

Manuscript for: Killen C P, Hunt R A and Kleinschmidt E J (2008), “Project portfolio management for product innovation”, *International Journal of Quality and Reliability Management*, Volume 25, issue 1, January, pages 24-38.

Project portfolio management for product innovation

Catherine P. Killen
Faculty of Engineering, University of Technology Sydney (UTS)
PO Box 123, Broadway 2007, Australia
c.killen@uts.edu.au

Robert A. Hunt
Macquarie Graduate School of Management, Macquarie University 2109, Australia
robert.hunt@gsm.mq.edu.au

Elko J. Kleinschmidt
DeGroot School of Business, McMaster University, Hamilton, ON, Canada
kleinsc@mcmaster.ca

Research Paper

KEYWORDS: Project Portfolio Management, Innovation, New Product Development (NPD), Service Development, Service product, NPD program outcome

ABSTRACT

Purpose

To create a benchmark and identify best practices for Project Portfolio Management (PPM) for both tangible product-based and service product-based development project portfolios.

Design

A questionnaire was developed to gather data to compare the PPM methods used, PPM performance, PPM challenges, and resulting new product success measures in sixty Australian organisations in a diverse range of service and manufacturing industries.

Findings

PPM practices are shown to be very similar for service product development project portfolios and tangible product development project portfolios. New product success rates show strong correlation with measures of PPM performance and the use of some PPM methods is correlated with specific PPM performance outcomes.

Research Limitations/Implications

The findings are based on a survey of a diverse sample of sixty Australian organisations. The results are strengthened by comparisons with similar North American research, however may not be representative of all environments. Research in other regions would further qualify the findings. As each organisation's PPM process is unique, case study methods are recommended for future studies to capture more of the complexity in the environment.

Practical Implications

PPM practitioners and executives who make decisions about the development of tangible products and/or service products will benefit from the findings.

Value

This study extends the existing understanding of PPM practices to include service development project portfolios as well as tangible product development project portfolios and strengthens the links between PPM practices and outcomes.

INTRODUCTION

Innovation project portfolio management (PPM) is of growing importance in a world of global competition where organisational survival increasingly depends upon a steady stream of successful new products. Innovation is now understood to be the main driver of economic growth in developed nations (OECD, 2000, DITR, 2003). Therefore the importance of maximising outcomes from innovation project portfolios is escalating. 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 organisational 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). PPM methods aim to improve product success rates by ensuring that a strategically aligned portfolio of innovation projects is maintained. According to PPM literature, to provide the best value to the organisation, the portfolio must contain a balance of project types and risk levels and the number of projects must be limited to ensure that all projects can be resourced effectively, but sufficient to enable an adequate flow of projects and new product introductions. 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 and Kleinschmidt, 2001, Matheson and Matheson, 1998), however empirical research in this area is limited (Killen, Hunt and Kleinschmidt, 2007). 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 organisations (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 (De Reyck *et al.*, 2005, Morris and Pinto, 2004). While the bulk of innovation PPM research focuses on the development of 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 that provides a benchmark of PPM practices in Australia that is comparable to previous North American research (Cooper, *et al.* 2001). The research team includes a member of the North American team ensuring continuity and comparability of the results. The PPM findings presented provide a significant contribution to current PPM knowledge by including service products as well as tangible products in the study. The Australian study also extends the earlier research by exploring more deeply the relationship between the PPM methods used and new product success measures.

The main research questions posed in this project are:

How do PPM practices for service product development project portfolios compare with PPM practices for tangible product development project portfolios?

Is new product success related to the methods used for PPM?

What are the main challenges to organisations in managing their portfolios?

BACKGROUND and RESEARCH HYPOTHESES

Portfolio Management for Tangible Products and Service Products

Although innovation research has traditionally focused on the processes involved with tangible products, service innovation has become increasingly important and now makes a larger contribution to developed economies (Pilat, 2000). Services are generally distinguished from tangible products by simultaneity of consumption and production of the service and the intangible nature of services (Cooper and Edgett, 1999, Menor, Tatikonda and Sampson, 2002, Oden 1997). Many innovative sections of the service sectors are growing rapidly and an increasing percentage of total organisational R&D expenditure is now dedicated to service innovation (Edwards and Croker, 2001). About two-thirds of GDP growth in OECD businesses between 1985 and 1997 was a result of the increases in the service sector (Pilat, 2000).

