

University of Wollongong - Research Online

Thesis Collection

Title: The effect of marketing's participation in new product development on its manifest influence: a test of a contingency model

Author: Eddie Fu-Keung Yu

Year: 2006

Repository DOI:

Copyright Warning

You may print or download ONE copy of this document for the purpose of your own research or study. The University does not authorise you to copy, communicate or otherwise make available electronically to any other person any copyright material contained on this site.

You are reminded of the following: This work is copyright. Apart from any use permitted under the Copyright Act 1968, no part of this work may be reproduced by any process, nor may any other exclusive right be exercised, without the permission of the author. Copyright owners are entitled to take legal action against persons who infringe their copyright. A reproduction of material that is protected by copyright may be a copyright infringement. A court may impose penalties and award damages in relation to offences and infringements relating to copyright material.

Higher penalties may apply, and higher damages may be awarded, for offences and infringements involving the conversion of material into digital or electronic form.

Unless otherwise indicated, the views expressed in this thesis are those of the author and do not necessarily represent the views of the University of Wollongong.

Research Online is the open access repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au

University of Wollongong Thesis Collections

University of Wollongong Thesis Collection

University of Wollongong

Year 2006

The effect of marketing's participation in
new product development on its manifest
influence: a test of a contingency model

Eddie Fu-Keung Yu
University of Wollongong

Yu, Eddie Fu-Keung, The effect of marketing's participation in new product development on its manifest influence: a test of a contingency model, PhD thesis, School of Management and Marketing, University of Wollongong, 2006. <http://ro.uow.edu.au/theses/581>

This paper is posted at Research Online.

<http://ro.uow.edu.au/theses/581>

NOTE

This online version of the thesis may have different page formatting and pagination from the paper copy held in the University of Wollongong Library.

UNIVERSITY OF WOLLONGONG

COPYRIGHT WARNING

You may print or download ONE copy of this document for the purpose of your own research or study. The University does not authorise you to copy, communicate or otherwise make available electronically to any other person any copyright material contained on this site. You are reminded of the following:

Copyright owners are entitled to take legal action against persons who infringe their copyright. A reproduction of material that is protected by copyright may be a copyright infringement. A court may impose penalties and award damages in relation to offences and infringements relating to copyright material. Higher penalties may apply, and higher damages may be awarded, for offences and infringements involving the conversion of material into digital or electronic form.

**The Effect of Marketing's Participation in
New Product Development on its Manifest Influence:
A Test of a Contingency Model**

A thesis submitted in fulfilment of the
requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

UNIVERSITY OF WOLLONGONG

by

EDDIE FU-KEUNG YU

MSc. Management Studies (University of Durham)

SCHOOL OF MANAGEMENT AND MARKETING

2006

Certification

I, Eddie F. K. Yu, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Department of Biological Science, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Eddie F. K. Yu

1 July 2006

Abstract

A substantial body of research suggests that new product development (NPD) is a critical potential source of competitive advantage and profitability for organisations. It has also been well recognized that new product development is a complex process that involves multi-disciplinary and multi-functional activities. This thesis initially argues a critical factor that influences the efficacy of the NPD process in the participation of different functional groups. Despite the strong theoretical link between the interaction of R&D and Marketing and NPD success, empirical studies on this topic have had contradictory results. One important reason attributing to these inconsistent results is that few studies have distinguished participation from influence. While NPD researchers acknowledge that functional team members interact in the NPD process, participation is treated the same as influence, or is seen to spontaneously lead to intended influence. Consequently, few studies have examined the influence of functional groups within the NPD process. This obscures the effects of Marketing and R&D's participation in the NPD process. This thesis aims to close this important knowledge gap by addressing two main research questions as follows:

1. What are the effects of Marketing's participation on its manifest influence in the new product development process?
2. How do the contingencies, such as organisational, individual and project factors, moderate the relationship between Marketing's participation and its manifest influence in the new product development process?

A theoretical model with nine hypotheses has been developed to examine these two questions. The model was constructed by synthesising the NPD, organisation theory, socio-political and power literature, and the hypotheses so derived were tested using 114 NPD project data from a survey of R&D managers in Hong Kong companies. The hypotheses testing process has gone through three stages. Firstly, the data were tested to ensure that the assumptions for regression analysis were met. Secondly, the main effects of the proposed model were tested using bivariate regression analysis. Thirdly, the contingency effects in the model were tested using moderated regression analysis.

The findings of this study indicate that while Marketing's participation is positively related to its influence on R&D in the NPD process, its influence was, to various degrees, moderated by the hypothesized three groups of contingency factors, namely new product project characteristics, individual factors and organisational factors. The introduction of control variable (team size and self-perceived influence) did not change the significance of the moderating effects of the contingency factors.

This thesis has made four theoretical contributions. First, it has conceptualised and empirically tested the relationship between Marketing's participation in the NPD process and its influence on R&D in that process. Second, it has created a new contingency framework to empirically investigate the effects of seven contingency factors on the relationship between Marketing's participation in the NPD process and its influence on R&D in that process. Third, to reduce bias, the survey instrument was designed to measure R&D's perception of Marketing's influence rather than self-reporting by Marketing, arguably considered as more reliable and accurate. Finally, despite its importance very few NPD studies have been conducted in Hong Kong

particularly from an organisational behaviour perspective. This study will help advance the knowledge in this particular research area.

Apart from theoretical contributions, this thesis has made several managerial contributions. The study findings suggest that management, in order to secure a better new product performance, should help build a well-represented cross-functional NPD project team. Management should also facilitate effective participation of functional representatives. Knowing the importance of the seven contingency factors to the effective function of the team, management should direct their effects positively to help achieve desirable goals that best serve corporate interest. To this extent, a 3-H model has been created to enable management to easier assimilate and apply complex theoretical concepts developed in this thesis.

Acknowledgement

Completing a thesis is like running a marathon, both demand remarkable perseverance to go through the ups and downs. The main difference between two events is that a marathon runner has to complete a race alone, however, seldom a PhD student can complete a thesis all by himself without other people's guidance or support. I am grateful to several people who have contributed in different ways to the successful completion of this thesis.

First and foremost, I owe a great deal to my thesis supervisor, Professor Paul K. Couchman. I benefited immensely from Paul's supervision in many ways: for the generosity of his time to give so much invaluable advice at different stages of my thesis development, for his continued encouragement and for all the critical review comments on the draft chapters of my thesis.

I am also very grateful to my colleague, Professor Kwaku Atuahene-Gima, for inviting me to conduct joint research on such a fascinating research area – new product development. I learned a great deal from him and was much inspired by other NPD guru speakers (e.g., Prof Thomas Hustad, Prof Rabi Bhagat, Prof Ashok Gupta, Prof David Wilemon, Prof Ulrike de Brentani, Prof Randall Schuler and Mr Milton Rosenau) in the three seminars that we co-organized. Kwaku was instrumental in helping to structure my PhD programme with the University. He has also inspired me with special ways in the early development of my thesis.

I was so fortunate to have Prof Rabi Bhagat reviewed the first draft of my thesis. Prof Bhagat has given me very helpful comments and encouraging remarks of which I greatly appreciated.

I would like to thank the strong team of the City University Statistical Consulting Unit for polishing my rusty statistical skills in conducting the data analysis and hypothesis tests.

It has been my privilege to have been associated with the Marketing and R&D staff of the company I interned for the pilot case study, and all the managers, engineers and colleagues I interviewed and discussed with in the early stage of my theoretical model and questionnaire development. I thank you all for your very helpful input and experiences sharing.

Last but not the least, I owe a great deal to my wife Tracy and daughter Clare who lived the thesis development process along with me. I am so much indebted to their sacrifice of years of summer vacations in which I selfishly used for catching up on my thesis work.

TABLE OF CONTENT

CHAPTER 1	INTRODUCTION.....	1
1.1	Outline of the Thesis	10
1.2	Chapter Summary.....	11
CHAPTER 2	LITERATURE REVIEW.....	11
2.1	New Products and the New Product Development Process.....	12
2.2	An Overview of Empirical Studies on NPD	13
2.2.1	Reviews of the NPD Literature.....	15
2.2.2	Three Approaches to the Study of NPD.....	20
2.2.3	Towards a Contingency Approach.....	24
2.3	The Relationship Between Marketing and R&D during NPD.....	26
2.3.1	The Integration of Marketing and R&D	27
2.3.2	Cross-functional Cooperation and New Product Success.....	29
2.3.3	Theorising the Marketing/R&D Interface.....	36
2.3.4	Participation and Influence in the NPD Process	45
2.4	Literature Review Framework	48
2.5	Chapter Summary.....	50
CHAPTER 3	THEORETICAL MODEL AND HYPOTHESES.....	51
3.1	Theoretical Rationale	52
3.1.1	The Socio-political Perspective	52
3.1.2	The Information Processing Perspective.....	54
3.1.3	The Resource Dependence Perspective	56
3.2	Theoretical Model and Research Hypotheses.....	58
3.2.1	The Proposed Model	58
3.2.2	The Independent and Dependent Variables	58
3.2.3	The Moderating Variables	62
3.3	Chapter Summary.....	72
CHAPTER 4	RESEARCH METHODS.....	74
4.1	Research Design.....	74
4.2	The Case Study Research.....	76
4.3	The Mail-Out Survey	78
4.3.1	Sampling Strategy	78
4.3.2	Questionnaire Development.....	79
4.3.3	Administration of the Survey	91
4.3.4	Survey Data Analysis.....	92
4.4	Chapter Summary.....	95

CHAPTER 5	DATA ANALYSIS & HYPOTHESES TESTING.....	96
5.1	The Survey Sample	96
5.1.1	Response Rate	97
5.1.2	Profile of Firms in the Sample	100
5.1.3	Profile of Survey Respondents.....	102
5.1.4	Profile of the New Product Projects in the Sample.....	104
5.2	Assessment of the Scales Used in the Survey Instrument	106
5.2.1	Scale Reliability	109
5.2.2	Scale Unidimensionality	110
5.2.3	Construct Validity Assessment	115
5.3	Hypotheses Testing	119
5.3.1	Testing the Assumptions for Linear Regression Analysis	120
5.3.2	Testing the Main Effects: Hypotheses 1 and 2	127
5.3.3	Testing the Contingency Effects: Hypotheses 3 to 9	132
5.4	Summary of Main Findings	142
CHAPTER 6	DISCUSSION AND CONCLUSIONS.....	144
6.1	Review of Research Purpose and Objectives.....	144
6.2	Discussion of the Findings	147
6.2.1	The Relationship between Marketing's Participation and Influence	147
6.2.2	The Relationship between Marketing's Manifest Influence and NPD Performance	148
6.2.3	A Contingency Perspective on Marketing and R&D Interaction	148
6.3	Contributions of the Study	158
6.3.1	Theoretical Contributions	158
6.3.2	Managerial Contributions	164
6.4	Limitations and Areas for Future Research	172
6.5	Conclusions	174

LIST OF TABLES

Table 2.1 Summary of Studies on Cross-functional Cooperation and New Product Success	30
Table 2.2 Summary of the Study on Personality Differences Between Marketing and R&D Personnel (Saxberg and Slocum 1968)	32
Table 2.3 Key Cultural Differences between Marketing and R&D Dougherty (1992), Gupta et al. (1986), and Lorsch and Lawrence (1967)	33
Table 3.1 Summary of the Proposed Hypotheses	73
Table 4.1: Cronbach's Alpha Scores for Pre-test on Initial Returns (n = 30).....	90
Table 5.1.1 Comparisons of the Group* 1 and Group 2 for the Characteristics of the Sampled Organisations and Respondents	98
Table 5.1.2 T-Tests between Group* 1 and Group 2 for Major Constructs	99
Table 5.1 - Characteristics of the Sampled Organisations	101
Table 5.2 - Characteristics of the Respondents.....	103
Table 5.3 - Characteristics of the Selected New Product Project	105
Table 5.4 Sources of Key Scales and their Items.....	107
Table 5.5 Scale Measurement (n = 114)	109
Table 5.6.1 Marketing's Manifested Influence with Rotated Factor Loadings	110
Table 5.6.2 NP Performance with Rotated Factor Loadings	111
Table 5.6.3 Marketing's Participation with Rotated Factor Loadings.....	111
Table 5.6.4 Influence Attempt with Rotated Factor Loadings.....	111
Table 5.6.5 Departmental Power with Rotated Factor Loadings.....	112
Table 5.6.6 Expert Power with Rotated Factor Loadings	113
Table 5.6.7 Customer Orientation with Rotated Factor Loadings	113
Table 5.6.8 Formalisation of NPD with Rotated Factor Loadings	113
Table 5.6.9 Importance of New Product with Rotated Factor Loadings	114
Table 5.7a Correlation Matrix of each Parameter.....	116
Table 5.7b Discriminant Validity of Measurement Scales	117
Table 5.8 Collinearity Statistics	126
Table 5.9 Means, Standard Deviations and Correlations among the Variables.....	129
Table 5.10 The Effect of Marketing's Participation on Marketing's Manifest Influence (Standardised Regression Coefficients).....	130
Table 5.11 The Effect of Marketing's Manifest Influence on New Product Performance (Standardised Regression Coefficients).....	131
Table 5.12 Hierarchical Regression Analysis of the Moderating Effects of the Individual Factors on Marketing's Participation and Influence on R&D in NPD (Standardised Coefficient)	135
Table 5.13 Hierarchical Regression Analysis of the Moderating Effects of Marketing Participation and Influence on R&D in NPD (Standardised Coefficient)	138
Table 5.14 Hierarchical Regression Analysis of the Moderating Effects of Marketing Participation and Influence on R&D in NPD – On New Product Project Characteristics (Standardised Coefficient)	140
Table 5.15 Summary of Research Hypotheses	143
Table 5.16 Summary of Research Hypotheses and Theoretical Implications	160

LIST OF FIGURES

Figure 2.1 Gupta et al's (1986) Model of the Marketing and R&D Interface	37
Figure 2.2 Ruekert and Walker's (1987) Model of the Marketing and R&D Interface	39
Figure 2.3 A Framework for Studying the Project-Level Marketing/R&D Interface (Adopted from Griffin and Hauser 1996)	43
Figure 2.4 Literature Review Framework for this Study	49
Figure 3.1 The Effect of Marketing's Participation on its Manifest Influence on New Product Development: A Contingency Model	59
Figure 5.1 Scatterplot of ZRESID against ZPRED	121
Figure 5.2 Scatterplot of ZRESID against ZPRED	122
Figure 5.4.1 Histogram of Regression Standardised Residuals for Marketing's Manifested Influence on R&D	123
Figure 5.4.2 Histogram of Regression Standardised Residuals for New Product Performance	124
Figure 5.5.1 Normal P-P Plot of Regression Standardised Residuals for Marketing's Manifested Influence on R&D	124
Figure 5.5.2 Normal P-P Plot of Regression Standardised Residuals for NP Performance	125
Figure 6.1 Three-H Perspective of Effective Participation in NPD Project	171
Figure 5.3.1 Scatterplot of ZRESID against ZPRED (Marketing Participation on Manifest Influence)	222
Figure 5.3.2 Scatterplot of ZRESID against ZPRED (Expert Power on Manifest Influence)	223
Figure 5.3.3 Scatterplot of ZRESID against ZPRED (Departmental Power on Manifest Influence)	223
Figure 5.3.4 Scatterplot of ZRESID against ZPRED (Complexity of New Product on Manifest Influence)	224
Figure 5.3.5 Scatterplot of ZRESID against ZPRED (Influence Attempts on Manifest Influence)	224
Figure 5.3.6 Scatterplot of ZRESID against ZPRED (Customer Orientation on Manifest Influence)	225
Figure 5.3.7 Scatterplot of ZRESID against ZPRED (Formalisation of NPD on Manifest Influence)	225
Figure 5.3.8 Scatterplot of ZRESID against ZPRED (Importance of new product on Manifest Influence)	226

CHAPTER 1 INTRODUCTION

Background

New product development (NPD) is not only an important means by which organisations adapt themselves to rapidly changing technological and competitive environments (Schoonhoven, Eisenhardt and Lyman 1990), but also a critical potential source of competitive advantage and profitability for firms (Brown and Eisenhardt 1995; Wind and Majajjan 1997). Drawing from the definitions of Crawford (1997) and Booz, Allen and Hamilton (1982), the ‘newness’ of a product can be defined in terms of the perceptions of the market and of the firm. It ranges from ‘new to the world’ to incremental improvements in product or production process. NPD is particularly important to high technology firms (i.e., those which produce advanced systems or devices, e.g., computer or telecommunication software or hardware products) as these firms are continuously challenged by an increasing rate of change in technology that revolutionises market needs and shortens product life cycles.

