IOSR Journal of Economics and Finance (IOSR-JEF)
e-ISSN: 2321-5933, p-ISSN: 2321-5925.Volume 6, Issue 4. Ver. I (Jul. - Aug. 2015), PP 08-20
www.iosrjournals.org

An Assessment of Project Portfolio Management Techniques on Product and Service Innovation: Evidence from Nigerian Selected Industries

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Abstract: *The crises of product and service innovation in most organisations due to global competition and the need for scientific research in the project portfolio management discipline were factors that motivated this research. The purpose of this study is to investigate how project portfolio management(ppm) contributes to product and service innovation. A questionnaire was developed to gather data to compare the PPM methods used, PPM performance and resulting new product success measures in sixty Nigeria organisations in a diverse range of service and manufacturing industries. The study findings indicated that PPM practices have a greater impact in the new product and services success rate. Also, business strategy method result in better alignment of the projects in the portfolio. This conclusion is supported by the 0.630 Pearson correlations at 0.000 significance between percentage of successful products and PPM performance level. The results reveal that for better innovation outcomes, management should place a priority on developing and improving PPM.*

Keywords: *Project Portfolio Management, Innovation, New Product Development (NPD), Service Development, Service product.*

I. Introduction

The widespread of information technology in a corporate organization globally has caused the information technology processing and strategies to out weight the traditional way of processing in an organization. The most perilous time for an organization is when the old strategies are cast-off and new ones are developed to respond to competitive opportunities. The changes that are appearing in the global market place have no precedence; survival in today's vindictive marketplace requires extraordinary changes in organizational products, services and the organizational processes needed to identify, conceptualize, develop, produce and market something of value to customers. Projects, as building blocks in the design and execution of organizational strategies, provide the means for bringing about realizable changes in products and processes (Cleland, 1999).

In today's vindictive global economy Portfolio management for product innovation has come into limelight as a significant management function. The impact of information technology, new systems and improvements in distribution and services has changed the environment in which organizations compete. The companies now extremely susceptible to shorter product life cycles and shifts in consumer taste that compel them to review their existing products and to launch new ones. Projects provide the means for an enterprise to respond to rapid change and to gain competitive advantage, helping in the design and execution of organizational strategies that yield innovative products and services (Cooper and Kleinschimdt, 1996) .Competition is characterized by the appearance of 'unknown, uncertain, not obvious products and services', which requires 'project-driven strategic planning' .Projects function as 'building blocks of strategy' (Cleland 1999) allowing organizations to pool their financial and human resources towards the achievement of new products and processes that can win significant market share and strengthen the company's positioning. Companies that are most successful have been found to have a continuous flow of projects in which ideas are generated, evaluated and implemented. These multiple projects, when consolidated and integrated for analysis and decision-making become part of the firm's project portfolio. Project portfolio management can be defined as the management of multiple projects with a focus on single project contribution to the success of the enterprise (Dye and Pennypacker,1999). A portfolio of projects, when managed in a coordinated way can deliver benefits which would not be possible were the projects managed independently (Cleland,1999)

Wideman (2005), suggested that in portfolio management, the determination of the strategic fit of a project based on the integration of the senior manager and the project manager, together with an adequate allocation of resources through a project selection framework, result on benefits that are aligned with the company's mission and market focus. This in turn, enables the organization to compete on the basis of strategic performance, rather than on operational improvements, treating its product or process development projects as a business venture.

Project portfolio management (PPM) innovation is of growing importance in a world of global competition where organizational survival increasingly depends upon a steady stream of successful new products. In the recent time in developed nations innovation is now understood to be the impelling cause of economic growth (OECD, 2000). Therefore the importance of maximizing outcomes from innovation project portfolios is intensifying. This is especially true for innovation projects for service product development as service products represent an escalating percentage of all new products (Pilat, 2000). Although product development projects are absorbing increasing levels of organizational resources (Edwards and Croker, 2001), new product success rates remain low. Many projects do not reach the launch or delivery stage and for those that do, the new product success rates range from about thirty-five percent to sixty percent (Griffin, 1997, Tidd, Bessant and Pavitt, 2005, Cooper, 2005).

A common theme in the literature on PPM is the assertion that adopting certain methods or establishing best practices will improve innovation outcomes (Cooper, Edgett & Kleins chmidt, 2000). Building upon previous PPM research, the research presented here broadens the understanding of relationships between PPM practices and outcomes. The findings provide guidance for practitioners and directions for future research. The past decade has seen the firm establishment of PPM as a discipline (Adams-Bigelow, 2006, PMI, 2006). PPM practices have a strong base in R&D management and in the management of innovation projects and have now evolved to support the management of project-based organizations (Dye and Pennypacker, 1999).

This research project focuses on innovation projects only, however similar PPM methods are used across various types of project portfolios (such as IT projects and infrastructure projects) and findings from one area may lend insight to other areas (Morris and Pinto, 2004). While the bulk of innovation PPM research focuses on the development of product and service in an organisation. tangible products, this research also considers PPM methods for service product development projects. For the purposes of this paper the term "products" will be used to include both service and tangible products. The term "services" or "service products" will refer to service products and the term "tangible products" will refer to manufactured or tangible products. This paper presents the findings of a research project portfolio management practices as a best option for better product and service innovation in Nigeria organisations. The PPM findings presented provide a significant contribution to business strategy method in project portfolios.