The research on innovation in services has escalated in recent years reflecting the increasing importance of services. Most of this research focuses exclusively on service innovation, however it is becoming increasingly clear that many organisations manage a portfolio of a mixture of both tangible and service products (Andersson, 2000, Slack, Chambers and Johnson, 2004). Therefore studies that include both services and tangible products are necessary to better understand the current innovation environment. In addition, the distinctions between tangible product- and service product-based organisations are becoming blurred (Andersson, 2000, Barras, 1990, Slack *et al.*, 2004). Some studies rate products on a ‘goods-services’ continuum to reflect the blending of the two ends of the spectrum (Shostack, 1982).

Most service innovation research focuses on the individual service product development project level (de Brentani, 1991, Cooper and de Brentani, 1991, Griffin, 1997), with only minimal attention to portfolio management (Cooper and Edgett 1999, Menor *et al.*, 2002). It has been shown that service-based organisations are at a lower level of maturity with respect to individual new product development processes (Griffin, 1997), and that many elements of the development process were first designed for the tangible new product development (NPD) environment and subsequently adapted to the service product development environment (Easingwood, 1986, Griffin, 1997, Killen *et al.*, 2006). The more recent application of many NPD tools to service development may explain the lower level of the maturity of the service-based NPD applications. Because PPM for services is a fairly recent concept, it is hypothesised that PPM methods will follow the NPD trend and be less mature among service-based organisations than among tangible product-based organisations. It is hypothesised that:

H1: the PPM processes in service product-based organisations are less mature than the PPM processes in tangible product-based organisations.

PPM Performance Measurements and New Product Success

It is often asserted that the introduction of a formal PPM process is a key factor for project success (Wideman, 2005, Cooper *et al.*, 2001). 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 best metrics for one type of development activity may not be appropriate for others (Hauser and Zettelmeyer, 1997) making it difficult to establish standard innovation project metrics. In addition, the measurement of innovation success can be difficult due to the complexity of the environment and the unique set of challenges faced by each industry (Mikkola, 2001).

Due to these challenges, this research project measures innovation success through a range of metrics on both the PPM process (through 'PPM performance measures') and outcomes (through 'new product success measures'). Success of the PPM process is measured by 'PPM performance measures' that assess the process with respect to the main goals for the PPM process (Cooper *et al.*, 2001). The main goals for a PPM process are generally agreed to be: to maximise the financial value of the portfolio, to ensure balance among projects, to limit the number of projects to fit with organisational capacity, and to ensure that the portfolio reflects the business's strategy (Cooper and Edgett 2003, Dawidson, 2004). Three 'new product success measures' (derived from Brown and Eisenhardt, 1995) are used to assess the outcomes of the portfolio of new product projects: the percentage of launched products that are successful by company assessment criteria, the level of profit and the level of revenue from new products (products introduced in the past three years). The earlier North American study assesses 'PPM performance measures' with the assumption that good performance on these measures will lead to success, but does not include data on final product outcomes through 'new product success measures'. The Australian research study tests this assumption by including both types of performance measures. It is hypothesised that the research will reveal a positive relationship between the two types of success measures:

H2: 'PPM performance measures' correlate positively to 'new product success measures'.

PPM Methods and outcomes

There are many PPM methods that are used to assist with strategic decision-making, risk evaluation, and resource allocation for both new and ongoing projects. Financial analysis is almost always one of the tools used for project portfolio selection and management, and many different financial methods have been developed (for examples see Hatfield, 2002, Ringuest,

Graves and Case, 1999, Faulkner, 1996). Other commonly used PPM tools include scoring models and checklists, strategic approaches, and mapping approaches (Cooper *et al.*, 2001, Mikkola, 2001). Some early PPM methods attempted to develop formulaic solutions through mathematical models and optimisation techniques; however these are not widely used due to the complex nature of the environment (Coldrick, Longhurst, Ivey and Hannis, 2005). PPM experts now recognise that there is not any single model or PPM tool that will suit all situations. Hybrid or composite approaches are popular – these encompass a variety of tools and methods that can be combined as needed (Coldrick *et al.*, 2005, Cooper *et al.*, 2001). This research project aims to improve the understanding of the relationships between methods and outcomes to help guide management in selecting appropriate PPM tools. It is hypothesised that certain PPM methods lead to specific outcomes, in particular that:

H3_a: the use of financial methods results in higher value projects in the portfolio.