NPD is a complex process that involves multi-disciplinary and multi-functional activities. NPD management is both an art and a science (Crawford 1997). Managing different people in various stages of product development is essentially an art. Nevertheless, a new product programme involves rigorous tests, such as concept tests, product use tests and market tests, in which mathematical and statistical models can be systematically applied.

The complexity of the NPD process can also be appreciated from a theoretical perspective. For instance, information processing theorists posit that communication amongst functional groups not only leads to the better acquisition and sharing of pertinent information amongst those involved in new product development, but also helps project team members to understand the process from various perspectives (Daft and Weick 1984; Moenaert and Souder 1990 and 1996; Tushman and Nadler 1978). Resource dependence theorists argue that firms are not self-sufficient; rather, they require resources from other organisations to effectively perform their value creation activities (Hickson et al. 1971; Pfeffer and Salancik 1978). Likewise, departments within an organisation are interdependent. For example, though all functional groups within a firm contribute different resources and expertise to a new product development process, functions such as Marketing and R&D play relatively more important roles. Marketing provides market information on customer needs, competitors and other environmental conditions, while R&D provides technology information and technical skills to design new products that meet market needs. Resource dependence theory also advocates that frequent communication leads to higher performing development processes by increasing the resources that are available to the product development team (Brown and Eisenhardt 1995, p. 358).

Not surprisingly, a critical factor that influences the efficacy of the NPD process is the participation of different functional groups (Griffin and Hauser 1996). Drawing on the definitions of McQuiston and Dickson (1991), Maute and Locader (1994) and Atuahene-Gima and Evangelista (2000), *participation* is defined here as the degree

of involvement by, and interaction between, individuals or functions in the NPD process in terms of information sharing and communication.

A substantial body of research suggests that the participation of the Marketing and R&D functions is one of the most important elements in NPD success (Atuahene-Gima and Li 1997; Griffin and Hauser 1992, 1996; Gupta, Raj and Wilemon 1986; Homburg, Workman and Krohmer 1999; Li and Atuahene-Gima 1996; Souder 1987, 1988). This research stream implies that Marketing and R&D should be centrally involved in the NPD process. Yet, several scholars have argued that given the political nature of the new product process, the participation of Marketing and R&D may not be equal. In particular, although Marketing is a critical function in the new product development process, it is considered to have limited participation and influence in new product development relative to R&D in high technology firms (Li and Atuahene-Gima 1999; Workman 1993). Indeed, this limited participation and influence is believed to be a significant reason for the failure of many new products introduced by high technology companies.

This finding raises both theoretical and practical issues. Theoretically, the question is: to what extent does Marketing's participation in the new product development process affect the outcomes of the process? In other words, what is the link between Marketing's participation and its influence on the new product development process? Practically, the question is: how can marketing managers enhance their influence on the new product process, and thus affect the outcomes of that process? Unfortunately, few studies have sought to systematically examine these questions. Yet, as Homburg et al (1999) and Workman (1993) have emphasised, it is widely agreed that the

interface of marketing with other management processes, functions, and disciplines is one of the most important issues that management has to deal with.

Despite the strong theoretical link between the interaction of R&D and Marketing and NPD success, empirical studies on this topic have had contradictory results. For example, in a study of 16 NPD projects, Dougherty (1992) found that if Marketing and R&D shared information on customer needs and market segments, the likelihood of product success increased. Based on a study of 289 NPD projects from 56 consumer and industrial product firms, Souder (1988) found that the quality of R&D and Marketing interaction affected the degree of success of new product performance. In contrast, a study of Japanese hi-tech industry showed that the relationship between the integration of R&D and Marketing and new product success was very weak (Song and Parry 1993). Based on a nine-month participant observation at a computer systems firm, Workman (1993) found that Marketing played a limited role in the firm's NPD, which implied that R&D and Marketing interaction was not as important as expected in new product decisions. To emphasise the inconsistent findings of NPD studies, Balachandra and Friar (1997) listed 13 factors from different studies that had contradictory effects on NPD performance. These included market-related factors (potential market/existing market, market analysis, high growth, early to market, rate of product introduction), technology-related factors (innovative product, perceived value, patentability, demand pull/technology push), and organization-related factors (support from marketing, use of quantitative techniques, source of ideas from marketing). These contradictory findings lead them to advocate the idea of a contingency perspective for studying NPD performance.

One important reason for these inconsistent results is that few studies have so far distinguished participation from influence. Drawing on the definitions of Atuahene-Gima and Li (2000), McQuiston and Dickson (1991), and Kohli (1989), *influence* here refers to the degree of success that an influence source (e.g., Marketing) has in changing the attitudes or behaviour of an influence target (e.g., R&D). Atuahene-Gima and Evangelista (2000, p. 1269) posit that “although this research stream has advanced our understanding of Marketing’s and R&D’s role in the NPD process, (mere) participation is not sufficient to explain their impact on new product performance”. Thus, while NPD researchers acknowledge that functional team members interact in the NPD process, participation is mostly treated the same as influence, or is seen to spontaneously lead to influence. Consequently, few studies have examined the influence of functional groups within the NPD process, especially from the political and organisational context perspectives. This obscures the effects of Marketing’s participation in the decisions made and actions taken by R&D in the NPD process (Atuahene-Gima and Yu 1998).

Krohmer, Homburg and Workman (2002) maintained that this important research gap has not been closed. They postulate that a “cross-functional approach requires more than simple interaction between people in order to strengthen NPD performance . . . prior research has typically focused on interaction between functional groups but has not addressed the question of Marketing’s influence on other functional groups in NPD decisions.”

Research Objectives and Contribution

This study is primarily designed to address the important knowledge gap identified above by addressing the following questions.

1. What are the effects of Marketing's participation on its manifest influence in the new product development process?
2. How do the contingencies, such as organisational, individual and project factors, moderate the relationship between Marketing's participation and its manifest influence in the new product development process?

In answering these questions, this study aims to contribute to the literature in three ways. First, the study conceptually and empirically distinguishes between the participation and influence of Marketing in a NPD process. This distinction is important if we want to ensure theoretical clarity in research that examines the role of different functions in the NPD process and their effect on NPD outcomes.

Second, the contingency perspective further clarifies the relationship between participation and manifest influence, but builds theoretical boundaries within which Marketing's participation may enhance or diminish its manifest influence. This is an important theoretical contribution for two main reasons. The lack of a 'contingency perspective' might be the main reason for the above-noted inconsistent findings about the relationship between functional interaction and NPD success (Balachandra and Friar 1997). As Craig and Hart (1992) concluded from their review of the literature, a contingency approach that emphasises the importance of situational

influences is perhaps most appropriate for studying and managing the NPD process. However, they did not specify the key contingency factors that NPD managers need to monitor in a given situation. Thus, this study appears to be the first to respond to calls for a contingency approach in this research domain. Moreover, it identifies three main contextual factors, namely the new product project characteristics, individual factors and organisational factors, and empirically tests their moderating effects on the relationship between Marketing's participation and its manifest influence at the Marketing-R&D interface. The acknowledged significance of this interface to new product success, coupled with the breadth of the contingency factors that are examined here, provide potential for generalising the findings to other functional interfaces in the NPD process.

The third contribution of this study is methodological. Current research (e.g., Kohli 1989; Maute and Locander 1994; Yukl et al., 1996) suggests that participants in a decision-making process are likely to overstate the importance and efficacy of their own influence. Yet few studies to date (e.g., Atuahene-Gima and Evangelista 2000; Atuahene-Gima and Li 2000) have collected data from the influence target about the influence source, and then controlled for the self-perceived influence of the influence target. To avoid potential confounding effects, this study was designed so that data on Marketing's was collected from R&D personnel's self-reported influence. By so doing, the findings of this study more accurately reflect the efficacy of Marketing's influence on R&D in the NPD process.

The third contribution of this study is to help advance NPD knowledge in local environment. While the above referenced studies are very important in the new product

development field and they are very useful for us to understand the complicated context of NPD environments, yet they were conducted in the West and mostly in large-scale organisations. The business context of high-technology in Hong Kong has the following distinctive features that might affect the applicability of the western research findings.

Firstly, Hong Kong's high-technology industry is predominantly entrepreneurial small-medium enterprises (Baark and So 2006). Most of the firms' size is about 30 employees and have an annual sales turnover of less than HK\$50 million.

Secondly, the industry is characterized by consumer rather than industrial products, e.g., consumer electronics. Other sectors include electronic components, computer software and telecommunications.

Thirdly, given the OEM originated mentality, management is more inclined to invest in short payback period projects (Tuan and Ng 2006). In the study, the respondents said that a single project requiring over 12 months would be considered as too long.

Fourthly, given the nature of the industry, the content of "high-technology" may refer to the incorporation of a newly designed electronic component into a product or a modification of the circuit board design, which is not directly comparable to the prominent new products like PDA or iPod, invented by their counterparts in the West.

Fifthly, as indicated in a recent survey report's findings (*From OEM to ODM*, Hong Kong Productivity Council 2004), more and more firms are now involving Marketing & Sales and R&D personnel on their NPD project teams. Unlike their counterparts in the West, Hong Kong managers, because of relatively short history in ODM business, are rather inexperienced in managing the relationship between these two functions as they interact in the course of the NPD process.

Finally, due to the colonial government's passive industrial policy, very few public funds have been invested in technology development. Consequently, the supply of skilled labour, capital and general infrastructure for technology development was much weaker as compared with even those of its Asian neighbours such as Singapore, Taiwan and South Korea.

Under this business environment, the high-technology industry in Hong Kong warrants more indigenous studies to help firms gear up the pace of their technological development. The samples of the study, as illustrated in Table 5.1, the profile of the sampled organisations, possessed similar distinctive features as presented above, and the respondent firms should be reasonably representative. The research questions related to the effective integration between R&D and Marketing in NPD shall help management in the industry to understand more about the complicated context of NPD and learn different ways to effectively manage such relationships.

Apart from advancing knowledge in these areas, this study is also timely for the high-technology firms in Hong Kong, because the Government, the private sector and academia are now searching for effective ways of upgrading their innovation and R&D capabilities. As the cost advantage created from relocating Hong Kong's manufacturing base to China has been weakening due to increasing production costs, it is now widely held that Hong Kong firms should be more innovative and export high value added goods and services. In response to this perspective, the Hong Kong SAR Government has introduced many technology committees and institutions (e.g., the Innovation and Technology Commission, the Hong Kong Science and Technology Park and the Hong Kong Design Centre), and has set aside a fund of over \$1 billion for supporting innovation and technology development. However, few of these initiatives focus on innovation management. A great majority of them

are aimed at technical and technology development projects. Thus, from a managerial perspective, this study will help managers to understand *what* the key factors are, and *how* they can participate to better affect the efficacy of their interaction with other functions in the NPD process.

1.1 Outline of the Thesis

This thesis is organised into six chapters: the introduction (chapter one), the literature review (chapter two), the theoretical framework and hypotheses (chapter three), the research methods (chapter four), data analysis and hypotheses testing (chapter five) and the discussion and conclusions (chapter six).

Chapter one, the introduction chapter, provides a general overview of the study and defines the key concepts. Chapter two provides a review of the existing NPD literature, which focuses on the relationship between Marketing and R&D interactions and in so doing identifies key knowledge gaps. Aiming to narrow the identified knowledge gaps, chapter three first delineates the key theoretical rationale, which serves as the basis for building a framework and hypotheses for the study. The chapter then postulates links between the independent variable (participation of Marketing) and the contingency variables (new product project characteristics, and individual factors and organisational factors), and the dependent variable (influence on R&D). Chapter four discusses and justifies the research methods used in the study. That chapter first presents a clear description of the sampling and data collection method, and explains the operationalisation of the constructs and the data analysis method employed. It also accounts for the methodological aspects of the

data analysis, hypothesis testing and research findings. Chapter five reports the findings from the survey and the results of the hypotheses testing. Chapter six discusses the research findings in terms of the theoretical and managerial implications raised. To conclude the thesis, it also discusses the limitations of the study and suggests directions for future research.

1.2 Chapter Summary

This chapter has discussed the background to this study, with special reference to how it relates to the body of NPD knowledge. It has delineated the scope of the study, and highlighted the contributions of the study to the NPD field. Finally, it has summarised the structure of the thesis.

CHAPTER 2 LITERATURE REVIEW

Preamble

This chapter discusses the germane theoretical perspectives, models, key concepts and empirical findings of the literature. It has three main objectives, the first of which is to delineate the field of new product development and review the key approaches to the systematic study of this field of knowledge. The second objective is to identify the key emergent themes in the field and to identify the knowledge gaps while paying particular attention to the relationship between Marketing and R&D. From a contingency perspective, it is argued that the efficacy of marketing's participation, in terms of its manifest influence on R&D, has not been adequately studied. That leads

to the third objective of the review, to synthesise the participation literature and define the boundary of this study. This literature review provides the necessary background for developing the hypotheses to be discussed in the next chapter.

2.1 New Products and the New Product Development Process

For this study, a ‘product’ was defined as any manufactured good (e.g. a mobile phone, a personal computer) or service (e.g. IT or operation system development) that is sold in markets. It should be noted that much of the NPD literature to date has focused on the more tangible goods, and has tended to either overlook services or blur the distinction between goods and services. The ‘newness’ of a product can be broadly defined with respect to the perceptions of the market and the firm. Drawing on Crawford (1997) and Booz, Allen & Hamilton (1968, 1982), a ‘new product’ can be defined as including the following categories:

New to the world products: products that are true innovations, and are entirely new to the market, e.g. Walkman first appeared in early 1980s, and iPod first appeared in the early 2000s.

New category entries: e.g. Microsoft’s *Explorer*, a new product category for Internet navigation. In this case, the product is new to the firm but not to the market.

Additions to product lines: products that are line extensions or new versions of existing products, e.g., Intel’s *Pentium 4* (from *Pentium 3*), Microsoft’s *Office XP* from *Office 2000*.

Product improvements: incremental improvements to current products, e.g., Norton’s online upgraded anti-virus software.

Re-positioned products: products that are re-targeted for a new use or application; e.g. Lucozade was an energy replenishing drink for sick people and sold at pharmacists, but has been repositioned as a sports drink and is now a fast-moving-consumer product at convenience stores and supermarkets. This has not involved any changes in product design or production.

Cost reductions, e.g. Toyota's *just-in-time* inventory management to minimize inventory costs.

Process innovations, new business operation flows and configurations from order processing to supply logistics, e.g. Amazon's online shopping and Dell's direct business model. Internet technology opens up a wide spectrum of new online business opportunities around the world.

Crawford (1997) further defines new product development (NPD) as an overall process encompassing strategy, organisation, concept generation, engineering, production, marketing and commercialisation of a "new" product. However, the focus of this study is on the interaction between the Marketing and R&D departments in the process of product development and thus is centrally concerned with process and human resource management. The crucial management tasks within the NPD process include managing the resources, organisational factors, schedules, systems and – most important of all – individual factors, particularly power and politics, as the new product project team is trying to achieve its goals. The effectiveness of NPD, and hence the success of a new product project, is largely dependent on whether these management tasks can be properly managed.

2.2 An Overview of Empirical Studies on NPD

Product development is the nexus of competition for many firms, as well as a central process for organisational adaptation and renewal (Brown and Eisenhardt 1995; Clark and Fujimoto 1991). Despite its importance, the field of NPD studies does not have a long established history. Systematic studies were first conducted in the 1970s. After four decades of development, although there has been a plethora of research into NPD related topics, NPD is still not a very well organized body of knowledge as evidenced by the following comments by researchers in the field. For instance, Johnes and Snelson (1988, p. 114) have argued that the body of NPD literature is “confusing”. Calantone and di Benedetto (1990, p. 165) have expressed their concern that the literature development is “nonconvergent”. Craig and Hart (1992) have commented on the lack of consensus amongst NPD researchers about the best approach to investigating NPD. Brown and Eisenhardt (1995, p. 344) have considered the NPD literature to be rather “fragmented”. More significantly, Garcia and Calantone (2002) have complained that after decades of NPD research, even the fundamental terms in the field, such as ‘innovation’ and ‘innovativeness’, are still ambiguous to many researchers and practitioners. Given this inherent weakness in the development of NPD knowledge, more systematic work on synthesising rather than just understanding the existing NPD literature is required.

In order to address these deficiencies, three comprehensive NPD literature reviews, Brown and Eisenhardt (1995), Calantone and di Benedetto (1990) and Craig and Hart (1992), were examined as a starting point. These authors used different lenses to examine the NPD (product innovation) literature. They conducted both summative and formative analyses of the research methods and findings of previous work. The

reviews provide a sharp perspective with which to venture through the “jungle” of the NPD literature. Their analyses will serve as the backbone of this literature review.