II. Discussion Of The Problem

In this study, various classifications of industries have been investigated. Their main problem areas are new product and service success rate remain low and many product do not reach the launch or delivery stage. To deal with the situation they have begun investigating a way of increasing the control of the application portfolio and define a strategy for how to deal with this issue in the future. It is often asserted that the introduction of a formal PPM process is a key factor for project success (Wideman, 2005, Cooper et al., 2000). However, standard performance measures to evaluate the level of establishment of the PPM process or the success of product development project portfolio do not exist.

The purpose of this study is to create a framework for identify strategic techniques in making better informed decisions about what actions are best for dealing with the applications in the project portfolio management on product and service innovation. To be able to decide the strategic techniques, this research work will examine key principles important to consider when managing an application project portfolio management. Given the scenario, this research will assess project portfolio management practices and their contribution to the creation of innovative products and services through this major question:

How do Nigeria companies manage their project portfolio to foster product and service innovation?

We will answer the questions by examining an application portfolio management initiative within the classification of industry investigated and find out how the problem is addressed in the scientific literature. This will give us an empirical as well as theoretical understanding of the aspects important in decision-making about applications within an organization. With this knowledge we will set out to create a framework that can be used by managers when deciding the actions of their applications.

III. Objectives Of The Study

The main objective of the study is to investigate how project portfolio management contributes to product and service innovation. The sub aims within the study are:

1. To examine PPM performance measures' that can sustain new product and service.
2. To investigate the extent to which Project Portfolio Management (PPM) methods were implemented for product and service innovation.

Hypotheses

1. H_0: PPM performance measures' correlate negatively to 'new product and services success Measures'
2. H_0: The use of Project Portfolio Management (PPM) methods are not significantly related to implementation of product and service innovation.

Project Management

The genesis of project management can be traced to a report published by the UK Institution of Civil Engineers on post WWII national development. The document pointed out the need for a 'systemic approach' with a planned break down of activities to achieve a fixed objective (Wideman, 1995). To answer to that demand, construction projects such as the Polaris program by the U.S. Navy and the Apollo Program by NASA were initiated. These projects were managed on an ad-hoc basis with the aid of tools such as the WBS, Gantt Charts and Critical Path Method. Cleland (1999) refers to 'projects, as building blocks in the design and execution of organizational strategies, with the means for bringing about realizable changes in products and processes.' Similarly, the Project Management Institute states that a project is a 'temporary endeavour to create a unique product, service, or result'. Projects have constraints such as 'scope, time and cost'; 'quality' is ultimately affected by the balance between these three elements. The process of project management is explained by stages such as project initiation, planning, execution, control and closure. (PMI 2000). The figure below illustrates this process:

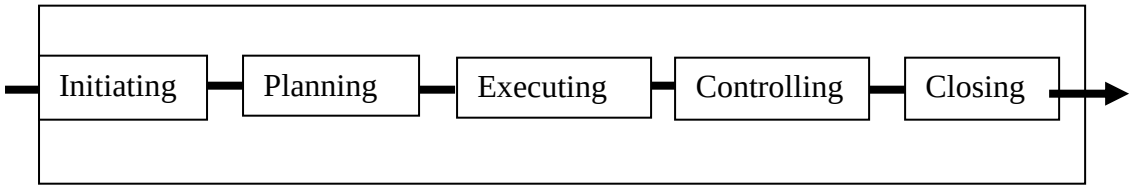

Figure 1: The project management process

Source: PMBOK (2000)

In the initiation phase, the project is reviewed for organizational fit and overall contribution to strategic objectives. This step includes a feasibility study, market research and the organization of the PMO. In the planning phase, people across the organization pool their knowledge to define the scope and the project's roadmap. At this stage, different types of plans are defined, such as financial, resource, quality and communications. The following step comprises the definition of deliverables based on the various work packages. In controlling, the project's deliverables, scope, risk and resources are monitored to ensure minimum or zero deviations, as well as overall success. The final stage, called closing, includes decommissioning of resources, handing over of project documentation and releasing final deliverables. Finally, as part of the analysis of project management, it is important to list some of the elements that affect project success (Leintz and Rea, 1995):

- The clarity of project objectives
- The integration of project objectives and scope
- The interaction between the project and the organization's strategy
- The skills of the project management team in implementing the project's objectives.

Program Management

In the 1960s, the concept of program management emerged from a need of a systemic view of all the organization's projects. According to Morris and Jamielson (2005) program management is a powerful tool for implementing strategy because it includes all projects and programs undertaken by the organization. Most definitions of the term refer to the coordinated management of a collection of interrelated projects. The PMI (2000) adds that through a program an organization is able to achieve benefits that cannot be reached through managing projects individually. Gardiner (2004) also emphasizes that program management helps the firm to introduce a wider organizational context into their project management culture. Gardiner (2005) notes that program management (or management by projects) consists of a portfolio of projects, carefully prioritized and selected to implement the organization's strategic plan, with phases such as 'initiation, planning, delivery, renewal and dissolution' (Pellegrinelli, 1997). Program management is strategic in nature, with ongoing operations for a given business unit that help an organization retain a strong customer focus (Markowitz,1999).Such organisation-wide programme governance framework has risen from the need of

companies to respond the challenges of their competitive markets. The differences between project management and program management are listed below:

Table 1: Comparison of program and project management

Programme	**Project**
An organizing framework	A process for delivery a specific outcome
May have an indefinite time horizon	Will have a fixed duration
Evolve in line with business needs	Has set objective
May involve the management of multiple related deliveries	Involve the management of single deliveries
Focus on meeting strategic or extra project objective	Focus on delivery of an asset or change

Source: Pellegrinelli (1997)

The differences presented in Table1 reinforce the idea that as organizations began to face increased pressures stemming from globalization, rapidly changing levels of technology and inconsistent consumer tastes, program management became a necessity. Program management helped organize both potential and approved projects and activities and presented an integrated approach to project management. It answered to the need of working with higher level objectives that helped implement business strategy. It made important projects visible to top management and prioritized those with the highest potential for stakeholder value maximization.