H3_b: the use of strategic methods results in better alignment of the projects in the portfolio with business strategy, and with spending better reflecting strategy.

H3_c: the use of portfolio mapping methods results in better balance in the portfolio.

PPM Challenges

Although this research focuses primarily on PPM practices, it is recognised that the environment is complex and that successful outcomes are dependent upon many factors. The literature outlines a variety of challenges for PPM including gaining senior management support and commitment (Kendall and Rollins, 2003, Levine 2005), achieving a portfolio vision across the projects (Wheelwright, 1992 McDonough, 2003), obtaining appropriate data for PPM (Wideman, 2004, Martino, 1995), and finding enough time to implement PPM (Vähäniitty, 2006, Lawson, Longhurst and Ivey, 2006). To capture the most significant PPM challenges Australian organisations are currently facing, the following research question is included in this study without proposing a hypothesis:

RQ1: What are the most significant PPM challenges that organisations face?

RESEARCH DESIGN and METHOD

In order to test the hypotheses H1, H2, and H3_{abc} and to collect data on RQ1, 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 Australia. A portion of the survey draws upon the earlier surveys used by Cooper *et al.* (2001) in North America and the results from the common portions of the new survey are directly compared with the North American data. The Australian survey is also significantly extended and addresses two emerging challenges for managing a portfolio of new product projects. One challenge is to better understand service product PPM and how it compares to tangible product PPM and the other is to find ways to better measure the effectiveness of PPM methods.

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 2005. The survey contains eighty-eight questions (some with sub-questions) on the importance of PPM to the organisation, PPM structures in the organisation, 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 email 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. The median size of the responding organisations is USD 94 million.

FINDINGS and HYPOTHESIS TESTING

There are no significant differences between the large majority of the PPM methods and outcomes in North America and Australia based on the responses to the common portions of the survey. Statistical significance is based on two-tailed significance values of less than 0.05 for a comparison of means of independent samples unless otherwise noted. The high level of similarity between responses in the two regions indicates that the insights gained from the Australian survey are likely to be applicable to North America and possibly other developed nations (Hofstede, 1997, Killen *et al.*, 2006).

Surveys from both regions include organisations spread across many different industry groups. The North American survey includes data from 205 organisations that focus on tangible products. The Australian survey includes data from sixty organisations that produce tangible or service products or a combination of both. To capture the blurring of the distinction

between tangible and service products, each organisation was asked to indicate whether their new product portfolios includes only service products, only tangible products or a mix represented on a sliding scale from one to ten (Shostack, 1982, Slack *et al.*, 2004). The sixty Australian organisations participating in the survey represent an even split between predominantly tangible product-based organisations and predominantly service product-based organisations. Innovation project investment levels are similar for tangible product-based organisations in both the North American and Australian studies. More detail of the benchmark respondents and results is available in the research working paper (Killen *et al.*, 2005).

H1: Differences in PPM processes between tangible product and service product development portfolios

There are many more similarities than differences between the PPM practices used for tangible product- and service product-based organisations. There are some significant differences in the project portfolio profiles: service product-based organisations invest a higher percentage of their revenue in the development of new products (8.7 percent of turnover compared to 5.3 percent for tangible product development) while tangible product-based organisations report significantly more profit generated from new products (twenty-eight percent compared to thirteen percent for service product-based organisations); and tangible products take longer to develop than service products (seventeen months versus eight months).

Despite these differences in the project portfolio profiles, the number and types of methods used and correlations between methods and performance are very similar for both tangible product- and service product-based organisations. The only statistically significant areas of PPM practice difference relate to teamwork. Decision-making processes are more likely to be performed in a group or management meeting and are more likely to involve the use of portfolio maps in tangible product-based organisations. These differences may be influenced by the fact that the development of tangible products often requires input from more disciplines than service product development. One of the primary aims of portfolio maps is to aid group decision-making by providing a display of the projects in relationship to factors that need to be balanced. Therefore it follows that when more decisions are made in groups, as they are in tangible product organisations, it would be appropriate for portfolio maps to be used more often.

Tangible product-based organisations have longer-established PPM methods than service-based organisations; however the evidence from this study suggests that the portfolio management processes are just as mature. PPM maturity is measured by the degree of

formality of the process, the level of integration of projects into a portfolio for decision-making, PPM performance measurements, and the number and types of methods used (Kahn, Barczak and Moss, 2006, Notargiacomo, 2006). No significant differences in PPM maturity are found between tangible product- and service product-based organisations in this study. Therefore this research study does not provide support for hypothesis H1. The PPM processes used by service product-based organisations are *not* less mature than the PPM processes in tangible product-based organisations.