2.2.1 Reviews of the NPD Literature

The Calantone and di Benedetto (1990) review serves as a useful entry point to the NPD literature. They categorized the NPD literature into five main areas and drew the following conclusions. First, the effectiveness of product innovation is contingent on various contextual factors, such as management strategy, organisational structure and industry condition (Calantone and di Benedetto 1990, p. 159). Second, marketing academics and consultants have developed a large quantity of complex NPD and forecasting models. However, sophisticated models are not necessarily more accurate than less complex methods. Third, the interfacing of R&D and Marketing requires adequate coordination, cooperation and proper management. Fourth, organisational structure has significant impacts on the outcomes of relations at the interface, such as the effectiveness of team collaboration. Finally, they concluded that matrix structures appear to be particularly suited to NPD, and notably that organisation and interdepartmental communication must also be managed to ensure successful NPD (Calantone and di Benedetto 1990, p. 163).

Calantone and di Benedetto's (1990) review provides a valuable guide to understanding NPD knowledge as a discipline and it is particularly helpful to practitioners. However, due to its issue-orientation, the review fails to offer an integrated and coherent perspective, which can be considered as a major deficiency

given the holistic nature of NPD. Furthermore, it lacks a theoretical framework with which to synthesise all of the analysed literature.

By conducting a content analysis on the NPD literature, Craig and Hart (1992) identified six main themes: strategy, management, company characteristics, process, people, and information. They concluded that the contingency approach, which emphasises the importance of situational influence, is the most appropriate for managing the NPD process. However, they did not specify the key contingency factors that managers must monitor in a given situation. Compared with Calandone and di Benedetto's review, that of Craig and Hart is more valuable to this study. The six-theme classification is particularly useful. More importantly, the authors point to the significance of cross-functional team dynamics and the contingency approach in NPD research.

Brown and Eisenhardt (1995) categorised the product development and related literature into three research streams: rational planning, communication web and disciplined problem-solving. The rational plan stream advocates the idea that successful NPD can be achieved through rational planning of the process. According to these streams, it is important to identify key success factors such as the superiority of a product, the attractiveness of a market, the competence of a cross-functional team and senior management support. This stream is primarily exploratory and atheoretical, which helps to broadly define the relevant factors of NPD research. The communication web stream posits that NPD success can be achieved by the effective management of internal and external communication. Therefore, it is important to examine the flow of information and its effect within the organisation. This stream of

studies is largely based on the information processing and resource dependence theories. It is most relevant to this study. The disciplined problem-solving stream argues that the NPD process is essentially a balancing act between the project team's autonomous problem solving and the discipline of the heavyweight leader, strong senior management and an overarching product vision (p. 359). It suggests the study of a wider range of actors and activities and draws heavily on information processing theory.

Each stream of research has its strengths and weaknesses. Rational planning provides a broad understanding of a range of key success factors for NPD. However, Brown and Eisenhardt were concerned that many previous studies were not based on well-defined constructs. Typically, such studies relied heavily on the retrospective sense-making of complex past processes, usually by single informants. Communication web studies, while exposing very important aspects of the political and information-processing dynamics of the NPD process, have often been very subjective. These studies did not distinguish between different types of products such as incremental and breakthrough products. Without such a distinction, managers may not be able to adopt an appropriate type of communication to suit the type of product being developed. The disciplined problem solving approach aids in the understanding of a wider scope of NPD activities, and the variety of actors that are important to the success of NPD. However, as an approach to understanding the NPD process, it lacks political and psychological dimensions. For example, with studies of this type, there is little appreciation of the problems of motivating cross-functional team members to work together in the NPD process.

Brown and Eisenhardt's (1995) review makes several valuable contributions to advancing the knowledge of NPD. The authors reorganise the rather fragmented literature into distinctive research approaches. Each approach includes factors that affect the success of product development, and this helps to distinguish NPD process performance and product effectiveness with respect to the influences of key participants, such as NPD team members, project leaders, senior managers, customers and suppliers. Having critically analysed the literature, the authors identify the incomplete concepts and missing links in the existing streams, and introduce a new research model that integrates the three streams. The main organizing idea behind the integrative model is that there are multiple participants whose actions influence product performance. Specifically, the participants affect both process and product effectiveness. The combination of efficient process, effective product and the nature of the market shapes the financial success of the product. Underlying this perspective are the theoretical frameworks that the authors identify from the combined research streams. For instance, the information processing and resource dependence perspectives are used to explain process performance and power, and group theories are used in explaining the inputs from the participants that have direct effects on product performance. Finally, Brown and Eisenhardt set the following important agenda for future NPD research, i.e. there is a need to:

examine the theoretical links between NPD process performance, successful products, market factors, and financial performance with more rigorous empirical research;

explore contingency models to address the incomplete understanding of the moderating factors that affect the product development process and outcomes; and

study how senior management affect product development, in terms of their visions, subtle control, support and competences in respect of market needs.

The authors concluded by noting that “the actual process of product development is still largely a ‘black box’ ” (p. 375) and that organisational structures, the roles of participants and effective processes are related to enhanced product development.

Brown and Eisenhardt’s (1995) review is particularly useful to this study. Apart from providing an organised view of the NPD literature, the authors also point out the importance of introducing a contingency approach to study cross-functional team interactions. Consistent across all three research streams identified, cross-functional teams are seen as critical to process performance (e.g., Clark & Fujimoto 1991; Dougherty 1992; Zirger and Maidique 1990). The underlying reasoning is that the functional diversity of these teams increases the amount and variety of information available for the design and development of new products. This increased information helps project team members to understand the design process more quickly and fully from a variety of perspectives, and thus improves design performance. However, as Brown and Eisenhardt finally concluded, the actual interaction of the project team in the product development process is still largely unknown as are the contingencies involved in moderating process and outcomes. This study was designed to help narrow that knowledge gap.

Having reviewed the extensive NPD literature, it is concluded that the knowledge of NPD which is relevant to this study can be synthesised into the following three broad approaches.

2.2.2 Three Approaches to the Study of NPD

The diverse NPD literature can be synthesised into three main approaches: the success factor approach, the integrative mechanism approach and the systematic practice approach. This categorisation allows a coherent description of the vast NPD literature, and provides an introduction to the central focus of this thesis. The first approach focuses on *what* factors affect NPD success or failure. The primary purpose of this line of research is to comprehensively explore the key determinants of NPD outcomes. The second approach seeks to explain *why* a particular new product succeeded or failed in market. The third approach concentrates on exploring *how* to develop products efficiently and effectively.

The Success Factor Approach

The pioneering empirical work on NPD success factors was conducted some 30 years ago (e.g., the SAPPHO studies by Rothwell in 1972 and 1974, Newprod by Cooper in 1979, and the Stanford Innovation Project by Maidique and Ziger in 1984). It was believed that firms could effectively manage their NPD performance if they could identify the key determinants of new product success. These determinants could range from 10 and even up to 50 (Brown and Eisenhardt 1995). The key factors that have been identified include the following.

- Organisational factors – such as a conducive organisational culture (e.g., innovation as a company charter), senior management support and product champions, are important for NPD success (e.g., Cooper and Kleinschmit 1995).
- Functional factors – a cross-functional team is most effective for NPD success, within which the interaction of the Marketing and R&D departments is most crucial (Cooper and Kleinschmit 1993).
- Project characteristics – technological and marketing synergy is widely considered to be a key determinant for NPD success (e.g., Cooper and Kleinschmit 1987).
- Process stages – the exploration, concept and start-up stages are important, especially under conditions of uncertainty (Souder and Song 1995).
- Product characteristics – differentiating products through innovative design tends to enhance product performance (Souder 1995).

Although success-factor studies are important for bringing to attention the key determinants when managing the NPD process, they have a number of significant limitations. Firstly, the unit of analysis is usually project or program based. The importance of an individual's influence (e.g., that of a Marketing manager) on the NPD process is ignored. Many studies also ignore political factors, such as individual and departmental power, and the individual's influence over the process. Secondly, the findings of some studies are contradictory or inconsistent, and one should generalize from them with great care. This may occur because the studies use different research protocols and often exhibit a lack of rigour in the research design. Thirdly, few of these studies have used a contingency approach in testing the proposed success factors. As Montoya-Weiss and Calantone (1994) have argued, the strength or the form of relationships between dependent and independent variables is expected to differ under different contingency settings (e.g., market environment factors, organisational factors, strategic factors). By failing to take contingency factors into consideration, the explanatory power of any research findings may be significantly weakened.

The Integrative Mechanism Approach

The underlying perspective of this approach is based on information processing theory. Typically, these researchers perceive the NPD process to be a flow of information from product concept to commercialisation. NPD performance becomes uncertain as information is distorted or lost. Therefore, this approach primarily focuses on the effectiveness and mechanics of communication amongst functional departments that are involved in the NPD process. Such studies have identified two

main themes: cross-functional interaction, particularly in relation to the Marketing and R&D interface (Hise et al. 1990; Rochford et al. 1992; Li and Atuahene-Gima 2001), and integrative mechanisms including the factors that enhance or hinder communication effectiveness between Marketing and R&D departments involved in the NPD process (Griffin et al. 1996; Gupta et al. 1986; Moenaert et al. 1995; Souder et al. 1992; Ruekert et al. 1987).

This approach mainly argues that effective communication amongst NPD participants improves functional integration and reduces uncertainty, which are both crucial to NPD success. Though the approach offers many insights into the integrative mechanisms of NPD teams, and is theoretically more robust than the success-factor approach, it has a number of following limitations. The concept of information processing has not been vigorously operationalised in most of these studies. In many instances, information processing has been treated as information exchange. However, in the NPD process information is not only transferred or exchanged, but also interpreted, augmented and translated (Tatikonda and Rosenthal 2000). The NPD participant's interpretation of the information received leads to further action that can be supportive or unsupportive of the information sender's desired goals. Few researchers have probed into this important issue.

The Systematic Practice Approach

This approach focuses on the use of NPD tools (e.g. QFD and CAD/CAM) and systematic practices (concurrent engineering, design for manufacturing, etc.), and is therefore of more interest to practitioners than the other two approaches. This approach has mainly used case studies. Haddad (1996) studied the “enablers” of

concurrent engineering, and suggested that the product development team should be product-focused and cross-functional, that organisational enablers include cross-group communication, participation and human resources practices, and that technological enablers include building design, CAD and computer networking. Krishnan (1996) investigated the execution of coupled design tasks, and noted that the coupling between design phases occurs in two dimensions – “upstream information evolution” and “downstream sensitivity”. Different overlapping types require different methods of information exchange. Swink et al. (1996) studied the customisation of concurrent engineering to product characteristics, customer needs and technology requirements, and suggested that projects with different priorities of design, cost and speed have different effects on design concurrency. The common feature of this approach, which is particularly popular in the managerialist literature, is an advocacy of more systematic methods as a means to achieve more effective NPD.

2.2.3 Towards a Contingency Approach

Despite the plethora of studies, and distinctive analytical perspectives, NPD research findings are still considered to be fragmented, contradictory and confused (e.g., Balachandra and Friar 1997), and there still remain many knowledge gaps. One of the main gaps of concern to this study is the lack of understanding of the effects of contingencies such as individual, organisational factors, and new product project characteristics.

Joan Woodward laid the groundwork for contingency theory in the UK during the late 1950s. In the USA, Lawrence and Lorsch (1967), Perrow (1967), Thompson (1967), and Hage and Aiken (1969) drew similar conclusions from their own empirical work. The basic tenet of contingency theory is that a firm's performance is considerably influenced by the extent to which its structure and managerial behaviour 'fit' with key features of its environment, thus giving rise to various contingent factors such as industry structure and market size. The more uncertain and complex the context (resulting from prevalent technologies, as well as product, capital and labour markets), the more organic and flexible the structure must be and the more need there is for information to flow vertically between levels and horizontally between functions. In contrast, the more certain and less complex the context, the more that organisational structure can be mechanistic, with greater emphasis on hierarchy and standard rules and procedures. Contingency theory has had an important influence on organisational, strategic and other management-related research (Atuahene-Gima 1995; Harrigan 1983; Justis 1975; Punnett and Shenkar 1994). Hence, applying the contingency perspective to NPD research should be treated as a mandatory rather than alternative approach.

Responding to the need for NPD research with a contingency perspective, this study will explore (a) the cross-functional participation between Marketing and R&D professionals in a high-technology NPD task environment, and (b) how that participation is manifested, as moderated by individual personnel factors, organisational factors and new product project characteristics, to influence R&D. Lacking a contingency perspective, many NPD cross-functional studies have simply argued that key functional areas such as Marketing, R&D and Manufacturing directly

influence each others' decisions in the NPD process, without considering the contextual factors that may adversely or otherwise affect the efficacy of participation. As discussed earlier, this deficiency has substantially weakened the value of the research contributions. The main objective of this study is to remedy that deficiency by adopting a contingency perspective to ascertain the effective degree of participation and interaction within cross-functional teams in the NPD process.

Having reviewed the NPD literature generally, and having identified key themes and knowledge gaps therein, the next stage is to consider previous research on the specific focus of this study, i.e. the relationship between the Marketing and R&D functions in the NPD process.

2.3 The Relationship Between Marketing and R&D during NPD

Griffin and Hauser (1996) provide a comprehensive literature review on the integration of the R&D and Marketing functions. They are concerned about the poor understanding of the nature of cross-functional interaction and the conditions for successful cross-functional integration. Although they do not clearly define integration, it can be understood as the degree to which Marketing and R&D personnel effectively participate and interact with each other in the NPD process to promote a cross-fertilisation of ideas, experience, and intelligence.

2.3.1 The Integration of Marketing and R&D

As discussed earlier, new product development is a complex process that involves many functional departments, including Marketing, R&D, Manufacturing, and Engineering. Cross-functional integration is widely considered to be critical to new product performance. NPD success factor studies indicate that successful development relies on strong communication links and cooperation amongst the functional groups to efficiently manage the transition of the product through the various development stages (Li and Atuahene-Gima 1999 & 2001; Rubenstein et al. 1976; Souder 1981; Souder and Chakrabarti 1979).

Of all cross-functional relationships, that between Marketing and R&D is considered as the most critical for new product performance because Marketing personnel often play a crucial role in coordinating the process so as to satisfy market and customers' demands (Gupta, Raj and Wilemon 1986; Ruekert and Walker 1987; Souder 1987). However, Marketing and R&D are not necessarily integrated in a company. For example, Souder (1988) examined Marketing and R&D interaction problems in 289 new product development projects from 56 consumer and industrial product firms. He found that 59% of the projects had experienced some type of conflict across the Marketing and R&D interface. Such disharmony resulted from a lack of appreciation, distrust, lack of interaction and lack of communication. Furthermore, Souder demonstrated that the quality of Marketing and R&D interaction directly affects the degree of new product success, because many of the projects in which there was disharmony failed.

Gupta, Raj and Wilemon (1987) studied the experiences of 167 high technology firms and found that four factors determined the level of interaction between Marketing and R&D. These factors were: the quality of Marketing and R&D relations, organisational structure, senior management attitudes, and the methods used to organise the new product development process. In another study, Gupta, Raj and Wilemon (1986b) compared the responses from 107 R&D managers and 109 Marketing managers in high-technology companies, and found that there were socio-cultural differences between the managers, and that those differences affected the quality of interaction between the two functions.

Griffin and Hauser (1996) have provided a comprehensive and systematic review of the R&D and Marketing integration literature and practice. They found that as a firm starts to grow, disintegration rather than integration of the two functions becomes more typical.

“In entrepreneurial firms, the producer-inventor frequently combines the knowledge of what is needed with how to develop it. However, as the firm grows, the Marketing and R&D functions become specialised. Scientists are hired to maintain and develop technology; marketing specialists are hired to sell the product, talk to customers, and communicate product benefits. Over time these groups grow apart, each expert at their own function, but less aware of the other’s contribution. As integration and communication between these critical functions decreases, their ability to combine skills to develop and produce successful products decreases. The firms suffer.”(p. 192)

The need for managing information flows across Marketing and R&D boundaries was recognised as important in the 1970s, and pioneering research in the area includes that of Rubenstein et al. (1976) and Souder (1977, 1978). Managing the interface was recognised as one of the key critical new product success factors in the 1980s, and remains so today (Souder 1993). With ever-growing competitive pressures in the domestic and global marketplaces, firms have to reduce NPD cycle times and manufacturing lead times to lower their costs. Many firms are experimenting with flatter management structures, cross-functional teams and cross-discipline management processes. Previous research, which assumed hierarchical corporate structures with separate functional groups, is now being reassessed in the light of these developments (Hitt, Hoskisson & Nixon 1993; Olson, Orville and Ruekert 1995; Valle & Avella 2003).

