Project portfolio management for product innovation in service and manufacturing industries

By

Catherine P Killen

Bachelor of Science in Mechanical Engineering (BSME),
Master of Engineering Management (MEM)

A thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy (PhD)

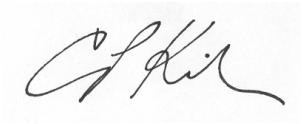
Macquarie University
Sydney, Australia

December 2008

Certification

This thesis is submitted in fulfilment of the requirements of the degree of PhD, in the Macquarie Graduate School of Management, Macquarie University. This represents the original work and contribution of the author, except as acknowledged by general and specific references.

I hereby certify that this has not been submitted for a higher degree to any other university or institution.



Catherine P Killen
10 December 2008

Abstract

This research examines the relationship between innovation project portfolio management (IPPM) capabilities and competitive advantage. Innovation projects – or projects for the development of new products – are of escalating importance in an increasingly competitive, globalised and deregulated environment characterised by shortening product lifecycles and dynamic markets. IPPM capabilities aim to improve the success rates for product innovation activities by providing a holistic and responsive decision-making environment to maximise the long-term value of innovation investments across the portfolio of innovation projects. This research takes a wide view and investigates the overall organisational capability for the management of the innovation project portfolio.

Successful product innovation is no longer primarily a concern of manufacturing-based industries – product development in service industries is a growing endeavour in an increasingly important industry. Therefore this research includes service product development environments and is the first to extend beyond the traditional manufacturing industry base for IPPM research. This is also the first study to investigate IPPM capabilities in Australia.

A pragmatic perspective guides a two-phase study encompassing a quantitative survey and a qualitative multiple-case study, the combination of methods providing a deeper level of understanding than could be achieved by either method alone. Findings support prior IPPM studies and suggest a positive relationship between structured IPPM capabilities and improved new product outcomes. The research highlights similarities and differences between service and manufacturing environments, and suggests future challenges will result from the increasing blurring of the boundaries between service and manufacturing industries. This research adopts a 'dynamic capabilities' perspective and draws on organisational learning theory to investigate the path-dependent nature of IPPM capability development. It adds to the understanding of how IPPM capabilities work with the resource base and contribute to competitive advantage. The findings of the research are presented in a maturity model and several conceptual models, and areas for future research are identified.

Contents

List of figures

List of tables

List of appendices

Abbreviations used in thesis

CMM	Capability Maturity Model
DSS	Decision Support System
IMP	Importance (of IPPM)
IP	Intellectual Property
IPPM	Innovation Project Portfolio Management
IT	Information Technology
MAT	Maturity (of IPPM)
METH	Method (used in IPPM process)
NPD	New Product Development
NPP	New Product Performance
NSD	New Service Development
OLMM	Outcomes and Learning-based Maturity Model (for IPPM)
OPP	Opportunity (product opportunity effectiveness)
PM	Project Management
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PPM	Project Portfolio Management
PPO	Product Portfolio Outcome
PPP	Processes, Positions, Paths
PRB	Portfolio Review Board
R&D	Research and Development
RBV	Resource Based View
S-C-P	Structure-Conduct-Performance
SEI	Software Engineering Institute
SME	Small to Medium Enterprise
VRIN	Valuable, Rare, Inimitable, Non-substitutable
VRINE	Valuable, Rare, Inimitable, Non-substitutable, Exploitable
VRIO	Valuable, Rare, Inimitable, Organisational capability to exploit resources

Glossary

Ambidexterity

The ability of an organisations to perform both exploitation and exploration activities and to balance these types of activities effectively.

Capabilities

A specific type of organisational resource that enables the organisation to deploy other resources to perform activities that result in desired outcomes.

Competitive advantage

Competitive advantage is achieved through a capability to gain better returns than competitors (such as from investments in innovation projects) - creating more value than competitors are able to achieve.

Dynamic capability

A particular type of organisational capability that enables organisations to be responsive to the dynamic environment and is a source of sustainable competitive advantage through its ability to effectively deploy, integrate and build other organisational capabilities and resources in dynamic environments.

Effective IPPM capability

An IPPM capability that leads to improved product portfolio outcome (PPO) measures.

Establishment mode (of IPPM capability development)

The establishment mode is defined in this thesis as the type of capability development that occurs when an organisation explicitly recognises the need to acquire or re-design an IPPM capability and engages deliberate actions towards this end. Strong establishment activity often signifies the initial introduction of the capability to the organisation; however, it can also signify a major change in the capability that involves a rebuilding or replacement of the main elements of the capability.

Evolution mode (of IPPM capability development)

The evolution mode is defined in this thesis as the type of capability development that involves adjustments and improvements within an existing IPPM capability framework. The 'evolution mode' may involve unintentional capability evolution, or purposeful evolution where the capability is monitored, evaluated, modified and adjusted as required.