H2: PPM Performance and New Product Success

Respondents in both the Australian and North American studies 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.	3.3
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.	3.2
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.	3.0
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.	2.9
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 1. These results from the Australian responses are nearly identical to results from the North American survey (Cooper *et al.*, 2001). Although some organisations score highly on these measures, the average performance levels leave much room for improvement. Lowest performance in both regions is for ‘Portfolio has the right number of projects’, reinforcing the emphasis on this problem in the literature.

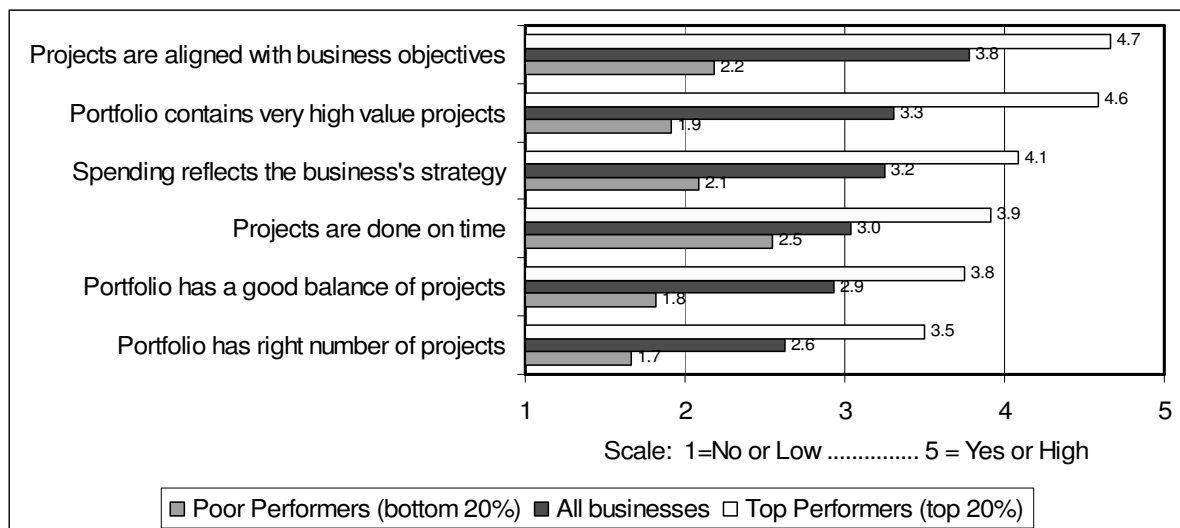


Figure 1: Portfolio performance results on six key metrics
 Performance metrics are ordered by mean scores,
 Significance level between top and bottom performers (.001)

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 Australian survey were asked to provide information on three new product success measures. Australian organisations 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 correlation at 0.000). This relationship is displayed in Figure 2 using the clustering of results for the ‘top’, ‘poor’ and ‘all/average’ PPM performance categories as defined for Figure 1. New product success is twice as likely in organisations that are ‘top’ PPM performers than in ‘poor’ PPM performers.

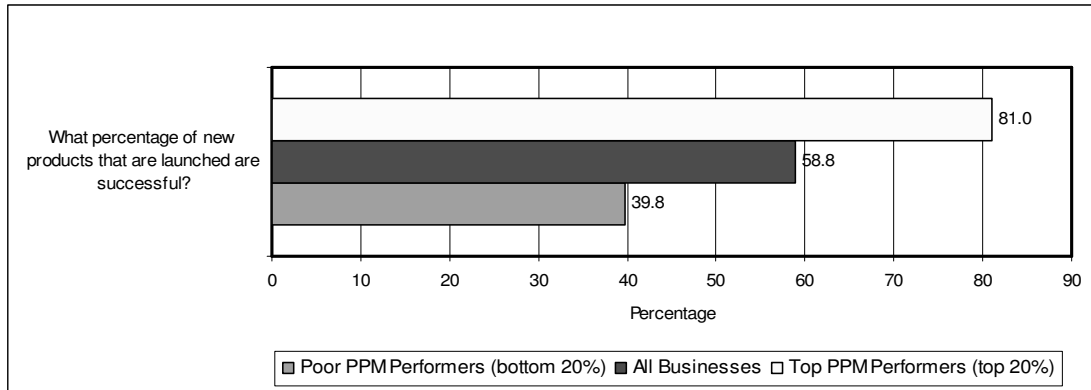


Figure 2: New product success rates in for PPM performance level.
 (0.630 Pearson correlation at 0.000 significance between percentage of successful products and PPM performance level)

The new product success rate findings provide strong support for hypothesis H2: that PPM performance measures correlate to new product 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 H2 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.