2.3.2 Cross-functional Cooperation and New Product Success

Griffin and Hauser (1996) selected 15 research studies on the cooperation between Marketing and R&D in NPD. In each study the findings either supported or were consistent with the proposition that cooperation enhances new product success. Four new product studies that sampled high technology firms are presented in Table 2.1 to illustrate the research evidence. Other important findings from these studies were that friendship differs from cooperation – although the harmony between Marketing and R&D enhanced the chance of NP success, too much socialising at the expense of professional interaction was harmful because it prevented much needed objective criticism (Souder 1988).

Table 2.1 Summary of Studies on Cross-functional Cooperation and New Product Success

Researcher	Sample	Type of Firm	Findings
Cooper (1984)	122 firms	Electronic and others	Management strategies that balance marketing and R&D have a greater chance of new product successes and a greater chance of their sales coming from new products.
Gupta, Raj & Wilemon (1985)	167 firms 107 R&D managers 109 marketing managers	High-technology	Lack of communication is the largest barrier to achieving integration between marketing and R&D.
Moenaert, Souder, DeMeyer & Deschoolmeester (1994)	40 Belgian firms	Technological innovative firms	Significant correlation between commercial success and inter-functional climate and information received by R&D.
Pelz & Andrews (1993)	1311 scientists and engineers	Scientists and engineering firms	Positive relationships between the amount of interaction and performance.

Although there is strong evidence of an association between effective cross-functional cooperation and NPD success, both communication and cooperation must be properly managed to make them work (Ancona and Caldwell 1992). However, researchers have identified numerous barriers to communication and cooperation between the R&D and Marketing functions.

Empirical research indicates that disharmony between Marketing and R&D is the rule, rather than the exception in many firms (Moenaert and Souder 1990). For example in a survey of 274 R&D and 264 Marketing managers, Song and Parry (1993) found the correlation between the stated ideal level of integration and the achieved level to be 0.55; in other words, achieved integration was only about half of the desired level. Studies have shown that there are many barriers to effective cross-functional communication and cooperation and that these barriers can be people-related, organisational, and physical.

People-related barriers to communication and cooperation include the personalities of the R&D and Marketing personnel, their cultural thought worlds, and the language and jargon that they use to think and communicate. An early study conducted by Saxberg and Slocum (1968) on the personality differences between Marketing and R&D personnel is shown in Table 2.2.

Table 2.2 Summary of the Study on Personality Differences Between Marketing and R&D Personnel (Saxberg and Slocum 1968)

The above traits may be seen as stereotypes rather than actual personality differences. However, as Griffin and Hauser (1996) have argued, when they exist, these traits can form formidable barriers between the two functions. If one or the other group believes in these stereotypes, that belief alone can become a barrier to mutual understanding.

Due to different training, experience and backgrounds, the “world views” of Marketing and R&D personnel can be quite different. Unfortunately, organisational routines tend to reinforce these differences (Dougherty 1990, 1992; Douglas 1987). Dougherty (1992), Gupta et al. (1986), and Lorsch and Lawrence (1967) have identified the salient cultural differences between Marketing and R&D as shown in the table below.

Table 2.3 Key Cultural Differences between Marketing and R&D Dougherty (1992), Gupta et al. (1986), and Lorsch and Lawrence (1967)

According to research such as that summarised in the table, Marketing personnel prefer the short time horizon of incremental projects, tend to focus on the market, and accept a high degree of ambiguity and bureaucracy. In contrast, R&D personnel prefer long time horizons and advanced projects. They focus on the development process, exhibit a strong loyalty to their profession, and have low tolerances for ambiguity and bureaucracy. These differences in thought worlds suggest that Marketing and R&D run the danger of developing self-contained sub-cultures. Even though both functions work for the same firm with the same overall corporate goals, the “lens” through which each interprets those goals differ (Souder 1977). More importantly, separate thought worlds mean that Marketing and R&D may have difficulty in understanding one another’s goals, solutions and trade-offs. However, to

work together effectively they must be able to understand and appreciate the other's thought world.

R&D and Marketing also use different jargons, or technical terms. Marketing professionals speak in terms of product benefits, and perceptual positions of customers. R&D professionals speak the quantitative/engineering language of product specifications and performance. When misunderstanding occurs, customer needs and engineering solutions are disconnected even though each group thinks that they are talking about the same product. Subtle differences in language often imply vastly different solutions, and can result in a difference between a successful project and an unsuccessful project (Griffin and Hauser 1993).

Organisational barriers can be created through differences in the allocation of *organisational responsibilities* and through a lack of senior management support. Different task priorities and responsibilities of R&D and Marketing personnel can build up organisational barriers (Dougherty 1992; Souder 1975, 1993). Similarly, different functional success measures (e.g., market share vs number of patents) also discourage integration between two groups (e.g. Souder 1988). A lack of senior management support is also a major hurdle for cooperation between R&D and Marketing (Griffin and Hauser 1996). Given the differences between the two functions discussed earlier, without senior management's drive or the formalization of collaboration between the two functions, it is unlikely that they will work together spontaneously.

Finally, organisations can erect physical barriers to cooperation between the two functions. Allen (1970, 1986) found that it is not uncommon for Marketing to be physically isolated from R&D in a firm. For example, at a major computer company, the Marketing offices were located in different US states. Physical barriers decrease communication, reinforce separate thought worlds, encourage jargon-ridden communication, and heighten perceptions of the difference between R&D and Marketing personnel. These barriers can lead to strong ‘not invented here’ attitudes, where each function supports the work generated only from within its own group. Consequently, genuine team work and cross-functional collaboration will be hindered (Carroad and Carroad 1982).

2.3.3 Theorising the Marketing/R&D Interface

Gupta, Raj and Wilemon (1986) formulated a model of the Marketing and R&D interface (Figure 2.1), and have argued from a contingency perspective that the desired degree of integration depends on a firm's innovation strategy and the uncertainty of the environment within which it operates. Higher environmental uncertainty and strategies that target risky technology or product positions lead to an increased need for R&D and Marketing integration. However, the evidence with respect to this model and its central argument has been mixed. In another study, Gupta, Raj and Wilemon (1986b) compared the responses of 107 R&D managers and 109 Marketing managers in high-technology companies, and found that there were socio-cultural differences between them which affected the quality of their interaction.

Figure 2.1 Gupta et al's (1986) Model of the Marketing and R&D Interface

The main contribution of these two studies is that they identified a common lack of integration between Marketing and R&D functions in firms, highlighted the organisational and individual factors that affect the degree of integration, and propose that the required degree of integration depends upon organisation strategy and perceived environmental uncertainty. Gupta, Raj and Wilemon (1986b) also posited that the greater the gap between the required and actual degree of cross-functional integration, the lower the probability of new product success. However, their model has a major limitation in that it does not account for the dynamics of the relationship between Marketing and R&D, particularly the socio-political dimension, as they interact with each other in the NPD process.

Parry and Song (1993) tested the constructs of the Gupta et al (1986) study by surveying Japanese high technology firms, and generally found support for the hypotheses. They found that Japanese managers in firms which emphasised developing new markets and new product areas (“prospectors”) perceived a higher need for integrating Marketing and R&D than did firms that pursued more cautious innovation strategies (“analysers”). In turn, analyser firms desired more integration than did firms that placed little emphasis on innovation (“defenders”). These findings indicate that managers’ perceptions of the external environment are important mediating factors for Marketing and R&D integration. The Gupta, Raj and Wilemon model suggests how one might analyse the desired level of Marketing and R&D integration given a firm’s strategy and environment. However, the unit of analysis is integration at the program level, rather than at the project-level which is more

frequently used in this area of research (Griffin & Page 1993). In contrast, a study that uses the project as the unit of analysis, as the study reported in this thesis does, may be more beneficial to practitioners.

Ruekert and Walker (1987) proposed a more detailed model to explain the Marketing and R&D interface (Figure 2.2). This model has three dimensions: situational (internal and external environments); structural/process (transactions, communication and coordination factors); and outcome (functional outcomes and psycho-social outcomes). The framework and the associated 14 propositions examine how effectively Marketing personnel interact with personnel in other functional areas when planning, implementing and evaluating marketing activities. Their framework is based on resource dependence theory (Gupta, Raj and Wilemon 1986; Ruekert and Walker 1987) and it will be dealt with in detail in the next chapter. These authors transformed each of their propositions into testable hypotheses and empirically tested parts of the theoretical model by using survey responses from Marketing, R& D, Manufacturing and Accounting personnel in three divisions of a Fortune 500 firm. Their model differs from that of Gupta, Raj and Wilemon (1986) because the situational dimensions feed into a delineation of the management situations and processes that govern whether interaction and integration are achieved, as well as specifically how they have been achieved. Ruekert and Walker (1987) predicted that more interdependence, task and work similarity, formal between-group interaction, and between-group influence lead to less conflict and higher flows of resources, work, assistance as well as higher levels of perceived effectiveness between the groups. In a small pilot study, they found support for the basic proposition that Marketing and R&D interaction results from, and is influenced by, perceived

resource dependencies in the completion of tasks. The more one function believes that it depends on another function, the greater the interactions and resource flows across the functional boundaries and the more influence the information-providing group has over the information receiving group.

Figure 2.2 Ruekert and Walker's (1987) Model of the Marketing and R&D Interface

Ruekert and Walker's (1987) model may be more appropriate for analysing interfaces within one company or within a set of companies that are facing similar environments and using similar strategies. This model can be used to ascertain the aspects of integration that a company might want to improve. It does not, however, suggest solutions to particular integration problems. In particular, it does not explicitly examine the degree to which each function influences the others, and the extent to which such influence would affect the outcomes of the process.

Combining and extending the models of Gupta, Raj and Wilemon (1985) and Ruekert and Walker (1987), Griffin and Hauser (1996) propose a framework to focus research on integrating mechanisms at the project level. Like Ruekert and Walker's model, it is organised in terms of situational, structural/process, and outcome dimensions (Figure 2.3).

The *situational dimension* indicates that the amount and kind of cross-functional integration needed in a project depends upon specific situations such as the nature and phase of the project and the level of project uncertainty. For example, earlier product development phases require the highest level of integration between Marketing and R&D. Close integration between these two functions is less critical to success later in the process, although R&D may need to become closer to other functions, such as Manufacturing, at that time (Dwyer and Mellor 1991; Moenaert, Souder and DeMeyer 1994). Higher project uncertainty also leads to a greater need for Marketing and R&D integration (Gupta, Raj & Wilemon 1986). Project uncertainties include market, customer, competitor, and technological aspects (Moenaert and Souder 1990). Each of the firm's current products addresses a certain set of needs for a certain set of customers. Market certainty is highest for NPD projects that are intended to solve the needs for current customers. Solving an expanded set of needs for current customers, or the current set of needs for a new set of customers, increases market uncertainty, and solving a new set of needs for a new set of customers maximises market uncertainty. Griffin and Hauser (1996) further suggested that each product or service meets a set of needs with a certain set of product-performance and process technologies. Technological uncertainty is lowest

for a project that uses only the product-performance and process technologies already used in meeting this set of needs. Technological uncertainties are increased by incorporating technologies (e.g., components, materials, mechanisms) not used before in a given product area. Technological uncertainty is maximised when the firm has to develop or import completely new technologies, whether they be product performance or process related.

The *structural/process dimension* indicates how organisational structure and processes can enhance or reduce cross-functional integration. Griffin and Hauser (1996) suggested six organisational factors that may affect integration: relocation and facilities, personnel movement, informal social systems, organisational structure, incentives and rewards, and formal integrative management processes. How each factor affects integration, and which actions are required for enhancing cross-functional integration, depends upon the needs of the firm and its situation.

The *outcome dimension* measures the effect of integration on both final project outcomes and intermediate process outcomes. Griffin and Hauser (1996) postulated that success, in terms of financial, market, firm-level (e.g. success rate of new product) and process (e.g. time to market) measures, is more likely to occur when the integration that is achieved matches the integration that is needed. In addition, the actual integration achieved and the integration mechanisms chosen affect both the technology and the market outcome.

Griffin and Hauser's (1996) framework is more comprehensive than that of Gupta, Raj and Wilemon (1985) and Ruekert and Walker (1987), especially in the

structural/process dimension. It helps us to better conceive the causal relationship of perceived needs and achievement, and in turn the outcome of integration. However, as Griffin and Hauser (1996, p. 191) have noted, it is a formally undeveloped “causal map”, and researchers are given no specific explanation of how to operationalise the constructs and systematically test the model. Moreover, the model does not include political aspects, in terms of the power and influence of individual key members in the cross-functional teams. As the organisational studies literature has long emphasized (e.g, Mintzberg 1983; Pfeffer 1992), power is endemic within organisations and demonstrably has important effects on individuals and teams.

Situational Dimensions	Structural/Process Dimensions	Outcome
Dimensions		

Figure 2.3 A Framework for Studying the Project-Level Marketing/R&D Interface (Adopted from Griffin and Hauser 1996)

Although there are several well-cited articles on the specific dimensions of cross-functional integration (e.g. Anderson 1982; Ruekert and Walker 1987; Wind 1981), there is no *integrative framework* that encompasses the dimensions of organisation, project level activities and power for relating Marketing's participation to its influence on NPD decision making. Moreover, the following key questions remain unanswered by NPD research reported to date. First, how can managers ensure the necessary level of cooperation and interaction between R&D and Marketing in the NPD process (Griffin and Hauser 1996)? Second, why do some groups transform into high performance, collaborative cross-functional teams while others engage in an unrelenting struggle to function coherently (Jassawalla and Sashittal 1999)? Third, because the dynamics of Marketing and R&D interactions cannot be fully understood or explained by marketing knowledge alone, what social-political and organisational theories can be drawn on to help fill this gap?

This study was designed to address these knowledge gaps and to provide a better understanding of the critical NPD issues. Due to the social-political and organisational focus of this study, the knowledge gaps cannot be effectively addressed without importing knowledge from organisation and political science theories, particularly those relating to the constructs of participation and influence as they are used in this study (e.g., Gresov and Stephens 1993; Moenaert and Souder 1996). It is therefore necessary to review the relevant literatures.

2.3.4 Participation and Influence in the NPD Process

Shetzer (1993) noted that employee participation (i.e., active involvement in decision-making within organizations), and notably from a social information processing perspective, has been a growing area of enquiry and debate ever since the seminal work of Lewin and his colleagues in 1939. Strauss (1982) also noted that participation has become a major social, political and economic issue throughout the world in a wide variety of organisations. Participation enhances outcomes such as innovation, decision effectiveness, productivity, as well as employee satisfaction and commitment (Bartolke, Escheweiler, Flechsenberger and Tannenbaum 1982; March and Simon 1958; Tannenbaum 1976). Therefore, participation is a vital construct in organisational studies where employee motivation and commitment are important to a company's performance.

Although considerable research has been conducted to determine the efficacy of employee participation, an unequivocal verdict has not been reached (Campbell and Campbell 1988; Shetzer 1993). For instance, in their comprehensive review of empirical studies on participation, Locke and Schweiger (1979) concluded that participative interventions do appear to contribute to increases in satisfaction, but that the evidence for increases in productivity is equivocal at best. Despite this general conclusion, organisations have continued to implement participative interventions at an increasing rate (Gorlin and Schein 1984). Several reviews have attempted to integrate and summarise what is known about the relationship between participation and organisational outcomes (Cotton et al. 1988; Miller and Monge

1986; Tracey 2004; Wagner and Gooding 1987). Although these have generally extended the earlier attempts to understand participation, they have added little to our knowledge of the specific conditions under which participation can be expected to result in positive outcomes or indeed the extent to which participation even leads to influence in decision-making.

Suffering a similar weakness as that of the R&D and Marketing integration literature discussed earlier, the participation literature offers little understanding of the effects of contingency on the participation-influence relationship. For example, Gresov and Stephens (1993) found that participation-influence activity is not a simple matter of bilateral exchange, but behaviour that arises within a complex, interactive context, which influences the conditions under which it is possible for work units to attempt to influence the design or operations of other work units. Moreover, one of the most important determinants of managerial effectiveness is success in influencing people and developing commitment to task objectives (Yukl 1989). To achieve desirable outcomes, managers need to understand the antecedents of influence. Under normal circumstances, one must participate in a decision process to influence that decision. Thus, participation can be regarded as a necessary but not sufficient condition of influence (Moenaert and Souder 1996; Wagner 1994; Workman 1993).

To date, few studies have sought to ascertain the conditions under which Marketing's participation has the greatest influence within an NPD team. In particular, what contextual factors moderate the participation of Marketing personnel and their influence on R&D personnel (Workman 1993)? Few systematic studies have examined the effect of Marketing's influence on NPD in a contingency context.