Project Portfolio Management

Markowitz Harry published a paper in 1952 on modern portfolio theory (MPT), suggesting that a specific mix of investments, with carefully weighed risk levels could yield higher financial returns. Although the theory had a focus on the field of finance, it set the ground for research into its application in critically analyzing multiple projects. It signaled to companies that, when grouped for evaluation and prioritization under a set of criteria, projects could deliver better results. Figure 2 shows the evolution of Markowitz theory into concepts relevant to PPM.

Markowitz and the evolution of PPM		
MPM		**PPM**
1. Maximize return for a given risk	→	Maximization
2. Minimize risk for a given return	→	Balance
3. Avoid high correlation	→	Strategic Alignment
4. Are tailored to the individual company	→	Resources Balancing

Figure 2: Selection and prioritization criteria for financial and project portfolios
Source: Bonham, 2004

MPT theory focused on the evaluation of the financial portfolio based on risk management techniques aiming at balance among investments. It used an 'expected returns-variance of returns rule' for choosing the investments in the portfolio (Markowitz, 1952). Markowitz' principles in MPT theory were translated into a criterion for project prioritization that aids in the success of project portfolio management. In modern project portfolio management, other than risk and return, there are elements such as benefits maximization, balance, strategic alignment and resource leveling. Later on, in the 1970s, the Boston Consulting Group developed a model for the analysis of different projects that aided companies in their investment decisions. It consisted of a matrix containing four different quadrants, where projects were placed according to two dimensions – business growth and market share:

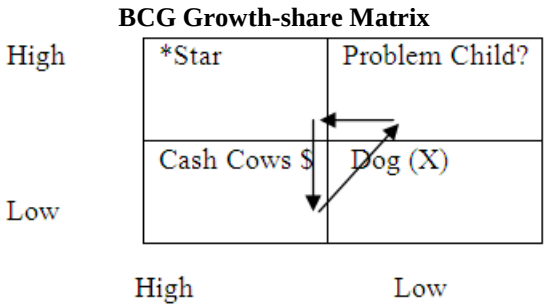

Figure 3: BCG growth-share matrix
Source: Adapted from Henderson (1979)

The method showed companies a different approach in selecting projects, clarifying that 'one size fits all' and generic strategies little contributed to the company's long term competitive advantage. Henderson (1979), the founder of BCG, emphasized that a 'portfolio of projects that generated products with different growth rates and market shares' helped a business succeed. The matrix aids in strategic decisions because it sets products in a systemic framework consisting of: '*stars*', whose high share and high growth assure the future' *cash cows'*, that supply funds for future growth *'problem children'*, to be converted into *'stars'* with the added funds *'dogs'*, which are not necessary; they are evidence of failure either to obtain a leadership position during the growth phase, or to get out and cut the losses (Henderson, 1979)

From a BCG matrix perspective, a business should have a balanced portfolio of projects, in which the cash flow generated by the created cash cows are high enough to develop 'question mark' and 'star products' to replace them in the future (Blomquist & Müller, 2006).

Innovation

Over the last decade, a company's ability to respond to its environment began to determine its success or failure. Companies can also not rely on passed success eternally. The only way to maintain success is by innovating and changing strategically, leading the organization to be ahead of its competitors (Bolton & Thompson 2005). The innovation era requires efficiency, creativity and growth. It creates a new organizational context characterized by 'intense competition, diverse markets, powerful end-customers, and rapidly changing technologies' (Clark,2002). The intensity of rivalry among firms results from deregulation, fast time-to-market times, high levels of customization, knowledge accessibility and strategic focus. Diverse markets are composed by both international and product diversification of the firm. Thus, cross-border operations that generate higher levels of local and international competition and new product ranges that tackle new market segments (Porter, 1985). The 'rapid obsolescence of products and services' result of customers' power in dictating how much they are willing to pay for more innovative substitute products (Cordero, 1991). Those firms that are not able to match the demand, or that do not supply products faster than competitors risk their survival. Finally, rapid changes in technology have improved the efficiency and effectiveness of the creation of products and services, and it has reconfigured processes that add significant value to customers. Never has the concept of innovation been so closely linked to competitive advantage, which is ability to serve customer's present and future needs creating customer loyalty (Porter, 1980; Kandampully & Duddy, 1999).

There are many definitions to the term 'innovation' (Cleland 2001 and Drucker 1985). Dye and Pennypacker (2002) defines innovation as the application of a new idea to create a new process or product that can differentiate a company and maintain it fit as environmental forces and competitors' strategies change. Cleland (2001) defines innovation as the creation of something that does not currently exist. Similarly, Drucker (1985) sees innovation as the process that creates 'markets that nobody before even imagined'. Hall (1994) relates innovation to the company's commercialization of a new 'good, service or production method'whereas Pinchot (1978) enlarges the scope of the term by relating it to the 'methods, relationships and processes of the organization'. Generally speaking innovation is the process of having new ideas and converting them into reality; it goes from idea generation to implementation. Successful innovation is more than just ´hatching ideas`, the ideas need to be implemented so they can bring specific results that create tangible customer value, improve process, and build new opportunities (Tucker,1998). That is why innovation and projects are strongly related, every innovation will lead to a project, even if it is not formally treated as one.