H3_{abc}: PPM Methods and Portfolio Performance Measures

Methods used for PPM are analysed 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 three most common methods used are financial, business strategy and portfolio maps. 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, business strategy and portfolio mapping methods also show a

significant relationship (0.05 or better) with one or more of the four additional ‘portfolio opportunity measures’ collected for the Australian 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 hypothesised in H3_a. Therefore hypothesis H3_a is not supported by this research. 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 Australian 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. Hypothesis H3_b, that 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.

Portfolio Maps are used by only twenty-five percent of the Australian organisations surveyed. The data on portfolio performance indicates a positive correlation between the use of portfolio maps and four performance measures relating to balancing the portfolio, developing existing technologies and technological competencies, alignment with strategic objectives, and the portfolio containing high value projects. Therefore, hypothesis H3_c, that the use of portfolio mapping methods results in better balance in the portfolio, is also strongly supported.

Challenges for PPM

Open-ended questions allowed respondents to highlight any PPM challenges facing their organisations. The majority of responses reinforce challenges highlighted throughout the PPM literature. Many respondents mention the need for a “central, well-communicated, formal process” and the need for “the support or buy-in for the PPM process from all relevant areas and levels of the organisation”. Shortages of time and resources make it difficult for many organisations to implement PPM. The need for the portfolio to reflect strategy is also a common challenge, and several respondents highlight the challenges associated with long-term strategy and long-term vision. Methods that link long-term planning and strategy with portfolio decisions are felt to be lacking or poorly understood, highlighting an area not well covered in the literature and suggesting an area for further research. The survey method only allows brief descriptions of the challenges to be captured and a deep understanding of the interrelationships between PPM practices, outcomes and other factors is beyond the scope of this research project. To fully understand the complexity of the environment, a case study method would be appropriate (Dawidson, 2004, Voss, Tsikriktsis and Frohlich, 2002, Yin, 2003)

CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Five hypotheses have been tested and the results are summarised in Table II.

Table II: summary of research hypotheses and findings

Hypothesis	Findings
H1: the PPM processes in service product-based organisations are less mature than the PPM processes in tangible product-based organisations.	Not supported
H2: PPM performance measures correlate positively to new product success measures.	Supported
H3a: the use of financial methods results in higher value projects in the portfolio.	Not supported
H3b: the use of strategic methods results in better alignment of the projects in the portfolio with business strategy, and with spending better reflecting strategy.	Strongly supported
H3c: the use of portfolio mapping methods results in better balance in the portfolio.	Strongly supported

PPM practices for tangible product- and service product-based organisations are surprisingly similar and the level of PPM maturity is similar even though the service-based organisations are generally newer to PPM. The similarities between responses from Australian and North American organisations and between tangible product- and service product-based organisations indicate that PPM practices may be fairly universal and that management may find value in adopting PPM practices from different environments. 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. However, keeping in mind the size of the data sample and the diverse range of industries represented, further research will be required to more fully understand the relationship.

Strategic methods and portfolio maps 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.

PPM challenges highlighted in the survey reinforce many of the challenges commonly discussed in the literature. The need for better methods to link long-term planning with project portfolio decisions is highlighted by several respondents, and represents an area under-explored in existing literature.

FUTURE RESEARCH

This research project provides a base for further research in an area of growing importance – service product PPM. PPM for services is an emerging area where very little research has been conducted. As services are becoming more important to the economies of developed nations, further research in this area presents many opportunities to extend the understanding of the

practices and relationships initially explored in this research project.

The links between PPM methods and outcomes presented in this paper could be further qualified and better understood through further research. In-depth case study analyses or studies that focus on a particular industry may assist in improving understanding of PPM relationships (Dawidson, 2004). In-depth case study research could also help to improve understanding and develop capability in methods to link long-term strategy and vision with current operations.