Managerial effectiveness in an organisation is primarily a function of power and influence strategies (Brass and Burkhardt 1993; Cook and Emerson 1978; Farmer et al. 1997; Yukl et al. 1990, 1992, 1996), but little empirical work has been conducted on the contingency factors that affect the attempts to achieve influence. Furthermore, the organisational context has significant effects on influence attempts (Gresov and Stephens 1993; McQuiston and Dickson 1991; Parry and Song 1993; Silk and Kalwani 1982), but few empirical studies have explored influence attempts at the individual level of participation. Finally, as discussed earlier, in the NPD process Marketing and R&D tend to have conflicting goals. Very often they need to compete for corporate resources and dominance through the exercise of power and influence (Maute and Locander 1994). Hence, it is important to clearly understand the concepts of participation and influence as part of the internal dynamics of Marketing and R&D interaction in the NPD process, which is what this study seeks to do.

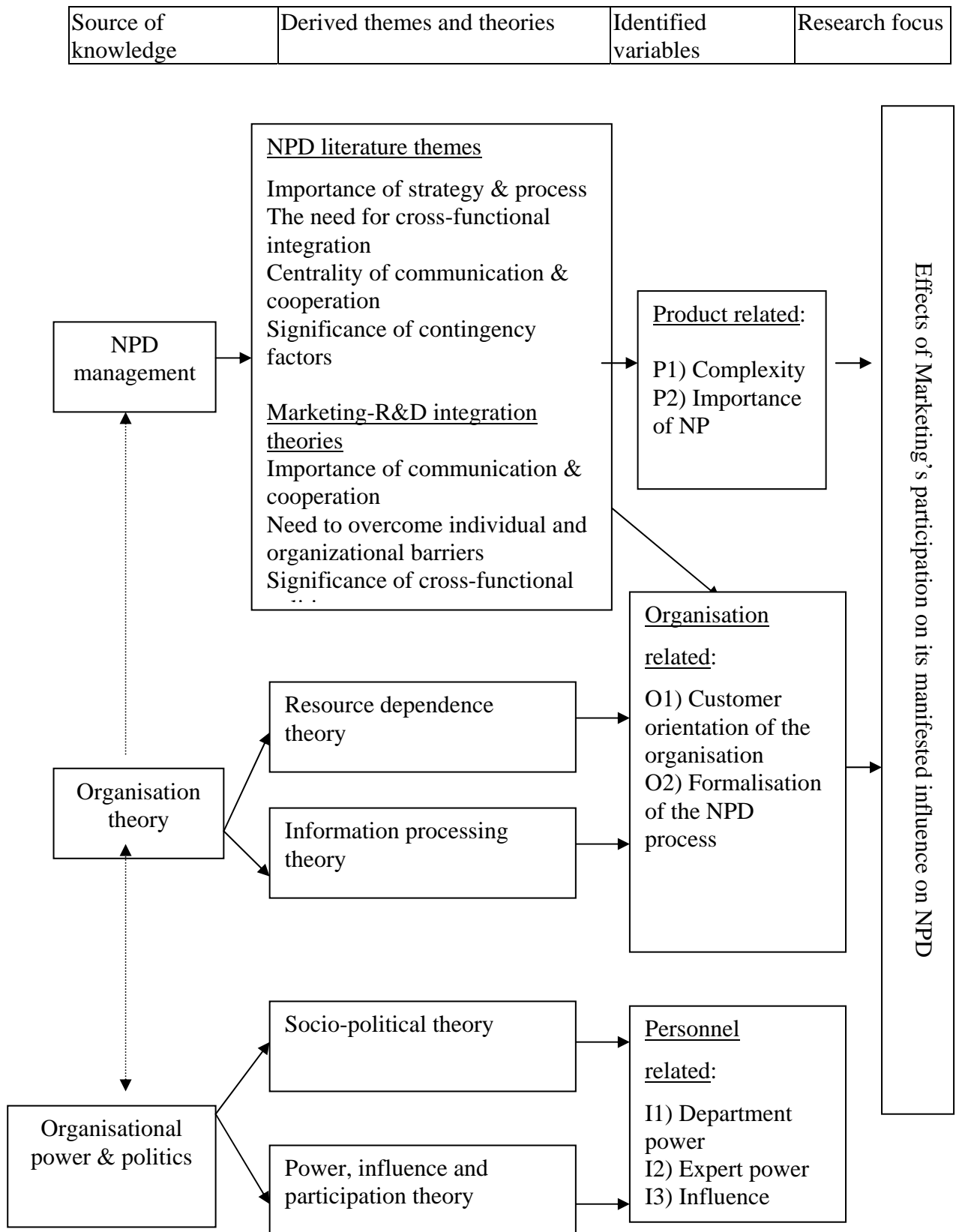
Participation in the context of this study is defined as the NPD activities in which Marketing and R&D are involved, as they collaborate to exchange information and expertise in order to accomplish their personal and job-related objectives (Gupta, Raj and Wilemon 1986; Moenaert and Souder 1996). The participation construct is operationalised here by items that reflect the “degree of involvement” of each function in the NPD decision making process (Silk and Kalwani 1982). Influence in the context of this study is defined as the extent to which information offered and actions exercised by participants in the NPD process lead to changes in the behaviour or actions of others involved in the NPD process (Kohli 1989; McQuiston and Dickson 1991). In this study, the degree of influence on NPD decision making is measured by items which are similar to that used by Kohli (1989) and Venkatesh et

al. (1995), e.g., to what extent did marketing personnel's participation influence decisions in an NPD project. Participation does not necessarily lead to influence, which only occurs when information that is received leads to changes in behaviour or decision making by the recipient. Thus, as noted above, participation is a necessary antecedent but not a sufficient condition of influence.

2.4 Literature Review Framework

The framework depicted in Figure 2.4 shows the linkages between the various literatures that have been drawn on in this review, and provides a basis for the development of the theoretical model proposed in Chapter 3.

Figure 2.4 Literature Review Framework for this Study



2.5 Chapter Summary

This chapter discussed the theoretical perspectives, key concepts and empirical findings in the relevant literatures, which form the theoretical foundation for developing the hypotheses in the next chapter. The literature review framework depicted in Figure 2.4 links the relevant bodies of knowledge and related theoretical roots with the individual constructs deployed in this study. The literature review was developed in the following way. Firstly, the overall body of NPD knowledge was addressed and synthesized into three main approaches that are relevant to this study. Secondly, the literature on cross-functional integration in NPD was reviewed, with special reference to the issues that affect Marketing and R&D interaction. Thirdly, the central construct of participation and its relationship to influence was examined. Few NPD studies to date have systematically explored functional participation and its effect in NPD decision-making . However, ignoring such an important aspect of the NPD process may significantly hamper our understanding of what actually influences the outcomes of cross-functional interaction. The next chapter addresses this knowledge gap in the NPD literature by advancing a theoretical model which seeks to explain the effect of the Marketing function's participation on its manifest influence in the NPD process.

CHAPTER 3 THEORETICAL MODEL AND HYPOTHESES

Preamble

Having reviewed the literature on new product development (NPD), focusing on the social and political aspects of cross-functional integration, a theoretical framework will now be built by further developing existing knowledge and addressing the identified knowledge gaps.

A central argument advanced in this thesis is that it is important to understand the relationship between the participation and influence of individual personnel within the new product development team. As indicated in the last chapter, the focus of this study is on the participation of Marketing personnel in new product development projects, and their potential influence on R&D personnel in the process. As previously discussed, this relationship may not always be positive, and the extent of influence also varies. Hence, it is important to know what factors moderate the effects of Marketing's participation on its influence in the NPD process.

This chapter first delineates the theoretical rationale that is the basis for building the conceptual framework of this study. The chapter then postulates the possible links between the independent variable (participation of Marketing), the contingency variables (personnel factors, organisational factors and new product characteristics), and the dependent variable (influence on R&D). Finally, the chapter explains the derivation of the hypotheses proposed in this thesis.

3.1 Theoretical Rationale

As discussed in the last chapter, the approach in cross-functional team studies to date has usually been based on one or more of the following theoretical perspectives: the *socio-political perspective* (Eisenhardt and Bourgeois 1988; Frost and Egri 1991; Maute and Locander 1994), the *information processing perspective* (Moenaert and Souder 1990; Souder and Moenaert 1992; Moenaert et al. 1994) and the *resource dependence perspective* (Gupta, Raj and Wilemon 1986; Ruekert and Walker 1987).

Each of these perspectives offers valuable insights into the nature of cross-functional interaction. However, each on its own is not sufficient to explain the nature of observed interaction or the conditions that influence cross-functional relationships in NPD projects. Therefore, these three perspectives have been synthesised to produce the model that is to be tested in this study. How each of the above perspective was incorporated in the synthesis is explained in the following sections.

3.1.1 The Socio-political Perspective

Frost and Egri (1991) argue that innovation is essentially shaped by organisational power and politics. Innovation engages and arouses human actors who have different interests and perspectives and who stand to gain or lose in different ways as a result of a particular innovation. Contests and struggles are often part and partial of the innovation process, which is usually played out through the exercise of power and influence.

The socio-political perspective views organisations as arenas for exchanging power and influence, in which actors are interdependent, purposive and who take into account the actual and prospective actions of others inside and outside of the organisation. Bacharach and Lawler (1997) define organisational politics as the efforts of individuals or groups in organisations to mobilise support for, or opposition to, organisational strategies, policies or practices in which they have a stake or interest. Hence, organisational politics are at the centre of organisational processes and are a principal way that people get things done. Bacharach and Lawler further propose three factors that managers are likely to consider before determining what influence strategies they use in a given situation: *contextualisation*, *mobilisation* and *coordination*. Contextualisation is a process by which individuals take into account the actions of others within the organisation, and assess the utility of not acting, acting alone, or acting in concert with others. The mobilisation factor is about how to use the resources (e.g. knowledge, information and authority) that are available for influencing organisational policies to achieve the desired ends. Coordination is about aligning individual or coalitional actions with anticipated actions or reactions from other individuals or groups in the organisation.

With the flourishing of cross-functional interaction research in the field of NPD, the socio-political perspective has gained greater attention. According to Maute and Locander (1994), influence is germane in NPD for three reasons. Firstly, at its core NPD is about risk, ambiguity and uncertainty, and is therefore replete with disputes about resources caused by differences in perceptions amongst the team members (Frost and Egri 1991). Secondly, managers who are charged with formal

responsibility for NPD may have limited authority to acquire information, resources and support. Thirdly, despite the recognition of effective functional interaction and joint decision making, NPD is often replete with cross-functional conflict. These conditions lead to a concentration of power and influence in those NPD team members who are in possession of relevant information and resources (Hickson et al. 1971; Hambrick 1981), and breed struggles for ascendancy by people with different goals and objectives (Maute and Locander 1994).

Given the significance of the socio-political perspective in explaining and predicting organisational behaviour and its impacts on the organisation's performance, this perspective has been chosen as one of the cornerstone theories in building the theoretical model used in this study. In the following section on hypotheses building, a group of power factors derived from the socio-political perspective have been selected to be tested for their moderating effects on the relationship between Marketing's participation and its manifest influence in NPD.

3.1.2 The Information Processing Perspective

Information processing refers to the gathering, interpreting, and synthesis of information in the context of organisational decision making. A basic assumption of the information processing approach is that organisations are open social systems that must deal with work-related uncertainties arising from an unstable environment. Organisations, in order to manage effectively, need to develop information processing mechanisms capable of dealing with uncertainty (Tushman and Nadler 1978). Therefore, the organisation can be seen as a "machine" for information

processing. For example, Simon (1973, p. 270) argued that the division of labour in an organisation means apportioning the total system of decisions that need to be made into relatively independent subsystems, each one of which can be designed with only minimal concern for its interaction with the others. Using the concept of 'bounded rationality', Simon concluded that an organisation which faces a complex environment should be designed in a way that minimises the need for information distribution amongst its units to reduce their information loads.

This perspective is important to help build the model used in this study because NPD teams are the information processing subsystems of the organisation that are designed to reduce customer, market and technology uncertainty (Daft and Weick 1984; Moenaert and Souder 1990 and 1996; Tushman and Nadler 1978). Hence, successful NPD outcomes require effective interaction between functions in exchanging information, knowledge and experience (Moenaert and Souder 1990). Similarly, Mintzberg (1979) notes that high levels of environmental uncertainty place high demands on a firm's information processing capability, which can be enhanced by high levels of interdepartmental integration (Parry and Song 1993).

The information processing perspective is useful in that emphasises the importance of formalizing organisational tasks and functions to ensure effective processes (Tushman and Nadler 1978). However, it fails to explain the relationship of this structuring with innovation (Burns and Stalker 1961). When organisations innovate, they do not simply process information, they actually effect a socialisation of exchange of knowledge amongst different units and functions within the organisation (Nonaka and Takeuchi 1995). Adopting this view, it can be seen that participation,

power and political influence are important activities in the process of socialisation and to understand this we need to draw on other theoretical perspectives.

3.1.3 The Resource Dependence Perspective

The resource dependence view, initially proposed by Pfeffer and Salancik (1978), posits that an organisation is a coalition of varying interests. Participants in organisational activities, while usually dependent on the inputs of others to achieve their own goals, do not necessarily share preferences and goals with them. The question of whose interests are to prevail in organisational actions politicises relationships amongst functional participants. Therefore, *dependence*, in this context, most often involves power struggles and attempts to exert political influence amongst the participants. Participants attempt to exchange their own resources and their performances for more control over the collective effort, and then use that control to pursue actions that promote their own interests. Pfeffer and Salancik (1978) further argue that effectiveness and organisational performance can be evaluated only by asking whose interests are being served. In turn, managerial effectiveness is measured by the effectiveness of managing the demands of the organisation's stakeholders, particularly the demands of interest groups upon which organisations depend for resources and support.

This perspective also assumes that managers take action to manage external uncertainty and dependence. Under conditions of uncertainty, personal-social relations become more necessary because they are more effective than impersonal mechanisms in resolving that uncertainty (Salancik and Pfeffer 1977). Hickson et al.

(1971) also note that power accrues to those in the organisation who are able to reduce uncertainties for the organisation, and the more central the uncertainty and the more irreplaceable the actor, the more influential that they will be. Salancik and Pfeffer (1974) indicate that the power of a department in an organisation is a function of the amount of important resources that it contributes to the organisation. Here, importance is determined in terms of the degree of dependence of other departments on those resources to achieve their own objectives. The resource dependence perspective therefore argues that Marketing and R&D are rarely self-sufficient with respect to the critical resources that are needed to carry out their NPD roles. Participation is required to allow for resource sharing and reliable resource flow (Gupta, Raj and Wilemon 1986; Ruekert and Walker 1987).

Hence, the power and human factors emphasised in the resource dependence perspective complements the information processing perspective in building the theoretical model of this study which also draws on the socio-political perspective. Despite the evident appeal of the resource dependence theory, nearly three decades after the pioneering work published by Pfeffer and Salancik (1978), “there is a limited amount of empirical work explicitly extending and testing resource dependence theory and its central tenets” (Pfeffer and Salancik 2003: xvi). This study attempts to provide an empirical test on this theory. The next section shall discuss how the constructs derived from the three perspectives were incorporated in the model for testing.