There are several types of innovation described in the literature. According to (Cooper, 1998), innovation can be multidimensional with considerations on 'product versus process, radical versus incremental and technological versus administrative'. Tidd, Bessant, John and Pavitt (2005) describe innovation by dividing it into four categories:

1. Product innovation – changes in the things (products/services) which an organization offers. These innovations can be incremental (less risky) or radical breakthroughs (more risky);
2. Process innovation – changes in the ways in which they are created and delivered;
3. Position innovation – changes in the context in which the products/services are introduced; and
4. Paradigm innovation – changes in the underlying mental models which frame what the organization does.

Project Portfolio Management for Product Service Innovation

Given the necessity of innovation for a firm's survival, companies today have a large number of projects on both incremental and radical innovation competing for scarce resources, and creating a *pipeline gridlock* (Cooper, Edgett & Kleinschimidt ,2000). In studies on the critical success factors in top-performing firms in new product development, Cooper et *al.* (2000) identified project portfolio management as a decisive factor in efficiency because it enables for the selection of 'right projects and right investments' that will win the 'product innovation war'. In a similar study, Mikkola (2001) argued that portfolio management aids in leading

with uncertainty and in estimating the best set of projects. Mikkola (2001) suggested the use of a R&D project portfolio matrix in which projects could be identified according to the benefits that could generate to customers and the levels of competitive advantage that could yield for the company. Kuczmarski (1996) also referred to 'a balanced new product and technology portfolio as the recipe for successful product innovation'. Figure 4 depicts project portfolio management as a driver of product innovation.

Drivers of Product Innovation

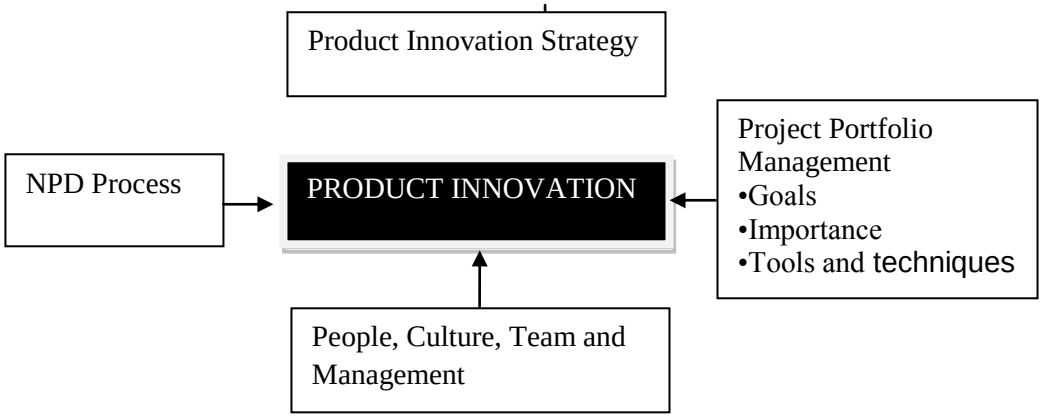

Figure 4: Drivers of product innovation
Source: Adapted from Cooper et al. (2007)

Although the product and service innovation process consists of drivers such as new product and service development, organizational culture and innovation strategy, for the sake of this research, the focus will be on the role of project portfolio management. The goals of project portfolio management (focus on right projects, balance and strategic alignment) provide a structured setting for the application of most of the tools and techniques of portfolio selection (financial methods, strategy, bubble diagrams, scoring models, etc.) that enables the selection of projects at 'the right quality, for the right price and at the right time' (Cooper, Edgett & Kleinschimidt, 2007).

In spite of the critical importance of project portfolio management for product and service innovation, several studies have revealed it as a weak area (Cooper et *al.* 2005). Reasons include lack of strong Go/Kill decision points, weak criteria for strategic decisions, poor project prioritization and limited number of resources (Cooper, 2005). When discussing the main causes of failure of innovation portfolios within organizations,Cooper (2005) also highlight difficulties associated with portfolio management:

_ poor leadership and direction
_ poor alignment between goals and projects
_ poor monitoring of holistic process results
_ poor planning and control of action implementation

Theoretical Framework

Modern Portfolio Theory (MPT)

Harry Markowitz (Markowitz, 1952) began developing his theories on modern portfolio theory (MPT) in the early 1950s,. In "applying the concepts of variance and covariance, Markowitz displayed that a diversified portfolio of financial assets could be optimized to deliver the maximum return for a given level of risk" .Markowitz (1999) gives credit to A.D. Roy for his contribution to MPT. "Roy also proposed making choices on the basis of mean and variance of the portfolio as a whole. He proposed choosing the portfolio that maximised a portfolio (E - *d)/ σ,* where *d* is a fixed disastrous return and *σ* is standard deviation of return. Roy's formula for the variance of the portfolio included the co-variances of returns among securities". The main differences between Roy's analysis and Markowitz' analysis is that Markowitz required nonnegative investments whereas Roy's allowed the amount invested in any security to be positive or negative. Markowitz also proposed allowing the investor to choose a desired portfolio from the efficient mean-variance combinations whereas Roy recommended choice of a specific portfolio (Markowitz, 1999).

