities are performed in an organisation, and what is needed

to perform those activities. The methodology 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. This Methodology provides a structure, through which organisations can manage and coordinate their improvement process. The five stages in the methodology are briefly outlined in figure 2.

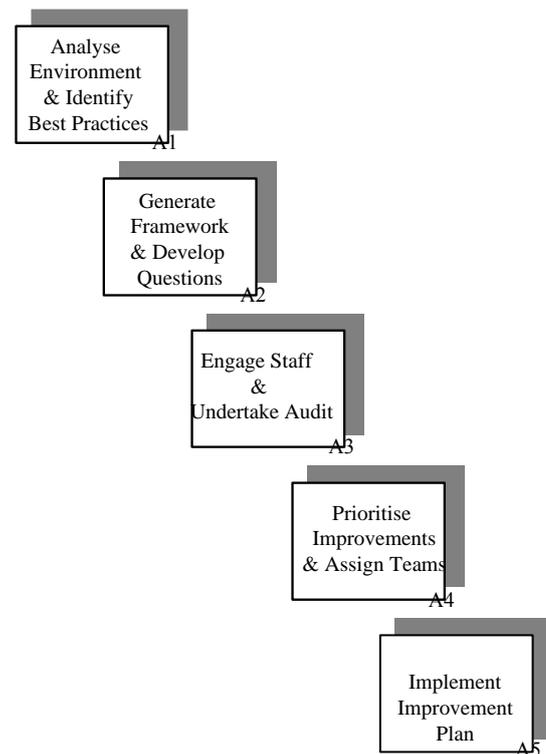


Figure 2: Self Assessment Methodology

- **Analyse environment and identify best practices:** The astute company will engage in boundary spanning activities (e.g. benchmarking audits, competitor analysis, gap analysis etc.) to observe changes in best practices. Such activities will enable organisations to analyse the environment in order to identify opportunities to enhance their strengths and capabilities.
- **Generate framework and develop questions:** From the analysis undertaken in the first stage a model or framework is developed which identifies the best practice dimensions to be examined. Questions associated with each of these best practices are then developed which can be used to evaluate the company's product innovation activities with respect to each of these best practices
- **Engage staff and undertake audit:** This stage helps to overcome any resistance to change by securing the commitment and support of all

concerned. Employees can take ownership of the change initiative by undertaking the audit. By doing this they will understand and evaluate the existing practices and be in a position to identify potential areas for change.

- **Prioritise improvements and assign teams:** Project prioritisation is used as a basis for ranking projects in order to determine how significant a particular improvement project is in meeting the organisation's goals relative to others in the portfolio. Specific teams are assigned responsibility and accountability to individual projects on the product innovation plan.
- **Implement improvement plan:** The projects on the improvement plan are implemented as individual projects, in accordance with the traditional processes of project management and the internal procedures of the organisation. This phase of the activity is the most visible, time consuming and labour intensive part of the methodology.

4 CRITICAL SUCCESS FACTORS FOR PIM

Successful product innovation depends on certain critical capabilities in many areas. Innovative capabilities are a comprehensive set of characteristics that facilitate and support innovation strategies. 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 into what we call the five product innovation levers. These are;

- Leadership & Culture
- Product Strategy & Portfolio Management
- Market Analysis & Customer Driven Requirements
- Project Planning & Selection
- Communication & Cross Functional Integration

Each of these levers identify factors, which facilitate product innovation in organisations and must be effectively managed to enhance product innovation. They are discussed in more detail below.

5.1 Leadership & Culture

The first lever identified refers to leadership and its ability to shape the firms internal culture and climate for innovation. Many researchers and theorists provide evidence to suggest that leaders have a significant impact on innovation (Cooper and Kleinschmidt 1996; Liberatone and Stylianou 1995; Wheelwright and Clark 1992). Whereas every member in the organisation has an input into innovation, leaders appear to have the largest effect on creating a culture for innovation in organisations. This is because the power to make, and implement decisions, are concentrated in the hands of a few, key, leading individuals in an organisation. Leaders role is to set objectives,

directions, manage multiple projects and aid in cross-functional issue resolution. Leaders have the ability to influence a group towards the achievement of goals. They drive innovative practice at all levels of the organisation. To be effective in product innovation it is imperative that leaders develop cooperation and implement consistent priorities across all functions in the organisations. In order to do this senior managers must adopt a systems approach to projects.