3.2 Theoretical Model and Research Hypotheses

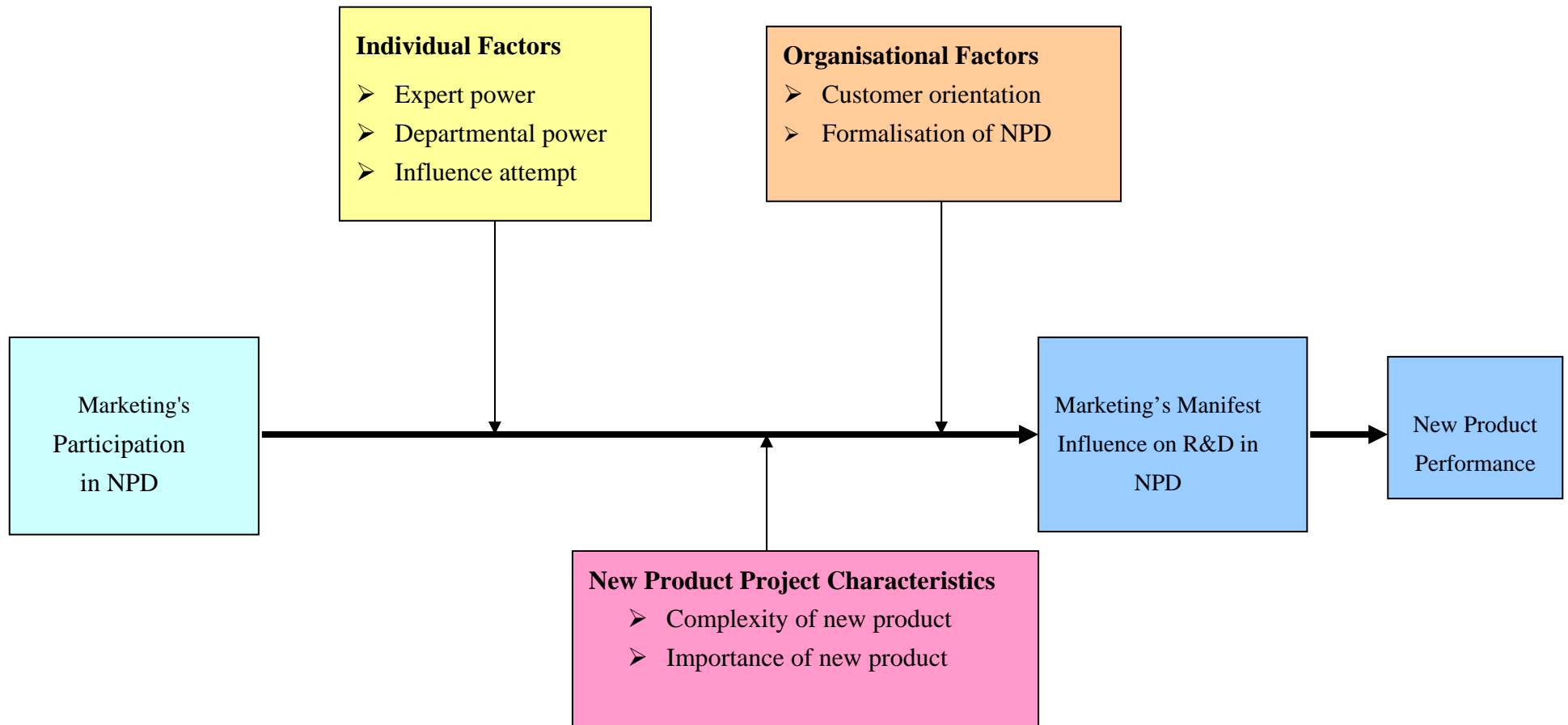
3.2.1 The Proposed Model

The proposed theoretical model is shown in figure 3.1. This model hypothesises that Marketing's participation will lead to its manifest influence on R&D in the NPD process. However, the theoretical rationale of this model, as discussed earlier, argues that three groups of contingency factors (individual, organisational, and project characteristics) derived from the three theoretical perspectives discussed above have moderating effects on the relationship between Marketing's participation and its influence on R&D in the NPD process. These contingency factors, adapted from Galbraith's (1982) key constructs of task, people and structure in organisational design, may have positive or negative effects on that relationship and this study aims to test these effects.

3.2.2 The Independent and Dependent Variables

The independent variable of the model of this study is Marketing's participation. *Participation* in this study, as defined in the previous chapter, refers to the extent of information sharing and shared activities between Marketing and R&D in the NPD process, and is measured by the total amount of written and/or verbal formal or informal communications that they exchange in the NPD process.

Figure 3.1 The Effect of Marketing's Participation on its Manifest Influence on New Product Development: A Contingency Model



Adding to the earlier discussion on participation, Ference (1970) and O'Reilly (1982) further explain that to carry out a decision task, individuals establish a communication network through which they send and receive the information that is needed to make that decision. Johnson and Bonoma (1981) also find that the decision-making team exists as a communication network, and derives its configuration from regularised patterns of communication that reflect the individuals involved and the relationships between them. Therefore, to participate in the NPD process, an individual must be a part of the communication network. Before one can influence another individual, one must participate in the communication process by sending information that is received by another person (McQuiston 1989). Kanter (1979) identifies participation in programs and problem-solving task forces as an organisational factor that can be used to predict power generation. More participation tends to generate higher power for the participant, and vice versa.

In this study, the definition of *influence* is similar to that used by Kohli (1989) and McQuiston and Dickson (1991), and refers to the extent to which the information that is offered and action that is taken by Marketing or R&D for consideration in the NPD process changes the behaviour and actions of other participants in the NPD team. It is argued here that Marketing's participation, as perceived by R&D, is related positively to its influence on R&D in the NPD process. This hypothesis is justified by the following arguments. Firstly, because an individual can influence another only by providing some information through the communication network, one would expect that the more an individual participates by offering communication, the greater is the possibility of that person influencing others (Stogdill 1974). Silk and

Kalwani (1982) also find that individuals who have a high degree of participation have a greater probability of having a high degree of influence.

Secondly, Song and Parry (1997) found that Marketing's functional knowledge domain through participation in the NPD process can enhance other functions' knowledge about marketing. For example, R&D can gain a better understanding about consumers and competition by jointly visiting major customers and conducting market research. Such integration benefits NP project performance. Accordingly, it is hypothesised that:

H1. Marketing's participation is positively related to its influence on R&D in the NPD process.

The dependent variable of the model in this study is new product performance. *New product performance* is the outcome of launching the new product. It is measured by profit, sales, sales growth and market share goals that are specified in the new product project. Performance is thus the extent to which a new product achieves such goals after launch. This dependent variable results from the effect of Marketing's manifest influence on R&D in the NPD process, and this in turn arises from Marketing's participation which is moderated by the three groups of contingency factors indicated above. With reference to the information processing and resource dependence perspectives, Marketing and R&D require information and other resources from each other to enhance their own performance. Marketing's influence should enable the NPD team to be aware of customer needs, market opportunities and threats, and thus should have positive effects on new product performance (Moenaert and Souder 1990; Ruekert and Walker 1987). Thus, it is hypothesised:

H2. Marketing's manifest influence is positively related to new product performance.

3.2.3 The Moderating Variables

As previously discussed, the relationship between the participation and influence of Marketing and R&D in the NPD process can be complex, and is best explained and understood through a contingency approach. This approach examines the effects of the three sets of moderating variables on the primary hypothesised relationship – Marketing's participation and manifested influence on R&D. These contingency factors were created with reference to Galbraith's contingency organisational design model (1982).

1. The Moderating Effect of Individual Power and Influence Attempts

The first category of contingency factors is related to the sources of power of the individual and the influence attempts exerted by the members of the NPD team. As noted in the literature review chapter, it is important to study the role and exercise of power in the NPD process. Mintzberg (1983, p.1) argues that although many forces affect what organisations do, power is critical to anyone who is interested in understanding how organisations work and what they end up doing. If we are to improve the functioning of organisations, then we must understand the power relationships that surround and infuse them.

Moreover, as discussed earlier with respect to the resource dependence perspective, the essence of organisations is interdependence, and personnel usually need to obtain assistance from others to accomplish their jobs. An ability to get things done within an organisation requires that personnel develop the power and the capacity to influence those on whom they depend (Pfeffer 1992). The increasingly rapid pace of technological, social and market changes, particularly in high technology firms, hastens the emphasis on speed in making organisational decisions. Consequently, employees in high technology firms tend to get things done in less formal ways, and they rely more on power and influence, as well as the leveraging of the positions of key personnel in social networks, and this involves ongoing negotiations amongst organisational participants (Pfeffer 1997).

There is no universally accepted definition of power, but the following definitions are amongst the most common. Mintzberg (1983, p. 4) defines power as the capacity to effect or affect personal or organisational outcomes. Kanter (1979) states that power is the ability to mobilise resources. Wrong (1968, p. 77) defines power as “the capacity to control others . . . The evidence that a person or group possesses the capacity to control others may be the frequency with which successful acts of control have been carried out in the past”, and that power is an “intentional and effective control by particular agents (p. 676). Dahl (1957, p. 202) defines power as a “relation amongst actors in which one can get another to do something that the other would not otherwise have done”.

Drawing on these definitions, power in this study is defined as the ability of one party (e.g., Marketing personnel) to influence another party (e.g., R&D personnel) or *vice versa*. The outcome of power is a successful modification of the behaviour and

actions of the target. Several studies have tested the sources of personal power as identified by French and Raven (1959), including coercive power, legitimate power and expert power that affect participation and influence (Kohli 1989; Patchen 19764; Speckman 1979). This study focuses on three forms of power, i.e. expert power, departmental power, and influence attempts. They have been chosen because they are as the most significant power-related constructs that are applied in NPD studies on cross-functional interaction (e.g., Souder, 1981 & 1988 and Workman, 1993).

Expert power is defined as the capacity to influence others by possessing important knowledge or skills that the others need in a particular situation (French and Raven 1959). It has been selected in this study because the nature of NPD tasks, especially in a high technology organisation, requires inputs of specialised knowledge or expertise from various functions. In this study, expert power is the degree to which Marketing personnel are perceived by R&D personnel as having valuable professional knowledge that is critical in the NPD process, e.g., knowledge on customer needs, market characteristics and marketing techniques. Although several studies have examined the perceived expert power of Marketing and R&D in the NPD (e.g. Gupta, Raj and Wilemon 1986; Souder 1988), none have examined its effect on the relationship between participation and influence. Generally, the more of this source of power a participant in a decision-making process has, then the higher the level of influence they can exert in that process. In this study, Marketing's participation is hypothesized to lead to stronger influence on R&D as the more R&D perceives Marketing to have expert power. The following hypothesis formally states this effect.

H3. When R&D perceives that the expert power of Marketing is higher than its own, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

Departmental power is the capacity to influence vested in a department by senior management, as perceived by other departments in the firm. The resource dependency perspective of organisations suggests that different departments within an organisation have differential abilities to obtain resources that are critical to the organisation. Those departments that are vested with higher power tend to be more influential in resource allocation. So, apart from personal sources, an individual's influence can also be derived from the power of their department. Hence an employee may be attributed influence simply on the basis of membership of a powerful department. In support of this argument, Brass (1984) found that a supervisor's ratings of subordinates were related to their departmental membership. Blau and Alba (1982) found that departmental membership had a more important source of influence than individual sources of power. Workman (1993) found that, in technology-oriented firms, Marketing personnel saw R&D as having greater influence in NPD. However, other research findings also suggest that where the R&D function is more powerful, it is often held responsible for the market performance of the new product (Song and Parry 1997). Hence, R&D tends to develop marketing capabilities, which further reduces the perceived legitimacy and role of Marketing in the NPD process (Workman 1993). Thus, it is hypothesised that:

H4. When R&D perceives that the departmental power of Marketing is less than its own, Marketing's participation will lead to a weaker influence on R&D in the NPD process.

Influence attempts are the degree of effort that an individual exerts to achieve influence with a targeted individual or group. Such effort involves applying pressure, attempting strong persuasion, and increasing consultation with the target to comply with the requests of the source. Gresov and Stephens (1993) found that influence attempts enhance the achievements of influence. The rationale is that such attempts imply increased effort and persistence to achieve the desired outcomes. Yukl, Kim and Falbe (1996) asserted that such strong persuasion and consultation are more likely to result in the commitment of the target to the source's requests because the targeted individual or group is more likely to be convinced by the stronger effort of influencing.

Similarly, Patchen (1976) and McMillan et al (1973) suggested that individuals who make stronger influence attempts tend to have greater manifest influence. Patchen (1976) found that individuals' stakes in decisions are related to their influence, and McMillan et al (1973) also discovered a significant correlation between individuals' self-confidence and their influence. However, Kohli (1989) found that when expert power is accompanied by strong influence attempts, it does not significantly lead to manifest influence. On the other hand, if expert power is accompanied by weak influence attempts, it is significantly related to manifest influence. Given the conflicting findings on this important moderating factor, this study seeks to test the effects of influence attempts on achieved influence as specified in the following hypothesis.

H5. When R&D perceives that the influence attempts of Marketing are higher than its own, Marketing's participation will lead to stronger influence on R&D in the NPD process.

2. The Moderating Effect of Project Characteristics

In addition to individual personnel factors, Adler (1995), Frost and Egri (1991), McQuiston (1989) and Moenaert and Souder (1990) found that the *characteristics of the new product project* moderate interdepartmental interdependence. Two such factors considered in this study are product complexity and the importance of the new product to the firm.

The complexity of a new product is the degree of task difficulty and variability inherent in designing and developing the product. Complexity thus creates a need for new and a greater amount of information in order to make accurate decisions in developing the new product. However, new product complexity entails not only technical complexity but also marketing complexity as greater product complexity often creates greater problems for both manufacturing and marketing. For instance, marketing a standard digital video disc (DVD) player is much simpler than marketing a digital video broadcasting (DVB) set top control box. It is not immediately clear how the new product complexity will affect the influence power of the two departments.

Adler (1995) has argued that a greater degree of complexity creates uncertainty, which in turn impedes the resolution of problems in the NPD process. This implies that complex products call for higher dependence on R&D's expertise, which also engenders a greater need for information sharing in the NPD team. Frost and Egri (1991) also suggest that the development of a complex product presents fundamental challenges for Marketing and R&D. Such challenges can be translated into political

influence due to the interdependence between Marketing and R&D as posited by socio-political and resource dependence theorists. In this situation, as argued earlier, the intensity of influence of R&D increases with the complexity of the new product design. Therefore, it is hypothesised that:

H6. When R&D perceives that the complexity of the new product is high, Marketing's participation will lead to a weaker influence on R&D in the NPD process.

Importance is the degree to which the new product project is perceived to have a significant effect on the company's profitability and other strategic goals. Prior research suggests that the higher importance of an activity leads to greater participation and influence by the members of the decision-making team (e.g., McQuiston 1989; Yukl, Kim and Falbe 1996). The rationale is that the closer the relationship between the project and company performance, the greater the focus of project team leaders and senior management on the performance of project members. Reve and Johansen (1982) identified the importance of the purchase decision to the organisation as one of the key factors that affect both the number of participants and their behaviour throughout the purchase process. Both information processing and resource dependence theories suggest that Marketing and R&D have information and expertise that can significantly affect new product project performance (Moenaert and Souder 1990). The importance of the new product project can serve as a general predictor for the amount of communication that will occur among members of a decision-making team (McQuiston 1989). Moreover, it can be argued that because Marketing personnel usually have the ultimate responsibility for meeting the company's sales targets, other NPD team members often do not want to risk being

accused of not being supportive of company profit goals. However, the importance effect of a new product project has not been tested on the relationship between participation and influence, hence the following hypothesis has been proposed.

H7. When R&D perceives that the importance of the new product project is high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

3. The Moderating Effect of Organisational Factors

The final category of contingency factors is related to organisational characteristics. It has long been established that organisational characteristics have important impacts on new production innovation outcomes (Burns and Stalker 1971). However, there have been few studies on how individual organisational factors actually affect the relationship between Marketing's participation and influence on R&D. In this study, two organisational factors have been selected based on their importance in the resource dependence and information processing perspectives, i.e., formalisation of NPD managerial roles and processes, and customer orientation of the firm.

Customer orientation is an organisational strategy that focuses on customer need and demand. By closely monitoring customer needs, the customer-centred company can decide which customer groups and emerging needs are the most important to serve, given its resources and capabilities. Customer-centred firms tend to adopt a marketing concept philosophy (Kotler 1997). Deshpande and Webster (1989) argued that customer orientation embodies organisational values and beliefs that put the customer at the centre of the organisation's thinking, and therefore of the development and implementation of strategy. Based on extensive field interviews

with managers, Kohli and Jaworski (1990) found that customer/market oriented companies tend to have three common practices: company-wide efforts to collect market information; dissemination of that information amongst organisational functions; and a systemic organisational response to such information. However, they concluded that a market orientation may or may not be desirable for a business, depending on the nature of its supply-side and demand-side factors. Atuahene-Gima (1996) proposed that customer/market orientation affects the firm's NPD characteristics and performance because it creates a setting that is conducive for effective and efficient organisational activities that lead to superior market performance. Similar views are shared by many other researchers, such as Jaworski and Kohli (1993), Narver and Slater (1990) and Ruekert (1992).

Moreover, the resource dependence view of the organisation suggests that the customer orientation of R&D challenges the role of Marketing in NPD (Pfeffer 1981 & 1992; Salancik and Pfeffer 1977). However, these studies do not clearly point to how a customer orientation can affect the relationship between Marketing's participation and its influence on R&D in the NPD process. Hence the following hypothesis has been proposed.

H8. When R&D perceives that the degree of the customer orientation of the firm is high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

Formalisation is a means of controlling the behaviour of an organisation's employees so that this behaviour is more predictable and more aligned with organisational goals (Child 1984, p. 153). Typically, such means include the

establishment of explicit policies, rules and procedures that prescribe expected actions to complete specific tasks. A similar definition can also be found in NPD studies, such as those of Gupta, Raj and Wilemon (1986) and Parry and Song (1993). Research on the effect of formalisation on participation and influence appears to have produced contradictory findings. On the one hand, several studies have found that increased formalisation leads to lower information use (Deshpande and Zaltman 1982) because it engenders a sense of autonomy amongst individuals and departments, and leads to an increased tendency for territorial behaviour and organisational conflicts (Corwin 1969; Pondy 1967). On the other hand, other research suggests that formalisation leads to greater participation and influence for Marketing because it allows greater recognition and acceptance of the importance of its role in the NPD process (Ruekert and Walker 1987).