McFarlan (1981) suggested that the selection of projects based on the risk profile of the portfolio could reduce the risk exposure to the organisation. However, McFarlan does not go into any detail regarding the portfolio management methodology, approach or definition but merely introduces the concept of portfolio management from a perspective of risk management. Nevertheless, the application of portfolio theory in a new field, specifically IT, has resulted in further study towards developing methods and standards for applying

portfolio theory to Project Portfolio theory. Montes, Moreno, and Molina, A(2003) suggested that MPT does not work for IT. According to Montes et .al (2003), IT investments are illiquid, that is they cannot be readily converted into cash. Liquidity is a necessary assumption for applying MPT. Nevertheless, trade articles such as that by Berinato (2001) and Ross (2005) recognised that the process of managing IT projects using a financial investment portfolio metaphor has attracted much interest from CIOs (Chief Information Officers) in Fortune 1000 companies. Teach and Goff (2003) referred to a Meta Group survey done that year which found that more than half of the 219 IT professionals surveyed had either implemented or planned to implement some aspect of portfolio theory by the end of 2004. Kersten and Ozdemir (2004) subsequently presented results of the application of Markowitz's modern portfolio theory (MPT) on a product portfolio of an IT company. They concluded that "with the mean variance theory constructed by Markowitz, the management of a product portfolio can be improved" (Kersten and Ozdemir, 2004). Their results showed "a considerable decrease in risk, while maintaining the same return. Even with constraints applied on the portfolio and its products, the optimal portfolios performed far better". They added that "the mean variance theory has proved its worthiness for an IT-product portfolio" and that "by evaluating returns achieved in the past, portfolio selection is possible" (Kersten and Ozdemir, 2004). While they acknowledged that their model was not predictive as it only diversified the portfolio by looking at the results of the past, the results gave insight to the executive board of their case study about which direction to adjust the portfolio. They concluded that the application of MPT to domains other than for which it was originally developed yielded interesting results and confirmed that their study introduced a quantitative approach to product portfolios and IT portfolios.

Modern portfolio theory (MPT) is relevant for this research as it provides a financial investment metaphor that can be applied to project portfolio management. Projects, programmes and operational initiatives can be viewed as investments that must be aligned to organizational goals. The project portfolio mix should be balanced in terms of risk exposure and investment returns. To understand the full impact of decisions regarding individual portfolio components, the aggregate must be considered, as opposed to the singular, projects, programmes and operational initiatives.

Multi Criteria Utility Theory (MCUT)

According to Ang and Tang (1984), many organisations approach the management of technology in an unstructured manner throughout the system's life cycle, thus making it difficult to compare IT/IS projects of different size or organizational impact. In addition, they stated that organisations adopting limited selection criteria lack confidence that their IT/IS projects will meet the organizational goals and objectives. MCUT considers the decision-maker's preferences in the form of utility function, which is defined over a set of criteria (Goicoechea, Hansen, & Duckstein, 1982 as cited in Stewart and Mohamed (2002). Utility is a measure of desirability or satisfaction and provides a uniform scale to compare tangible and intangible criteria (Ang et.al, 1984 A utility function quantifies the preferences of a decision maker by assigning a numerical index to varying levels of satisfaction of a criterion (Mustafa & Ryan, 1990)

Ang et.al (1984) state that decisions typically involve choosing one or a few alternatives from a list of several with each alternative assessed for desirability on a number of scored criteria. The utility function connects the criteria scores with desirability. According to Ang et.al (1984) the most common formulation of a multi-criteria utility function was the additive model (Keeney and Raiffa, 1993). To determine the overall utility function for any alternative, a decision-maker needs to determine the total number of criteria one-dimensional utility functions for that alternative. MCUT generally combines the main advantages of simple scoring techniques and optimization models.

According to Ang.et.al (1984) business unit managers typically proposed projects they wished to implement in the upcoming financial year. These projects were supported by business cases in which costs were detailed. As cost is only one criterion related to project selection, other criteria would be based on business value, risk, organisation needs that the project proposes to meet, and also other benefits to the organisation like product longevity and the likelihood of delivering the product. Each criterion is made up of a number of factors that contribute to the measurement of that criterion. For example, to determine the value that a Project Portfolio Management investment delivers, organisations need to go beyond the traditional NPV (Net Present Value) and ROI (Return on Investment) analysis methods. Value can be defined as the contribution of technology to enable the success of the business unit. Parker, Benson and Trainor (1988) suggest the assessment of two domains - business and technology – as they state that these determine value and should include:

Business Domain Factors:

1. Return on investment (ROI) – the cost benefit analysis plus the benefit created by the investment on other parts of the organisation.
2. Strategic match – the degree to which a proposed IT project supports the strategic aims of the organisation.

3. Competitive advantage – the degree to which IT projects create new business opportunity or facilitate business transformation.
4. Organizational risk – the degree to which a proposed IT project depends on new untested corporate skill, management capabilities and experience.

Technology Domain Factors:

1. Strategic architecture alignment – the degree to which the proposed IT project fits into the overall organisation structure.
2. Definition uncertainty risk – the degree to which the users' requirements are known.
3. Technical uncertainty risk – the readiness of the technical domain to embrace the IT project.
4. Technology infrastructure risk – the degree to which extra investment (outside the project) may be necessary to undertake the project.