The task of managing a climate conducive to innovative endeavours is not trivial. Leaders must reconcile the need to provide direction while allowing employees enough freedom of expression to feel in control of their destiny, so that they are prepared to be active, participate fully, be focused, flexible and fast moving. Leaders role is to create the environment that encourages employees to take risks and create new growth opportunities.

5.2 Product Strategy & Portfolio Management

Product Strategy & Portfolio Management have been identified as the second lever to enable product innovation. The importance of product's strategy is fairly well documented in the literature (England and Graham 1999; Clark and Wheelwright 1992). According to Cooper and Kleinschmidt (1996) the presence of an explicit new product strategy results in more positive performance. In their view, a product strategy should define the aims and objectives of the product innovation effort in relation to the company's overall strategy, specify product market arenas as areas to focus on and formalise the necessary organisational structures for implementation. A product strategy should be developed in a participative manner. It should also focus and integrate team effort and permit delegation.

Portfolio Management recognises that organisations' efforts to innovate will include the development of both radically new, innovative products as well as small scale, incremental redesigns. Cooper (1999) asserts that firms must maximise the value of the portfolio and seek the right balance of projects. They must also ensure that the projects and the spending breakdown mirror the business's strategy. One of the key skills in effective innovation management is balancing the composition of this portfolio and matching it to the firm's competencies and capabilities in technology and markets.

5.3 Market Analysis & Customer Requirements

The third lever identified for product innovation is market analysis and customer driven requirements. Marketing activities are an integral and essential part of the product innovation process. More specifically, such activities include; assessing the market attractiveness; identifying customers needs, wants and preferences and determining competitors' products, prices, technologies, production capacities and marketing strategies. Market analysis is more than simply determining

whether the market is promising or calculating the projects expected profits, it clarifies exactly how the new product will benefit both the company and the customer. Such activities justify the commitment of resources and identifies the risks associated with the potential project.

Furthermore, manufacturing enterprises cannot be competitive in international markets unless they are customer driven (Cooper 1999; Griffin and Hauser 1993). Therefore, a clear understanding of user needs is critical to product innovation and all operations must be driven by these needs. With this in mind, manufacturing companies must establish the voice of the customer and translate that value into the product concept. In order to do this, they must first identify, understand and interpret user expectations, voiced desires and as yet unperceived needs. Requirements engineering enables organisations to be pro-active rather than reactive and assures product quality as defined by the customer and/or user.

5.4 Project Planning & Selection

Brown and Eisenhart (1995) assert that a rationally planned product development effort is imperative for product innovation success. Cooper and Kleinschmidt (1996) emphasise the importance of pre-development activities to anticipate problems in advance and bring conflicts to the surface earlier in order to speed up the process and facilitate the integration of new technologies. In addition, selecting projects for their strategic emphasis is good for direction and helps form an environment for successful projects and comprehensive project planning significantly increases new product success and is strongly correlated with financial performance.

The purpose of using project selection methods 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. Cooper (1998) reports that top performing companies do not use financial methods for portfolio planning and project selection. Instead, they use strategic portfolio management methods to maximise the value of the portfolio. In this instance strategy decides project selection and criteria should be selected that can measurably compare how products support the organisation's strategy.

5.5 Communication & Functional Integration

The product innovation process can be described as an information transformation process where information is gathered and processed 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. However, expertise from each member participating in the

product innovation process is usually limited in both quality and quantity. Therefore, sharing and connecting information and knowledge is essential for any organisation to be a knowledge based system. According to Baets (1998) learning occurs in such companies when this information and knowledge are dynamically utilised and updated.

Frequent communication increases the amount of information directly in that more communication usually yields more information. 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.