Finally, this research project provides the first study into PPM practices in Australia. Initial indications are that PPM practices in Australia and North America are comparable and that the findings from each region should be applicable to the other. Future cross-cultural studies or international PPM comparisons will be useful to clarify or strengthen this understanding, and could also investigate relationships between PPM practices in other regions.

References

- Adams-Bigelow, M. (2006), "Rejoinder to 'Establishing an NPD best practice framework'", *Journal of Product Innovation Management*, 23:117-119.
- Andersson, T. (2000), "Report of conclusions of the innovation in services workshop", Sydney, Australia, November 2.
- Barras, R. (1990) "Interactive innovation in financial and business services: The vanguard of the service revolution", *Research Policy*, 19 (3), 215-237.
- Brown, S.L. and Eisenhardt, K.M. (1995) "Product development: Past research, present findings, and future directions", *Academy of Management Review* 20 (2), 343-378.
- Coldrick, S., Longhurst, P., Ivey, P. and Hannis, J. (2005), "An R&D options selection model for investment decisions", *Technovation* 25, 185-193.
- Cooper, R.G. (2005), "Section 7: PPM applications: New product development", in Levine, Harvey A., *Project portfolio management: a practical guide to selecting projects, managing portfolios, and maximizing benefits*, John Wiley and Sons, Inc, San Francisco.
- Cooper, R.G. and de Brentani, U. (1991), "New industrial financial services: What distinguishes the winners", *Journal of product innovation management*, 8 (2), 75-90.
- Cooper, R.G. and Edgett, S.J. (1999), *Product development for the service sector: Lessons from market leaders*, Perseus Press, Cambridge Mass.
- Cooper, R.G. and Edgett, S.J. (2003), "Overcoming the crunch in resources for new product development", *Research Technology Management*, 46, 3, May-June 2003, 48-58.
- Cooper, R.G., Edgett, S.J. and Kleinschmidt, E.J. (2001), *Portfolio management for new products*, 2nd ed, Perseus Press, Cambridge Mass.
- Dawidson, O. (2004), "Expectations to be fulfilled by R&D Project Portfolio Management", *Proceedings of the EIASM Product Development Management Conference*, Dublin, June 20-22, 331-346.
- de Brentani, U. (1991), "Success factors in developing new business services", *European journal of marketing*, 25 (2), 33-59.
- De Reyck, B., Grushka-Cockayne, Y., Lockett, M., Calderini, S.R., Moura, M. and Sloper, A. (2005),