Information processing theory suggests that formalisation accords greater legitimacy or credibility to functions and this leads to greater participation and influence. For example, Fombrun (1983) found that an individual's formal position was strongly related to his/her influence. Ronchetto, Hutt and Reingen (1989) also found that the formal rank of an individual in NPD is positively associated with their influence. From this perspective, a greater formalisation of Marketing's role in the NPD process will enhance its participation and influence on R&D.

H9. When R&D perceives that the degree of formalisation of Marketing's role in the NPD process is high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

3.3 Chapter Summary

In this chapter, a theoretical model was developed to explain the main effects of Marketing's participation in the NPD process, and the contingency factors that may influence such effects on R&D in NPD decision-making. Key theoretical perspectives, namely the socio-political, information processing and resource dependence perspectives were synthesised to identify a hypothesis was specified to account for the main effect of Marketing's participation on its manifest influence on R&D in the NPD process. A further hypothesis related Marketing's manifest influence to new product performance. Then, three sets of contingency factors were proposed – individual factors, organisational factors, and new product characteristics. Table 3.1 summarises the hypotheses developed in this chapter.

The next chapter will discuss the research methods that were used to test the proposed research hypotheses of the study.

Table 3.1 Summary of the Proposed Hypotheses

- H1. Marketing's participation is positively related to its influence on R&D in the NPD process.*
- H2. Marketing's manifest influence is positively related to new product performance.*
- H3. When R&D perceives that the expert power of Marketing is high, Marketing's participation will lead to stronger influence on R&D in the NPD process.*
- H4. When R&D perceives that the departmental power of Marketing is less than its own, Marketing's participation will lead to a weaker influence on R&D in the NPD process.*
- H5. When R&D perceives that the influence attempts of Marketing are high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.*
- H6. When R&D perceives that the complexity of the new product is high, Marketing's participation will lead to a weaker influence on R&D in the NPD process.*
- H7. When R&D perceives that the importance of the new product project is high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.*
- H8. When R&D perceives that the degree of customer orientation of the firm is high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.*
- H9. When R&D perceives that the degree of formalisation of Marketing's role in the NPD process is high, Marketing's participation will lead to a stronger influence on R&D in the NPD process.*

CHAPTER 4 RESEARCH METHODS

Preamble

This chapter discusses the research methods that were used in the study, and begins with a brief overview of the two-phased research design employed. This is followed by a description of the preliminary case study that was conducted using qualitative research methods to gain insights into the nature of NPD processes within a Hong Kong based high technology company. The remaining sections discuss the quantitative methods that were used in the second phase of the study to test the hypotheses that were presented in the last chapter. These sections cover the development of the survey sampling plan and data collection instrument, including the operationalisation of the constructs deployed in the proposed theoretical model, the administration of the mail-out survey, and the statistical methods that were used to analyse the survey data.

4.1 Research Design

Although most studies of NPD to date have employed quantitative methods, and most notably the survey, (e.g. Cooper and Kleinschmidt 1987; Moenaert et al. 1995; Olson et al. 2001; Sethi et al. 2001), such methods may not provide the depth of analysis and insights into the essentially process-based nature of this dynamic activity (Pettigrew 1995; Wallace 1984). NPD is a complex, often messy, iterative process that involves intensive social interaction and associated political dynamics within and across organisations, in marked contrast to the highly-structured and

‘rational’ procedures that are often prescribed in managerial texts (e.g. Cooper 1993; Smith and Reinertsen 1992). Recognising this, an increasing number of researchers have effectively used qualitative methods, e.g. participant observation and in-depth interviews, as part of detailed case studies to gain a greater understanding of how the NPD process is actually organised and managed within firms (e.g. Ancona and Caldwell 1990; Dougherty 1992; Jones and Stevens 1999; Workman 1993, 1995). Thus, a qualitative approach was initially adopted for this study to gain a better understanding both of the research problem and of the context within which the study was to be conducted. This was particularly important, given that before this study very little systematic research had been carried out within Hong Kong and Chinese firms on NPD, and so little was known of the management and organisational practices within these contexts. The preliminary qualitative phase of the study was initiated to provide a more thorough understanding of the organisational dynamics of NPD within the chosen context, and to use the insights so gained to develop a more feasible, authentic and effective research approach for the main part of the study. It was acknowledged from the outset that there was a major limitation to the qualitative research, i.e. that of limited generalisability from a single case to a population of interest, so a quantitative study was designed as the second and main phase of the research. This latter phase, collecting quantifiable data from a representative sample, would allow the statistical testing of the proposed hypotheses and enable the researcher to draw generalisable conclusions. In effect, then, the two-phase research design employed complementary methods that together provided more valid and reliable findings.

4.2 The Case Study Research

The aims of the preliminary case study were to gain a better understanding of the context and nature of the NPD process in high technology Hong Kong firms, and to contribute to the formulation of a theoretical model with specific hypotheses about the Marketing/R&D relationship during NPD. The author began looking for the case site company during a pilot study of ten high technology companies. The author notified ten companies of the study objectives and the information which was to be collected, but only one software firm – APEX (a pseudonym) – agreed to accept the author for a three-month, part-time ‘internship’. APEX offers a range of office based programming/software design services. This firm was active in both Marketing and R&D, and had project-based cross-functional NPD teams. The author was assigned to study the Optical Electronic Filing System (OEFS) project. The project was headed by a manager with a degree in electronic engineering who was supported by a business educated Marketing Manager, four R&D engineers and programmers. The team was expected to aggressively promote the software to banks, hospitals and other major private and public organisations that manually prepare and file large volumes of documents. Under the internship arrangement the author was allowed to sit in on weekly and ad hoc (OEFS) project development meetings. He was also allowed to interview the managers and access documents that were relevant to the sponsored project.

To enhance the accuracy and reliability of the data collection process, a case study protocol was formulated before entry into the company (Guba and Lincoln 1981; Yin

1994). The protocol specified the inquiry focus, how data was to be collected, recorded and analysed, and how the collected data was to be verified, i.e., largely through triangulation, using data from different and independent sources (Miles and Huberman 1994). Data was collected mainly through participant observation. The researcher took part in NPD team activities (e.g. scheduled planning and review meetings, new product committee meetings, management briefings, etc.) and also socialised with team members after work (e.g. at after work 'happy hour' functions and by playing tennis with them). All observations were systematically recorded, following the case study protocol. The observation data was complemented by informal discussions and semi-structured interviews with NPD personnel and managers, as well as with secondary data sources (e.g. new product specifications, project schedules, operating manuals, company brochures and annual reports, etc.). The two main focuses of the case study research were as follows. Firstly, the researcher sought to gain an appreciation of the nature of the NPD process at APEX, paying special attention to the roles of R&D and Marketing personnel in decision-making. Secondly, the researcher sought to discover whether the various factors that had been identified in previous studies as influencing the relationship between Marketing and R&D during NPD (i.e. organisational factors, new product and market factors, and individual personnel-related factors) would also be influential in a Hong Kong firm.

The main findings from the preliminary case study are summarised in Appendix 1. The major contributions of the case study findings to the main part of the research were a confirmation of the relevance and validity of the major constructs that were included in the theoretical model, indications of the relationships between the

constructs in the model and which were captured in the formal hypotheses, and an understanding of the appropriate language and terminology for the survey questionnaire.

4.3 The Mail-Out Survey

For the main part of the study, a mail-out survey was chosen to collect the required data because of its efficiency in terms of both cost and time, wide geographical coverage, lack of direct social interaction between researcher and respondent (thereby ensuring less potential for interviewer bias, a higher perceived anonymity for respondents, and a reduced susceptibility to social desirability issues in responding to attitudinal questions) and the ability to obtain responses from a wide variety of high technology firms (de Vaus 1995). This data collection has been widely used in NPD research as noted above (e.g., Cooper 1984; Gupta and Wilemon 1985; Pinto and Pinto 1990).

4.3.1 Sampling Strategy

The population of interest for the study was R&D Managers (or their functional equivalents) employed in actively innovating high technology firms based in Hong Kong. “High technology” firms were defined as those which operated in an environment characterised by frequent innovation, the placing of a high priority on R&D, and keen competition in a race to the marketplace (Mohr 1996). The problem here was that of obtaining or formulating an appropriate sampling frame. At the time of the study, there was no standard industrial classification of enterprises or a listing

which would have enabled the identification of high technology firms in Hong Kong. Discussions with professionals in recognised high technology firms indicated that the local electronics industry was widely seen to be part of high technology industry, and from a NPD perspective could be treated as representative of the category.

The starting point for obtaining the sample was the Hong Kong Electronics Industries Association Directory, which covered companies producing and/or supplying such products as electronics parts and components, computing equipment, computer software and communications equipment. This directory listed 966 distinct firms, which was close to the official number of 1,176 registered electronics companies in Hong Kong (Hong Kong Government Industry Department 1996). The firms listed in the directory were screened to select only those that had both Marketing and R&D functions. This reduced the list to 515 firms. Each of these was then contacted by telephone to ascertain that they actually had Marketing and R&D functions, had recently developed and introduced at least one new product, had one or more cross-functional NPD teams and were willing to participate in the survey. Two hundred and three firms met these criteria, and all were included in the sample and sent a survey questionnaire with an accompanying introductory letter. A sample of the letter is provided in Appendix 2.

4.3.2 Questionnaire Development

The starting point in the development of the survey questionnaire was the formulation of the theoretical model and its associated hypotheses, as discussed in Chapter 3. The self-administered questionnaire was designed primarily to collect data

that would enable the hypotheses in the model to be tested. After the model had been formulated, the three stages in the development of the survey questionnaire were: the operationalisation of the constructs in the model, the creation of a complete draft questionnaire, and the pilot testing and modification of the draft to produce a final version for the mail-out survey. A copy of the final questionnaire used in the survey is provided in Appendix 3.

1. Operationalising the Theoretical Constructs

The conceptual model, derived from a synthesis of the relevant literature as discussed in Chapter 3, contained 10 constructs (participation, influence and performance are the main constructs, together with moderate variables – expert power, departmental power, influence attempt, customer orientation, formalisation of NPD, complexity and importance of new product project). The measures used were adapted from well-cited research works published in high quality journals such as the *Journal of Marketing*, and *Journal of Business Research* and included: McQuiston and Dickson (1991) for *participation* and *influence*; Deshpande et al (1993) for *customer orientation* and *new product performance*; Kohli (1989) for *expert power*, *departmental power*, and *influence attempt*; Ruekert and Walker (1987) for *formalisation*; and McQuiston (1989) for *complexity* and *importance* of new product projects. Scale items were drawn from these sources and, where necessary for the study's context or where pilot testing revealed problems with the phrasing, minor modifications were made to the wording.

All key constructs in the study were assessed using multi-item measures. Such scales are necessary to capture the domain of the constructs adequately and accurately

(Churchill 1979; Nunnally 1978). Multi-item summated Likert-type scales (i.e. with 5-point response scales such as 1 = ‘strongly agree’ to 5 = ‘strongly disagree’) were used for all of the variables derived from the model. Such multi-item scales have been widely used in the marketing literature to measure multiple attribute constructs, thereby reducing measurement error and increasing the validity and reliability of the measures (Peter 1979; Zikmund 1997). Initially, each construct’s items have been examined by Principle Components Analysis to ascertain its internal consistency and unidimensionality. Consequently, some items of each construct have been deleted. Details of such testing have been illustrated in Chapter 5.

The independent variable of this study, *Marketing’s Participation*, was measured by three items to describe the amount of information shared between Marketing and R&D during an NPD project. The items were adopted from McQuiston and Dickson’s (1991) study and referred to the behaviour of a Marketing person in a product development team during the initiation phase of a project (response was in terms of a 5-point agreement scale). The items were: “*offered a large amount of relevant information for consideration during the development stage*”, “*offered a large amount of relevant information for consideration during the discussion of alternatives at the design stage*”, and “*participated fully in every aspect of the new product development process*”. The higher the summated score was on these items (i.e. the more the respondents agreed with the statements), was interpreted to mean the higher was the level of Marketing’s participation in NPD.

The variable Marketing’s influence was measured by seven items which were also adopted from McQuiston and Dickson’s (1991) study. These measures reflected the

weight that the R&D respondents gave to the input provided by a Marketing person in a product development team during the NPD process, and the response was in terms of a 5-point scale from 1 = 'a little' to 5 = 'a lot'). The items were: "to what extent did her/his participation influence decisions on the project?", "to what extent did s/he influence others into adopting certain positions about the various options?", "to what extent did s/he influence the criteria used for making the final decision?", "how much change did s/he induce in the references of other members?", "how much weight did the team members give to her/his input?", and "how much effect did her/his involvement in the new product team have on how the various options were rated?" Again the higher the summated score, the more that Marketing influenced the NPD decision-making process.

The dependent variable, New Product Performance, was measured by six items developed by Deshpande et al (1993). These items described the extent to which the new product achieved its project objectives and made contributions to the overall corporate objectives (the response was in terms of 1 = 'low' to 5 = 'high'). The items were: "overall company satisfaction with quality of the product", "quality level of the product relative to competition", "degree of customer acceptance of the product", "degree of customer satisfaction with the product", "quality level relative to other products of the firm" and "profit margin relative to stated objective". The higher the summated score, the better the performance of the new product after launch.

With regard to contingency factors, the power-related factors chosen for this study were expert power, departmental power and influence attempt and all were adopted from Kohli's (1989) study. Expert Power was measured by four items that reflected

the NPD-related expertise of Marketing as perceived by R&D. The items, referring to the behaviour of a Marketing person in a product development team during the initiation phase of a project and where the response was in terms of a 5-point agreement scale, were: “they felt s/he was knowledgeable about the company’s needs with respect to the product”, “they felt s/he was competent to make an assessment of the various options”, “they felt s/he knew exactly how the product would be used by customers” and “they felt s/he had the expertise to make the best decision”.

Departmental Power (Kohli 1989) was measured by four items that represented the degree to which the Marketing department was perceived by R&D to have the knowledge and skills pertinent to the NPD process. The items were (response was in terms of a 5-point agreement scale): “top management considers the R&D department to be more important than others”, “the functions performed by the R&D department are generally considered to be more critical than others”, “the R&D department is generally regarded as being more influential than others”, and “the R&D department tends to dominate others in the affairs of the organisation”.

Influence Attempt (Kohli 1989) was measured by four items that reflected the degree of effort that Marketing exerted in the NPD process to achieve its objectives, as perceived by R&D. The items were (response was in terms of a 5-point agreement scale): “Relative to others . . . s/he tried harder to shape the thinking of others”, “. . . s/he spent more time to impress her/his views on the team members”, “. . . s/he exerted more effort to make sure the final product reflected her/his views” and “. . . s/he spent more energy to make sure her/his opinions were taken into account”. For

each of these three power-related contingency factors, higher summated scores on the scale items were interpreted to mean a higher level of power or attempt to influence

To measure the second contingency group of organisational factors, two factors, customer orientation and formalisation of NPD were chosen. Customer Orientation, adopted from Deshpande et al (1993), was measured by three items that reflected the extent to which top management emphasised a customer-focused culture in the firm, as perceived by R&D. The items were (asked in terms of the environment for new product projects in the company and the response to which was a 5-point agreement scale): “R&D periodically gets together with other departments to plan responses to changes taking place in the business environment”, “R&D periodically reviews product development efforts to ensure that they are in line with what customers want”, and “R&D meets frequently with other business functions such as Marketing to discuss market trends and developments”. The higher the agreement with these statements was taken to mean the more a firm had a customer orientation.

Formalisation of NPD, adopted from Ruekert and Walker (1987), was measured by three items that tapped the extent to which clear boundaries and policies existed in the firm to govern the activities of the NPD team. The items were (asked in terms of the environment for new product projects in the company and the response to which was a 5-point agreement scale): “clear guidelines exist between functional groups on what role to play”, “there are specialised tasks within the new product process for marketing and R&D” and “extensive corporate policies and procedures exist for the role of each function”. The higher the agreement with these statements was taken to mean the more a firm had a formalised NPD process.