External communication is imperative for successful product innovation. The presence of a gatekeeper, or someone that scans the organisation's boundaries and brings information to the organisation and disperses it to those inside, is essential for product innovation. In particular, strong formal links to both suppliers and customers are very important to the product innovation process. Internal communication is also vital for product innovation success. In particular the impact of communication, cooperation and inter-functional harmony are strongly correlated with project success.

This section has introduced and presented five key levers essential to product innovation management. These levers are a synthesis of best practice in the area and useful to support the management of the product innovation process. These theoretical concepts can be translated into concrete statements through a scorecard, which forms the product innovation audit. This scorecard enables managers and decision makers to acquire an overview of their strengths (to be exploited) and weaknesses (to be improved) with regard to product innovation management. In other words, it serves as a checklist for effective product innovation management.

The audit consists of fifty statements, or traits, based on the five critical success factors, which were found to facilitate product innovation management. The survey simply requires respondents to circle the extent to which they agree or disagree with the statements where 1 = strongly agree and 5 = strongly disagree. The list of statements is presented in Table 2 overleaf. This audit was carried out in many design and manufacturing based in Ireland. The next section presents the findings of two case study analyses.

6 CASE STUDY ANALYSIS

Company A is a manufacturing facility located in the west of Ireland. It is part of a large global organisation. This company produces medical devices, diagnostics and nutritional products. It also manufactures pharmaceutical products to a lesser extent. Products are generally made to stock. The company is considered market leaders in some product lines such as pharmaceuticals, nutritionals and diagnostics. However, it also has

plenty of cash cows (high market share in industries with low growth rates) and dogs (relatively low market share in industries with low growth rates). These are mainly in the devices / hospital product line. The company is organised by divisions broken into functionally structured operations. The culture can be considered to be sluggish in nature.

Leadership & Culture

1. The organisation permits the emergence of intrapreneurs or product champions
2. The organisation provides support in terms of autonomy, time and rewards
3. Senior management is committed to risk taking in product innovation
4. Senior management are accountable for new product results
5. Leaders visibly drive innovation
6. Leaders adopt a consensus and shared approach to decision making
7. Leaders adopt a participative decision making style
8. Project teams are mentored and enabled
9. Money is made available for internal projects
10. Senior management actively encourages the submission of new product ideas

Product Strategy & Portfolio Management

1. The product strategic plan is effective and used
2. Product strategy is clearly defined and communicated to all employees
3. The product innovation programme has a long term thrust and focus
4. The project and the spending breakdown mirrors the businesses strategy
5. There is synergy among product innovation projects
6. Product strategy is used to align priorities with other functions
7. Strategies are flexible enough to respond to emergent changes in the business environment
8. There is a good balance of projects which maximises the value of the portfolio
9. The product portfolio is matched to the firm's competencies and capabilities
10. Adequate resources are available and committed to achieve project goals

Market analysis & Customer Driven Requirements

1. Preliminary and detailed market studies are undertaken regularly
2. Feasibility studies are undertaken for each new project prior to development
3. User needs analysis are undertaken
4. Customer needs are identified using multiple sources of information
5. The voice of the customer is built into all product innovations
6. Product requirements are generated, synthesised and fed back to potential customers
7. Potential customers are involved continuously and interactively during requirements definition
8. Customer requirements are documented and subject to formal change control
9. All operations are driven by customer needs
10. The company regularly undertakes competitive analysis / benchmarking

Project Planning & Selection

1. An effective product innovation process is implemented
2. The process is tailored to meet the specific needs of each project
3. A formal process is used to determine and update project priorities
4. Concepts are selected using predefined, multiple and explicit criteria
5. Pre-development feasibility studies are rigorously undertaken
6. Contingency planning is undertaken
7. Effective stage gate decision process is used throughout the project
8. Informed planning activities (i.e. delphi techniques, brainstorming etc.) influence product innovation plans
9. Projects are terminated if and when necessary
10. Project proposals are tested for alignment with organisational goals

Communication & Cross Functional Integration

1. Projects are developed using effective cross functional teams
2. All team members are mutually accountable
3. Team members are empowered to make decisions
4. Customers and suppliers are involved in the product innovation process
5. Communications among team members is efficient and effective
6. Communications between project teams is efficient and effective
7. New product concepts are generated jointly by employees, customers and suppliers
8. Employees participate in generating ideas
9. Team leaders are involved in setting the product performance objectives
10. Information on ideas generated, problems raised and project status are accessible

Table 2: Self Assessment Statements

As figure 3 indicates, this company does not score very well in terms of effective product innovation management in general. It seems that this organisation does not adopt a systematic approach to product innovation management. The findings of the scorecard reveal that the company scores below average in all of the five areas critical to product innovation management.