- “The impact of project portfolio management on information technology projects”, *International Journal of Project Management*, 23 (7), 524-537.
- DITR (2003), “Mapping Australian Science and Innovation – Main Report”, Department of Industry, Tourism and Resources, November 2003.
- Dye, L.D. and Pennypacker, J.S., Eds. (1999), *Project Portfolio Management: Selecting and Prioritising Projects for Competitive Advantage*, Center for Business Practices, Havertown PA.
- Easingwood, C.J. (1986), “New product development for service companies”, *Journal of Product Innovation Management*, 4, 264-275.
- Edwards, M. and Croker, M. (2001), “Chapter 1: Major trends and issues”, *Innovation and productivity in services*, OECD publications service, Paris, France, Industry, Services & Trade, 2001 (33), 7-16.
- Faulkner, T.W. (1996), “Applying ‘options thinking’ to R&D valuation”, *Research Technology Management* 39 (3), 50–56.
- Griffin, A. (1997), “PDMA research on new product development practices: Updating trends and benchmarking best practices”, *Journal of Product Innovation Management*, 14 (6), 429-458.
- Hatfield, G.R. (2002), “R&D in an EVA world”, *Research Technology Management*, 45 (1), 41 – 47.
- Hauser J. and Zettelmeyer, F. (1997), “Metrics to evaluate R,D&E”, *Research Technology Management*, 40 (4), 32-38.
- Hofstede, G. (1997), *Culture and organisations: Software of the mind 2ed.*, McGraw-Hill, New York.
- Kahn, K.B., Barczak, G. and Moss, R. (2006), “Perspective: Establishing an NPD best practices framework”, *Journal of Product Innovation Management*, 23,106-116.
- Kendall, G.I. and Rollins, S.C. (2003), *Advanced project portfolio management and the PMO: Multiplying ROI at warp speed*. 2003, Boca Raton, FL.: J. Ross Publishing.
- Killen, C.P., Hunt, R.A. and Kleinschmidt, E.J. (2005), “MGSM Working Papers in Management: Portfolio Management Practices in Australia”, *Macquarie Graduate School of Management Working Paper Series – WP 2005-10*, available at www.mgsm.edu.au.
- Killen, C.P., Hunt, R.A. and Kleinschmidt, E.J. (2006) “Innovation portfolio management: relating practices to outcomes”, *Proceedings of the 13th International Product Development Management (PDMA) conference*, Milan, 11-13 June, 2006.
- Killen, C.P., Hunt, R.A. and Kleinschmidt, E.J. (2007) “Managing the New Product Development Project Portfolio: A Review of the Literature and Empirical Evidence”, *Proceedings of the Portland International Conference on Managing Engineering and Technology (PICMET)*, Portland, 5-9 August, 2007.
- Lawson, C.P., Longhurst, P.J. and Ivey, P.C. (2006), "The application of a new research and development project selection model in SMEs". *Technovation*, vol. 26(2), pp. 242-250.
- Levine, H.A. (2005), *Project portfolio management : A practical guide to selecting projects, managing portfolios, and maximizing benefits*, Jossey-Bass, San Francisco.
- Martino, J.P. (1995), *Research and development project selection*, Wiley, New York.
- Matheson, D. and Matheson, J. (1998), *The smart organisation: Creating value through strategic R&D*, Harvard Business School Press, Boston.
- McDonough III, E.F. and Spital, F.C. (2003), "Managing project portfolios". *Research Technology Management*, vol. 46(3), pp. 40.
- Menor, L.J., Tatikonda M.V. and Sampson S.E. (2002), “New service development: areas for exploitation and exploration”, *Journal of Operations Management*, 20 (2), 135-157.
- Mikkola, J.H., (2001), “Portfolio management of R&D projects: Implications for innovation management”, *Technovation* 21 (4), 23-435.

- Morris, P.W.G. and Pinto, J.K., Eds. (2004), *The Wiley guide to managing projects*, John Wiley and Sons, Hoboken, NJ.
- Notargiacomo, R. (2006), "Rejoinder to 'Establishing an NPD best practices framework'", *Journal of Product Innovation Management*, 23, 123-124.
- Oden, H.W. (1997), *Managing corporate culture, innovation and intrapreneurship*, Quorum books, Westport Connecticut.
- OECD (2000), "A New Economy?", *The Changing Role of Innovation and Information Technology in Growth*, Organisation for Economic Co-operation and Development, Paris.
- Ozer, M. (2002), "What do we know about new product idea selection?", Center for Innovation Management Studies (CIMS), Raleigh, NC.
- Pilat, D. (2000), "No longer services as usual", *OECD Observer* No 223, November.
- PMI (2006), *The Standard for Portfolio Management*, Project Management Institute, Inc., Newtown Square, PA.
- Ringuest, J.L., Graves, S.B. and Case, R.H. (1999), "Formulating R&D portfolios that account for risk", *Research Technology Management*, 42 (6), 40-43.
- Slack, N., Chambers, S. and Johnson, R. (2004), *Operations management*, Pearson Education Ltd, Harlow, England.
- Shostack, G.L. (1982), "How to design a service", *European Journal of Marketing* 16 (1) 49-63.
- Tidd, J., Bessant, J. and Pavitt, K. (2005), *Managing innovation: Integrating technological, market and organisational change, 3rd Ed*, John Wiley and Sons, Chichester.
- Vähäniitty, J. (2006), "Do small software companies need portfolio management?" in *13th International Product Development Management Conference*, European Institute for Advanced Studies in Management, Milan, Italy.
- Voss, C., Tsiriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, 22 (2), 195-219.
- Wheelwright, S.C. and Clark, K.B. (1992), *Revolutionizing product development : Quantum leaps in speed, efficiency, and quality*, Free Press, New York.
- Wideman, R.M. (2004), *A management framework for project, program and portfolio management*, Trafford Publishing, Victoria B.C.
- Wideman, Max, (2005), "Foreword" in Levine, Harvey, A., *Project portfolio management: a practical guide to selecting projects, managing portfolios, and maximizing benefits*, John Wiley and Sons, Inc, San Francisco.
- Yin, Robert K (2003), *Applications of case study research* 2nd ed, Sage Publications, Thousand Oaks, CA.