Experience accumulation

Tacit learning mechanism where experiences drive learning, often through trial and error.

Exploitation trap

See 'Success trap'.

Exploitation / Exploitation projects

Exploitation processes use existing resources and processes. Exploitation projects are generally short-term projects that develop incremental changes to products. Exploitation projects are relatively low risk projects.

Exploration / Exploration projects

Exploration processes involve extending beyond established capabilities and developing new capabilities and processes to perform unfamiliar tasks. Exploration projects are generally long-term projects that develop radical or breakthrough innovation. Exploration projects are generally high risk, have lower levels of success than exploitation projects, but have the potential to gain high returns.

Industry type

Organisations are classified into two industry types for this research – either 'service-based' or 'manufacturing-based' industry types.

Innovation project

Projects for the development of any type of new product. These can be new manufactured products, new service products or new products that comprise a combination of manufactured and service elements.

Innovation project portfolio

An innovation project portfolio is defined in this thesis as a collection of innovation projects that are managed centrally to meet strategic business objectives.

IPPM capability

An IPPM capability is defined in this thesis as the overall organisational ability to manage the innovation project portfolio and maximise its contribution to the success of the organisation. The IPPM capability includes IPPM processes as well as organisational factors that contribute to the IPPM capability.

IPPM process

The policies, practices, activities, procedures, methods and tools that managers use for ongoing resource allocation and reallocation among a portfolio of innovation projects to maximise the contribution of projects to the overall welfare and success of the enterprise.

Knowledge articulation

Explicit learning mechanism where learning is enhanced by articulation activities such as meetings, discussions, seminars and training or educational sessions.

Knowledge codification

Explicit learning mechanism where learning is codified through documentation activities or through development of information capture and codification procedures.

Manufactured product

Manufactured products or physical goods that are primarily presented to customers in a tangible form.

Manufacturing-based organisation, manufacturing organisation, manufacturing industry

An organisation or industry that is primarily concerned with the development and delivery of manufactured products.

New product performance (NPP)

The performance of new products in the market, through measures such as profit, market share or success rates.

Product

Any developed offering that is available to customers. This includes both manufactured (or tangible) products and service-based (intangible) products, or products that include both tangible and intangible components.

Product portfolio outcome (PPO)

Product portfolio outcomes (PPO) are defined in this thesis as the product-based outcomes from the innovation project portfolio. PPO measures indicate the level of success of the new products resulting from the innovation portfolio. PPO measures include individual and portfolio-level measures of project success. Most PPO measures are based on meeting financial, market or technical objectives. Three types of PPO measures are included in this study: measures of performance on IPPM goals, measures of the effectiveness of the resulting products in

exploiting market or technology-based opportunities (OPP measures), and measures of new product performance (NPP measures) in the market.

Service product or 'service'

Products that are service offerings, or services that consumers can purchase. Services are defined by intangibility and simultaneity of production and consumption.

Service-based organisation, service organisation, service industry

An organisation or industry that is primarily concerned with the development and delivery of service products.

Stage-Gate process

Product development or project management process with defined stages and decision points (or gates) between the stages (as shown in Figure 2-3).

Success factors (for NPD or IPPM capabilities)

The factors that are associated with the development of successful products or portfolios of products.

Success trap

The 'success trap' is a situation where exploitation project success leads to an imbalance in the project portfolio, with too many exploitation projects and too few exploration projects. The imbalance is caused by an unintentional evolution of decision-making processes due to the fact that decisions to allocate resources to exploitation projects provide more frequent and rapid positive feedback to decision-makers than decisions to allocate resources to exploration projects. As a result, decision-making tends to favour short-term, incremental or low-risk 'exploitation' projects, at the expense of the more radical, breakthrough longer-term 'exploration' projects.

Sustainable competitive advantage

Competitive advantage that is enduring (long-lasting) and is not copied by competitors or rendered obsolete.

Acknowledgments

My supervisor, Associate Professor Bob Hunt has been a source of inspiration and motivation throughout this process – thank you, Bob for all your advice, and for encouraging me to explore and develop my ideas. I also want to thank my colleague and mentor Professor Elko Kleinschmidt whose interest and support has greatly assisted this project – Elko, you have been a much appreciated and valued sounding board throughout the process of this research. I am also grateful to Alison Basden for her efficient and expert assistance as a professional editor – many thanks, Alison, for so ably sharing the benefit of your experience to smooth this final path. I am fortunate to have had such a great supporting team.

Special thanks to the managers and organisations that have supported and contributed to this research – I have learned so much from you, and I greatly appreciate your interest and enthusiasm and the time you have invested in this project. To the members of the project portfolio management special interest group – thank you for your ongoing interest, feedback and support. Forming this community of practitioners has been an enjoyable, valuable and rewarding outcome of this research process.