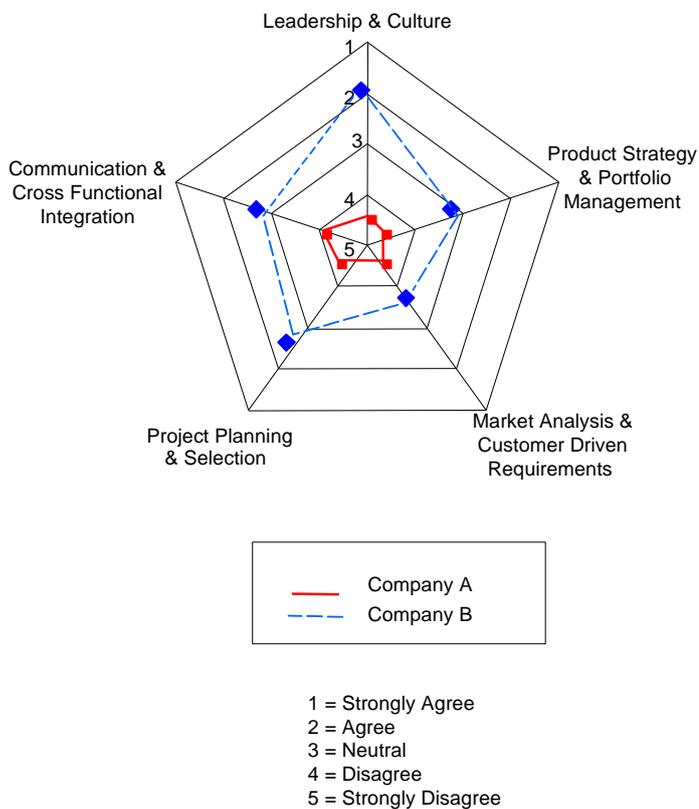


Figure 3. Findings of Case Study Analysis

Company B is a design and manufacturing facility, which is also located in the west of Ireland. It too is part of a larger group. The company produces transport temperature control units. Their market share varies for each segment but in general it is greater than 50%. Therefore, the company is considered to be market leaders in their industry. The manufacturing typology employed is manufacturing to order. The organisation's strategic focus lies in product and process innovation. The culture can be defined as dynamic. Customers, suppliers and shop floor personnel are involved during the early stages of product development as well as representatives from design, manufacturing and technical functions.

As can be seen from figure 3 this company fares significantly better in terms of product innovation management. Many of the best practices highlighted are adopted and used in this company. However, the results of this audit reveal that the company could focus more attention to product strategy and portfolio management as well as market analysis and customer driven requirements.

7 CONCLUSION

Successful product innovation is imperative to the survival of design and manufacturing enterprises. It is widely accepted that effective management significantly influences product innovation success rates. Self assessment scorecards can help R&D/product managers to identify gaps between their current and desired performance. They enable decision makers to identify where successful strategies can be further exploited and pinpoint where problems, or potential, problems lie. Furthermore, they provide the necessary information that can be used to develop action plans to improve performance. In other words, the self assessment process not only enables managers to draw in existing knowledge but also to apply it in a structured manner to their own priorities and concerns.

This paper introduces a self assessment scorecard specifically designed for R&D/product managers. It is based on the Product Innovation Management (PIM) model and comprises fifty statements, or traits, based on best practice research. The questions associated with each of these best practices are used to evaluate companies' product innovation management activities. Interpretation on scoring results provide information for management to evaluate their activities in light of their own special circumstances and characteristics. This paper presents the statements included in the audit and tests the audit using case study analysis on two organisations located in the west of Ireland.

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