The business and technology domain factors, as suggested above, are factors that could be considered by an organisation as those that contribute towards the Value criterion being measured. An organisation may choose different factors to represent Value. Other criteria, such as Longevity or the Likelihood of Delivering a product can also be used to evaluate portfolio components. MCUT contributes to the understanding of evaluating multiple criteria when determining the contribution of portfolio components to organizational objectives.

IV. Literature Review

Cooper (1998) and Cooper et al. (1997, 2000, 2001 and 2007) have extensively researched portfolio management practices for product innovation in large number of companies from different industries. Cooper (1998) explored the link between new product and service performance and strategy based on product and service programs from different firms. In the background study, the author argued that 'product and service innovation is the route to growth and prosperity', and found that companies with a better competitive edge had stronger market orientation in their innovation efforts. Cooper et al. (1997) argued that project portfolio management is vital for product innovation, listing some of the attributes that make it a priority for management. Among the most used methods for portfolio selection, financial was identified as the number one. The research was done in 205 businesses, segmented among high technology, processed materials, consumer goods industrial product and others. Managers were given detailed survey questionnaires with questions that included perceptions of portfolio methods,

approaches used and overall performance. Cooper et al. (2000) explored the topic of new product development by connecting it to portfolio management. The authors argued that succeeding with a new product strategy depended upon doing projects right and doing the right projects. Portfolio management appeared as the tool for selection of 'new product winners' and of strategic alignment between the firm's market effort and new product development. In this study, the reasons of importance of project portfolio management for innovation in firms were investigated, along with the effectiveness of project portfolio selection methods and challenges and problems in the area of project portfolio management. In another exploratory study of thirty firms, Cooper et al. (2000) sought to learn about the level of support of senior management to portfolio management, the most common techniques implemented along with their popularity and what distinguishes the best firms from the worst. Cooper et al. (2007) also investigated why some firms are successful at product innovation and identified portfolio management and resource allocation as one of the four major performance drivers. These drivers were depicted as a diamond, which at its center laid a business's new product performance.

Although most research in the field of project portfolio management regarding innovation has its foundation in R&D, it is possible to list some studies on the topic undertaken in the financial industry (Scuilli, 1998; Montes et al., 2003; Gardiner and Gallo, 2007). Scuilli (1998) studied the adoption of incremental innovation in the banking/financial industry and found that smaller companies with fewer levels of hierarchy and formalization were able to achieve better results. Scuilli (1998) also linked investment banking to innovation, studying it as a product that undergoes constant changes. At the end of her research, she also signaled that radical innovation was more likely to be found at larger companies, with greater availability of resources. Montes et al. (2003) explored how quality and innovation relate to each other in bank branches through empirical research with a sample of employees from eighty different bank offices. The study also sought to investigate the relationship between organizational climate (work satisfaction, commitment and motivation) to the achievement of innovation goals. Gardiner and Gallo (2007) researched the UK financial sector and the need for strategic change through 'projects or project

Portfolios'. The authors argued that innovation was among one of the challenges of financial organizations, and said that high levels of uncertainty dictated the need for a flexible approach to project management.

Important research has also been done in the field of innovation and competitive advantage. Studies confirmed that innovation leads to competitive advantage and that innovative firms outperform their competitors in terms of market share, profitability, growth or market capitalization (Tidd et al., 2005). Another example that demonstrates the need to innovate in order to compete was the study conducted by Peters and Waterman (1982) quoted in Kandampully and Duddy (1999) that included forty-three of the best run companies in the USA, but by the time they finished their book, only two years later, fourteen companies were in financial trouble. A Business Week study later reported that those companies had failed to anticipate, react and respond to changes in the market place (Kandampully and Duddy, 1999). These authors also demonstrated in their research how continuous improvement does not guarantee competitive advantage, emphasizing the need for market knowledge and strategic planning in the innovation process.

V. Research Methodology

In order to test the hypotheses H_{01} and H_{02}, a Comprehensive survey instrument was developed to capture PPM practices in use, outcomes from the PPM process and to identify PPM challenges. This survey was completed by sixty organisations in Nigeria. A pilot test of the survey was conducted with five organisations and the main phase of data collection from the sixty respondents was completed during 2012. The survey contains eighty-eight questions (some with sub-questions) on the importance of PPM to the organisation, PPM structures in the organisation and details of methods used, PPM performance measures, new product success measures and challenges for PPM. Survey instruments were mailed out to 166 organisations who manage a portfolio of new product development products. Individual e-mail and telephone contact was used to follow-up and to enhance the survey return rate. The final return rate of sixty valid responses represents a thirty-six percent return rate. The responding organisations represent a wide range of industries in 21 separate industrial classifications. Seventy percent of respondents fit within these nine classifications: Finance and Insurance; Basic Products, Agriculture; Computer and related; Communications and Telecomm; Health and Community Services; Electrical and Electronics; Food and Beverage; Petroleum, Coal and Chemical; and Construction.

Findings And Hypothesis Testing

1. H_0: PPM performance measures' correlate negatively to 'new product and services success Measures'

Respondents in Nigeria organisation in a separate industrial classification rated their PPM performance on six 'PPM performance measurements'. These measures represent the primary desired outcomes of a PPM system on a five-point Likert scale (five represents high performance on the measures). To improve the consistency of responses, anchoring statements were provided for the end points of the scales for each 'PPM performance measure' as shown in Table I. Similar anchoring statements were used throughout the survey.