Finally, I thank and acknowledge the family that has lived this process with me and supported me along the way: my husband Phil, and children Annabel and James. Thank you all for your patience and support – particularly Phil who has had to endure a household of students with their associated exams and deadlines. I also want to express my gratitude to my parents, William and Barbara Patterson, who taught me to value honesty and encouraged me in all my pursuits.

Publications based on this research

Dissemination of this research has followed a strategy designed to reach the wide range of audiences with interest in the topic and to gain their feedback to help shape the ongoing enquiry. Preliminary findings from this research have been disseminated in both academic and practitioner-oriented publications, as detailed below and through a number of practitioner-oriented conferences and seminars, outlined in section 7.4 in Chapter 7. The publications include two articles in refereed journals, a book chapter and several refereed conference proceedings.

Refereed journal articles

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

This journal article documents the first phase of the research, including analysis of the benchmark findings and differences between IPPM capabilities in Australia and North America and between service and manufacturing environments.

Killen, C P, Hunt, R A and Kleinschmidt, E J (2008) Learning investments and organisational capabilities: Case studies on the development of project portfolio management capabilities. *International Journal of Managing Projects in Business* 1 (3), 334-351.

This journal article presents findings from Phase 2 on learning investments and capability evolution and extends upon the work reported in this thesis.

Edited book chapter

Killen, C P, Hunt, R A and Kleinschmidt, E J (2008) The human factor in innovation project portfolio management, in *Inside the innovation matrix: finding the hidden human dimensions.* Australian Business Foundation (ed.), North Sydney, Australian Business Foundation Limited, pp. 158-176.

This book chapter in a practitioner-focused publication outlines the range of human factors that play a role in IPPM capabilities. As an extension of the work reported in this thesis, it addresses these aspects in detail.

Refereed conference papers

Killen, C P, Hunt, R A and Kleinschmidt, E J (2006) Benchmarking Innovation Portfolio Management Practices: Methods and Outcomes. *Proceedings of the International Association of the Management of Technology Conference*, Beijing, China, 22–26 May.

Findings of Phase 1 of the research detailing the comparison between North American and Australian findings from the quantitative survey.

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 Conference*, Milan, Italy, European Institute for Advanced Studies in Management (EIASM), 11–13 June.

Findings of Phase 1 of the research, including the analysis of differences between IPPM capabilities in service and manufacturing product development environments.

Killen, C P, Hunt, R A and Kleinschmidt, E J (2006) Project Portfolio Management and Enterprise Decision Making: Benchmarking Practices and Outcomes. *Proceedings of the 11th Annual Conference of Asia Pacific Decision Sciences Institute*, Hong Kong, 14–18 June.

Findings of Phase 1 of the research, highlighting the decision-making aspects of IPPM capabilities and reviewing the literature related to IPPM and decision-making capabilities.

Killen, C P, Hunt, R A and Kleinschmidt, E J (2006) Project Portfolio Management in Australia. *Proceedings of the 3rd International Conference on Project Management (ProMAC2006),* Sydney, Australia, Project Management Institute, 27–29 September.

Findings of Phase 1 of the research, incorporating the project management perspective and highlighting the relevance of this IPPM study to project and portfolio management in a range of environments.

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 PICMET 2007, Portland, Oregon, Portland International Conference on Managing Engineering and Technology (PICMET),* 5–9 August.

Literature review on IPPM capabilities – the first comprehensive literature review to bring together the literature from multiple disciplines and sources that relate to IPPM capabilities.

Killen, C P, Hunt, R A and Kleinschmidt, E J (2007) Dynamic Capabilities: Innovation Project Portfolio Management. *Proceedings of ANZAM 2007, Sydney, Australia,* Australia and New Zealand Academy of Management, 4–7 December.

Literature and theory linking the dynamic capabilities framework with existing research on IPPM capabilities.

Killen, C P, Hunt, R A and Kleinschmidt, E J (2007) Strategic alignment for product innovation. *CINet, Gothenberg, Sweden, 8th International CINet Conference: Continuous Innovation - Opportunities and Challenges*, 7–11 September.

Initial findings for Phase 2, including findings from the first four case studies.

Killen, C P, Hunt, R A and Kleinschmidt, E J (2007) Project portfolio management: Learning investments and the establishment and evolution of organisational capabilities. *ICAN 2007*_Sydney Australia, ICAN Research Centre: Innovative Collaborations, Alliances and Networks, 29–30 November.

This conference paper was later expanded and published in *International Journal of Managing Projects in Business* (see details above).

Killen, C P, Hunt, R A and Kleinschmidt, E J (2008) New Product Project Portfolio Management and Competitive Advantage: Cases from Diverse Industries. *Proceedings of the International Association of the Management of Technology Conference*, Dubai, UAE, 6–10 April.

Findings for Phase 2 – initial case summaries and initial cross-case analysis – including all six case studies.