Table I: PPM Performance Measure results

(Presented in order of average response, standard deviation between 1.0 and 1.1)

PPM Performance Measure Statement	**Average response**
The projects in our portfolio are aligned with our business objectives and our business's strategy. 1 = no, many are off strategy or have no strategy; 5 = aligned and on strategy.	3.8
Our portfolio of new product projects contains only high value ones to our business – profitable, high return projects with solid commercial prospects. 1 = no, many poor, mediocre, low value projects; 5 = definitely yes, high value projects to the business	4.3
The breakdown of spending (resources) in our portfolio of projects truly reflects our business's strategy. 1 = no, spending breakdown is inconsistent with our business strategy or have no strategy; 5 = spending consistent with strategy.	4.2
Our projects are done on time – in a timely and time efficient fashion. 1 = no, they're slow and late; 5 = on time and timely	4.0
Our portfolio of new product projects has an excellent balance in terms of long versus short term, high versus low risk, across markets and technologies, and so on. 1 = no, unbalanced and skewed; 5 = excellent balance.	3.9
We have the right number of new product projects for our resources – people, time and money – available. 1 = no, we're spread far too thin; 5 = right number of projects for our resources.	2.6

To graphically illustrate the wide spread in PPM performance across the respondents, respondents are grouped according to 'top' PPM performance representing the top twenty percent of scores for these six PPM performance measures and 'poor' PPM performance representing the bottom twenty percent. Responses for these groups are displayed with the average responses across the entire survey population in Figure 5. Although

some organisations score highly on these measures, the average performance levels leave much room for improvement. Lowest performance is for 'Portfolio has the right number of projects', reinforcing the emphasis on this problem in the literature.

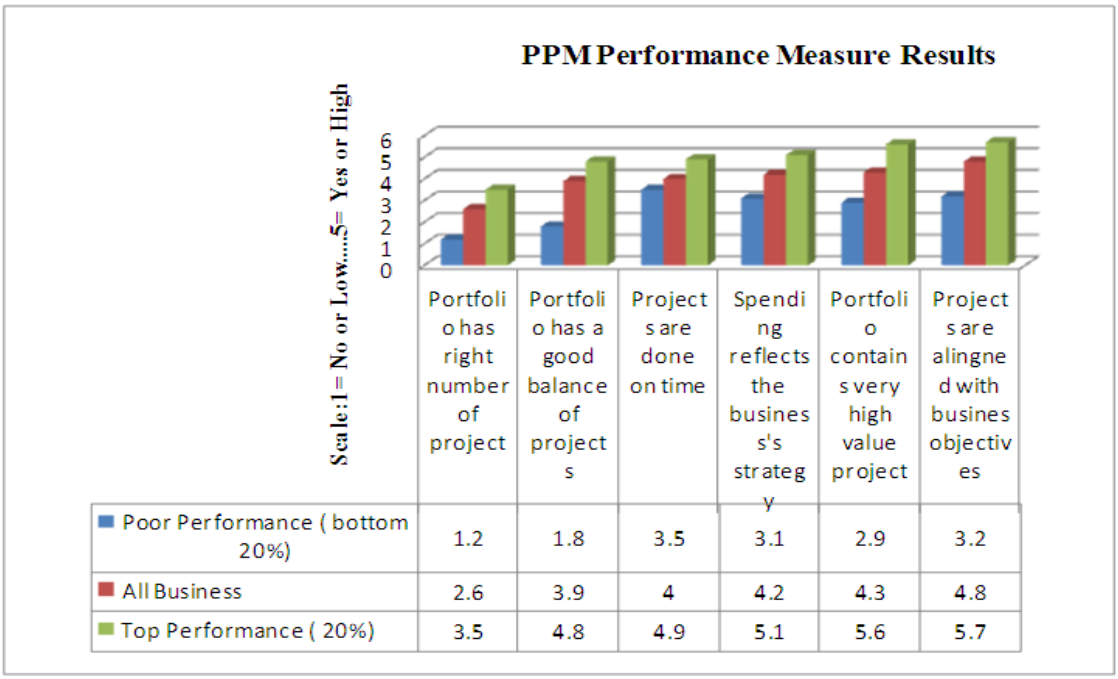

Figure 5: Portfolio performance results on six key metrics
Performance metrics are ordered by mean scores, Significance level between top and bottom performers (.001)

The Six PPM performance measures provide an indication of how well the PPM process is functioning, however they are not a direct measure of the resultant success of the new product program. In order to more directly measure outcomes, respondents in the Nigeria survey were asked to provide information on three new product success measures. Nigeria organizations report that new products (those introduced within the last three years) generate about a quarter of total revenue and profit, and an average of fifty-nine percent of new products are successful. New product success rates show a strong positive correlation with PPM performance measures (0.630 Pearson correlations at 0.000). This relationship is displayed in Figure 6 using the clustering of results for the 'top', 'poor' and 'all/average' PPM performance categories as defined for Figure 5. New product success is twice as likely in organisations that are 'top' PPM performers than in 'poor' PPM performers.

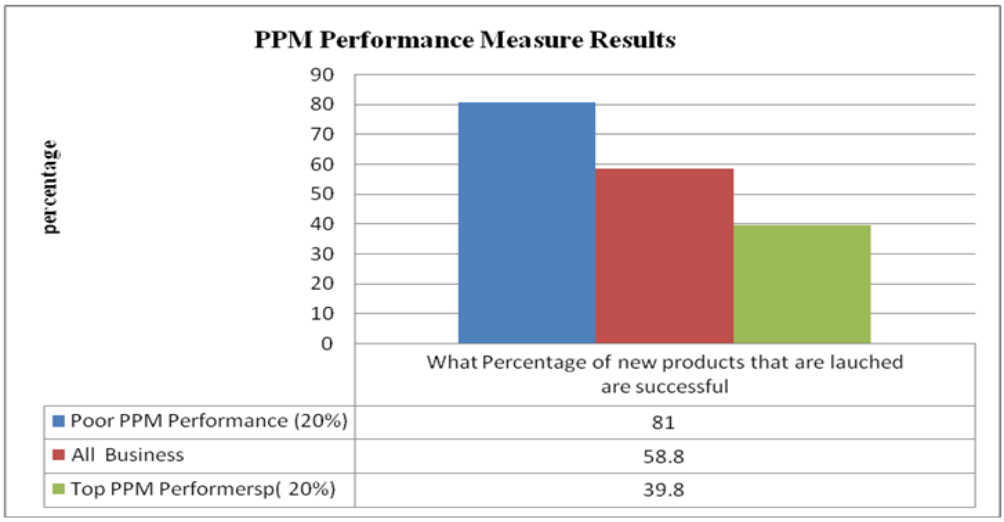

Figure 6: New product success rates in for PPM performance level.
(0.630 Pearson correlation at 0.000 significance between percentage of successful products and PPM performance level)

The new product success rate findings doesn't support for hypothesis H1: thatPPM performance measures' correlate negatively to 'new product and services success Measures' However, the new product sales revenue and profit level responses did not show any significant correlation with the PPM performance measures. Therefore overall support for hypotheses H1 is not as strong as indicated by the new product success percentage measure alone. In addition, the results must be considered with caution keeping in mind the size of the data sample and the diverse range of industries represented (Mikkola, 2001). Even so, the new product success rate correlation is a promising finding for the understanding of success factors for PPM applications and indicates that there may be a causal relationship between PPM process performance and the resulting new product success rates.

2. H_0: The use Project Portfolio Management (PPM) methods are not significantly related to implementation of for product and service innovation.

Methods used for PPM are analyzed in these five categories: Financial methods (such as discounted cash flow methods, return on investment or real options analysis), Business strategy methods (for example using strategy to drive top-down allocation of resource bundles), Scoring models (such as a balanced scorecard approach or a ranking matrix), Checklists (such as lists of hurdles or threshold requirements), and Portfolio maps (such as bubble charts and portfolio grids or matrices). On average, respondents use two of the five methods listed in detail in the survey. The two most common methods used are financial and business strategy. The use of these methods in the PPM process of an organisation is significantly (0.05 or better) related with one or more of the six PPM performance measures outlined above.

Organisations that use financial and business strategy methods also show a significant relationship (0.05 or better) with one or more of the four additional 'portfolio opportunity measures' collected for the Nigeria survey. These 'portfolio opportunity measures' evaluate innovation outcomes related to reaching new markets and developing technological capabilities. Respondents rated their organisation on a five-point Likert scale for four statements starting with "Our new product program" develops our existing technologies and technological competencies; brings new technologies to our organisation; leads our organisation into new product arenas; or enables our organisation to enter new markets.

Financial methods are used by seventy-seven percent of respondents. The use of financial methods is linked to good alignment of spending with strategy, but does not relate to high value projects in the portfolio as hypothesized in H_{02}. In addition, the use of financial measures is linked with a negative correlation on the ability of the new product program to bring the company into new product arenas. This is the only significant negative relationship revealed between the use of a PPM method and the 'PPM performance measures' or the 'portfolio opportunity measures'. In addition, financial measures are more likely to be used as the primary PPM method in organisations with weak PPM performance than in the high-performing organisations.

Business strategy methods are used in the PPM processes of fifty-six percent of Nigeria organisations. The use of business strategy for resource allocation correlates positively with six performance measures relating to alignment with strategic objectives, enabling the business to enter new markets, bringing new technologies into the business, balancing the portfolio, the portfolio containing high value projects, and spending reflecting business strategy. The use of strategic methods results in better alignment of the projects in the portfolio with business strategy and with spending better reflecting strategy, is strongly supported by this finding.

VI. Conclusions And Management Implications

These results could be read as indicating that 'best practice' PPM performance is found in both tangible product and service product environments, and that other organisations can learn from 'best practice' organisations regardless of whether they are service or tangible product-based organisations. Average PPM performance is not strong, but some organisations employ highly effective PPM practices. PPM performance measures correlate strongly with new product success rates. These findings suggest that for better innovation outcomes, management should place a priority on developing and improving PPM processes.

Strategic methods have the strongest positive influence on portfolio performance while financial methods correlate with positive performance on only one PPM measure and do not lead to higher value projects in the portfolio as expected. The only significant negative correlation found is between the use of financial methods and the ability of the new product program to bring the company into new product arenas. Further analysis of the relationship and the actual methods used may reveal more about this relationship. It is possible that the design of established financial methods undervalue opportunities in new product arenas, and therefore the resulting decisions negatively affect performance in this area.

Although financial measures are a part of most PPM processes, this research indicates that financial methods may not be the best dominant portfolio method to use. This finding reinforces earlier findings that expose some of the weaknesses of financial methods (Cooper *et al.*, 2001, Ozer, 2002). Sophisticated financial tools can make financial analysis seem rigorous, but the data required to use the tools can be unreliable.

Financial data is usually not very accurate at the stage where new product project portfolio decisions must be made, and may be skewed by optimism or enthusiasm.

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