The final group of contingency factors measured in the study was related to the new product development project characteristics. Two factors, *importance of the new product* and *complexity of the new product* were adopted from McQuiston (1989). *Importance of the new product* was measured by three items that reflected the criticality of the new product to the overall performance of the firm as perceived by R&D (response was in terms of a 5-point agreement scale). The items were: “*the product was considered critical to the overall success of the firm*”, “*the product was necessary to position the firm in a critical market segment*”, and “*we anticipated that the product would make a substantial contribution to overall profitability of the firm*”. A higher summated score on these items was taken to mean the more important the new product was perceived to be.

Complexity of the new product (derived from McQuiston 1989) was measured by three items that reflected the degree of complexity (in terms of the technology and development process) of the new product relative to previous new product projects undertaken by the firm (response was in terms of a 5-point agreement scale). The items were: “*the development of this product required a change of company procedures*”, “*the new product development was more complex than we were used to as a company*”, and “*we had to gather more information before and during the development of the new product than we usually do*”. A higher summated score on these items was taken to mean that the reported new product was more complex.

2. Construction of the Draft Questionnaire

After the core set of items had been obtained, the draft questionnaire was further developed by adding instructions to the respondents, by focusing the questions to make them more specific and easier to answer, and by including further questions on

particulars of the respondent and the employing company. Considerable effort was expended in the design of the questionnaire to maximise the response rate (e.g. by using accessible language and by making responding to the questions as easy and quick as possible) and to address the problems typically associated with the collection of retrospective data from key informants. Such widely-acknowledged problems include the possibility of the inaccurate recall of past events, inconsistent responses to attitude questions, and biased perceptions of the actions and motives of the respondents and others (Foddy 1993; Huber and Power 1985).

The questionnaire required the respondents to reply in terms of one particular new product project. To prevent any possible selection bias (e.g., of only successful new products or of those that were particularly memorable for whatever reason; see Moorman 1995), respondents were asked to “select the most recent new product introduced to the market for a minimum of 12 months by your firm”. The questionnaire sought information on the nature of social interaction between Marketing and R&D during the development of the selected new product. To avoid potential problems of respondent self-reporting bias (e.g. response biases arising from exaggerations of influence intensity or influence methods; see Kohli 1989; Maute and Locander 1994), R&D managers were asked to report on Marketing personnel. This strategy may, of course, have led to another problem whereby the R&D respondents ascribed greater influence to themselves and correspondingly less influence to Marketing. Items were added to the questionnaire to measure this possible effect and allow for its statistical control. Firstly, a set of five items asked each respondent to assess their influence in the NPD project (using a 5-point scale ranging from ‘little’ to ‘a lot’) in terms of team member opinions, decision-making

criteria, assessment of alternatives and the decisions made. Secondly, a question was asked about NPD project team size. This was added following the suggestion of Hare (1981) that an individual team member's influence is inversely related to team size. That is, an individual in a large team will tend to have less influence because there will be fewer interactions, of generally lower quality, amongst team members. The larger the team, it was believed, the less the likelihood of the R&D manager's high influence, and this measure could be used as a control for inflated perceptions of influence.

To reduce the recall burden and thereby improve the accuracy of the data obtained, respondents were asked to focus on the Initiation Phase of the selected NPD project, i.e., the phase that covered idea generation, idea screening, concept development and concept testing (Kohli 1989). Further items were added to the questionnaire to obtain information about the characteristics of the NPD project, perceptions of the new product's performance and details of the responding company or strategic business unit (e.g. the nature of its business, company/SBU size, expenditure on R&D, level of NPD activity, etc.). Closed questions were used for all of the items in the draft questionnaire in the belief that this would contribute to a higher response rate (questions with a fixed and limited number of response alternatives are quicker to answer and do not discriminate against less articulate respondents; de Vaus 1995) and reduce response errors. When all of the items had been collated, the overall questionnaire design was addressed to facilitate ease of completion and to ensure that there were no likely order effects in the sequencing of questions: e.g. questions that addressed similar topics were grouped, more sensitive questions were placed later and attempts were made to make the layout attractive for respondents.

The completed draft questionnaire was made up of seven sections, labelled A to G. On the front cover of the questionnaire was a letter to respondents that introduced the survey and its aims, provided instructions for its completion, emphasised that responses would be anonymous and confidential, and provided contact points if a respondent had any queries. Section A was designed to capture information about the characteristics of the new product project. Section B was designed to assess the performance of the new product. Section C was for identifying the roles of marketing personnel in the product development project. Section D was designed to collect information about the environment for new product development. Section E was for describing the behaviour of marketing personnel during the NPD process. Section F was designed for understanding the R&D informant's influence on the NPD project. Section G was designed to capture the particulars of the informant's company.

3. Pre-Testing of the Draft Questionnaire

During development of the survey instrument, drafts of the questionnaire were pre-tested to maximise the reliability and validity of the data collected. There were two stages of pre-testing. The first stage was conducted when an initial battery of scale items derived from the literature had been assembled. Three researchers who were experienced in the field of NPD studies were asked to assess the content validity of the items and to make recommendations about any required modifications. This expert assessment resulted in a more manageable list of items and an agreement on the face validity of the scales that were used in the draft questionnaire. The draft questionnaire so produced was then subjected to the second stage of pre-testing. This

was a pilot test to ensure that the questionnaire was culturally compatible, meaningful and comprehensible to potential respondents in the Hong Kong based sample, determine whether the coverage was suitably comprehensive and that there were no redundancies and make sure that the time required to respond was not too long (thereby pre-empting any respondent fatigue effects).

The pilot testing involved interviews with 16 R&D managers from 10 high technology companies (including the preliminary case study company). These were selected as a convenience sample. At each interview, the researcher followed a standard procedure. Firstly, it was confirmed that the respondent was appropriate for the pilot test (i.e. was drawn from the population of interest, was able to provide the required information and was prepared to participate). Secondly, the researcher explained the objectives of the study and its expected outcomes. Thirdly, the researcher read out each question and asked the respondent to indicate whether it was meaningful, comprehensible and appropriate. After all of the questions had been covered, the respondents were asked to indicate whether there had been any redundant questions (e.g. due to repetition or a lack of relevance) and whether the coverage was suitably comprehensive. Whenever problems were identified, e.g. due to misinterpretation or misunderstanding, questions were rephrased to make them clearer to respondents, more easily understood, less ambiguous and more appropriate. Valuable comments were obtained from this pilot test, and they resulted in a number of revisions to the draft questionnaire. Furthermore, a Chinese version of the questionnaire was drafted following a recommendation by some of the managers interviewed. This suggestion arose because it was believed that R&D managers in the sample who had been recruited from mainland China by the Hong Kong based

companies would prefer to read the questionnaire and answer it in Chinese. The Chinese language questionnaire was developed by a mainland Chinese academic with a postgraduate degree in translation. That questionnaire was back-translated into English to verify its accuracy and compatibility with the original version.

As a preliminary check on the reliability of the multi-item scales used, a first batch of 30 completed and returned questionnaires was analysed. Reliability was determined by assessing the extent of internal consistency of each scale using Cronbach's coefficient alpha (Green et al., 1988). Table 4.1 below shows the results of the alpha tests conducted on the first batch of 30 returned questionnaires.

Table 4.1: Cronbach's Alpha Scores for Pre-test on Initial Returns (n = 30)

Construct Measured	No. items	Alpha (α)
Marketing's participation	3	0.51
Marketing's manifest influence	7	0.89
New product performance	6	0.66
Expert power	4	0.80
Departmental power	4	0.67
Influence attempt	4	0.91
Customer orientation	6	0.81
Formalisation of NPD	3	0.69
Complexity of new product	4	0.59
Importance of new product	4	0.80

The accepted practice in the social sciences (e.g. Hair et al. 1998) is that coefficients of 0.60 - 0.70 are at the lower level of acceptability in indicating a sufficient level of internal consistency for a multi-item scale. As can be seen from the table, most of the measures that were used for the constructs met this criterion (the exceptions being

marketing's participation and new product complexity) and were considered to be suitably reliable for the study. On the basis of this finding and the knowledge that problematic scales could be adjusted to improve their internal consistency (i.e. by deleting items), it was decided to proceed with full-scale data collection from the whole sample.

4.3.3 Administration of the Survey

The finalised questionnaire, with its introductory letter, was posted to all companies in the sample ($n = 203$). Each questionnaire was numbered to allow follow-ups. The targeted respondents were informed that their responses would be anonymous and confidential, and were requested to return the completed questionnaire in the supplied reply-paid envelope no later than two weeks after receipt. To encourage responses, and to provide a token of appreciation for the time spent in answering the questionnaire, respondents were told that a copy of a summary report on the survey would be sent to their company. Three days after the mail-out, the researcher contacted all of the companies to confirm that they had received the questionnaire and that it had been forwarded to a suitable R&D manager with the required knowledge and experience necessary for its completion. Twelve days after the mail-out, targeted respondents were reminded by a letter (sample is provided in Appendix 4) and contacted by telephone to remind them to complete and return the questionnaire.

Seventeen days after the mail-out, targeted respondents were contacted by telephone to again remind them of the survey. Further telephone calls and fax messages were

sent to those who still did not respond. As a last resort, and to further enhance the response rate, non-respondents were contacted and informed that arrangements could be made for a research assistant to come and collect the completed questionnaire (this latter strategy was quite effective in boosting the response rate). The survey response period ended 10 weeks after the mail-out. Details of the achieved response rate are given in the next chapter.

4.3.4 Survey Data Analysis

Upon receipt, questionnaires were checked to ensure that they were eligible for inclusion in the sample. Questionnaires that had important responses missing (e.g. did not include responses to questions in Section B that pertain to describing the performance of the new product, or in Section C that related to the roles of marketing personnel in the product development project), or which had dubious responses to questions (e.g. circling only one column of answers throughout different sections) were considered as unusable and excluded from the sample. Data from the eligible questionnaires was entered into the PC-based statistical package SPSS. The entered data was checked to ensure accuracy, and edited if necessary. When it was considered that a 'clean' database of the survey responses had been achieved, summated and mean scores were calculated for each of the constructs in the proposed model. Initially a descriptive analysis of the survey data (using univariate and bivariate analyses) was conducted to gain insights into the nature of the organisations in the sample and into the characteristics of the new product projects about which the respondents had reported.

After this descriptive analysis, the hypotheses that were derived from the proposed model were statistically tested using linear and moderated regression analysis. This latter multivariate analysis was conducted in three stages.

In the first stage, the validity and reliability of the measures of the constructs in the proposed model were assessed. Construct validity was assessed in terms of both convergent and discriminant validity. A unidimensionality test was performed for each of the construct measures using principle components analysis (PCA) with varimax rotation. A confirmatory factor analysis was also conducted to assess the validity of the proposed model's structure. Confirmatory factor analysis via AMOS 4.0 was used to assess convergent validity by dividing the factors into four subsets of variables. Because of the sample size restrictions (usable returned questionnaires $n = 114$), this approach was chosen instead of examining all the variables in one model which would have violated the recommendation made by Bentler and Cho (1988) of not exceeding a five to one ratio of sample size to parameter estimates. Hence, four separate tests were performed. To test discriminant validity, inter-item correlation analysis was performed. The reliability of the construct measures was assessed using Cronbach's coefficient alpha, as discussed in the previous section. A discussion of the results of the assessment of the measures used is provided in Chapter 5.

Having determined that the measures of the constructs in the proposed model were both valid and reliable, and that the underlying assumptions for linear and moderating regression analysis were met by the survey data, the final stage of analysis was undertaken. Linear regression analysis was used to test the hypothesised relationships (a) between *Marketing's participation* and *Marketing's manifest*

influence (H_1), and (b) between *Marketing's manifest influence* and *new product performance* (H_2). Moderated regression analysis was then used to test the seven contingency hypotheses H_3 to H_9 . According to Arnold (1982), moderated regression analysis provides the most straightforward and general method for testing the contingency hypotheses in which an interaction is implied. Interaction effects are found to be significant only if they explain a significant greater portion of the variance in the dependent variable than that portion already explained by the other independent variables. Covin and Slevin (1989) and Dowling and McGee (1994) also agree that moderate regression analysis is a conservative method for testing interaction effects.

The moderated regression model for this study can be expressed with the following equations:

$$(1) y = b_0 + b_1c_i,$$

$$(2) y = b_0 + b_1c_i + b_2x_j \text{ and}$$

$$(3) y = b_0 + b_1c_i + b_2x_j + b_3x_jm_k,$$

where y is the criterion variable, c_i is a control variable, x_j is a predictor variable and m_k is the proposed moderator variable.

As indicated in the above regression equations, the interaction term is entered last so that the coefficient will not be confounded with variance stemming from the main effects of the variables. Furthermore, m_k can only be taken as a moderator variable if the change in the R^2 for Equation 3 over Equation 2 is statistically significant (Arnold 1982; Sharma, Durand and Gur-Arie 1981).

Schoonhoven (1981) has argued that for testing contingency hypotheses it is not sufficient to inspect only the signs and magnitudes of the regression coefficients. Rather, it should include an examination on a partial derivative from the regression equation because it could reveal non-monotonic effects not readily apparent in the regression coefficients. Therefore, the partial derivatives from the regression coefficients were examined in this study.

4.4 Chapter Summary

This chapter discussed the methods that were used in both the qualitative and quantitative stages of the study to collect and analyse the data required to address the research questions posed in Chapter 1. The central focus of the study is on the theoretical model and its associated hypotheses, so the main part of the thesis is restricted to the quantitative analysis. Accordingly, the next chapter presents a discussion of the achieved sample and of the results of a descriptive analysis of the survey data. It also presents the results of the multivariate analysis and the hypothesis testing.

CHAPTER 5 DATA ANALYSIS & HYPOTHESES TESTING

Preamble

This chapter reports the findings from the survey of R&D managers in the sampled high technology firms. The chapter has three main sections. The first section discusses the response rate achieved in the survey and presents descriptive data on the respondents, their companies and the characteristics of the new product projects focused on by respondents when completing the survey questionnaire. The second section presents the assessment of the multi-item summated scales that were used in the questionnaire to operationalise the constructs in the proposed theoretical model. These scales were assessed in terms of their unidimensionality, validity and reliability. The third section reports the results of the tests of the nine hypotheses that were derived from the theoretical model as discussed in Chapter 3. The implications of these findings are discussed in the next chapter.

5.1 The Survey Sample

The survey questionnaire was sent to 203 companies that met the criteria set for the study, as discussed in Chapter 4. In this section, the response to the survey is first discussed and then a description of the achieved sample is presented to provide a background context for the interpretation of the study's main findings.

5.1.1 Response Rate

The researcher sent questionnaires to the 203 companies, and by the specified return date 92 had been returned. After following up the non-responding companies with telephone calls, faxed reminders and in some cases personal visits, a further 33 questionnaires were received by the survey cut-off date (i.e. ten weeks after the questionnaires were mailed out) for a final total of 125 returned questionnaires. Of this total, 11 were unusable due either to the omission of important data (e.g. a failure to respond to one or more sections of the questionnaire) or to what appeared to be dubious responses (e.g. apparent response biases within and across questionnaire sections). Thus, there were 114 usable returned questionnaires, representing a response rate of 56%. This was considered to be a good response rate, given the nature of the sampled companies, and it is certainly satisfactory when compared to previously reported surveys of managers in business enterprises in Asian countries. For example, in the Song, Di Benedetto and Song (2000) multi-country study on new service development, the Hong Kong response rate was only 28.7%, which was substantially lower than that of Japan at 40.2% and Korea at 39.7%.

To assess the degree of non-response bias, responses were divided into two categories: those received before the reminders (first wave = 92) and those received after the reminders (second wave = 33). To determine whether there was any major difference between these two groups, significance tests were conducted on the responses to selected variables in the questionnaire (see Table 5.1.1 and 5.1.2). These calculations were made under the assumption that those who responded later in the second wave were similar to non-respondents (Armstrong & Overton 1977). There

were no significant differences between the groups. Hence, it was inferred that subjects who responded were not very different from those who did not respond, and thus the sample could be considered to be reasonably representative of the population from which it was drawn. However, it should be noted that the possibility of non-response bias cannot be ruled out by this analysis, and this needs to be taken into account when interpreting the analysed data.

Table 5.1.1 Comparisons of the Group* 1 and Group 2 for the Characteristics of the Sampled Organisations and Respondents

Characteristics	Group* 1	Group 2
Organisation Characteristics:		
Annual sales turnover: \$201m or more	42.7%	40.0%
Number of employees: 200 – 500 or over	48.1%	60%
Percentage annual sales turnover spent on R&D: 5% or more	48.1%	37%
Respondent Characteristics:		
Years involved in NPD: 5 or less	42.2%	48.3%
Number of new product projects engaged: 5 or less	50.6%	36.7%
Highest level of education completed: Bachelor Degree	50.0%	58.6%

***Group 1 = first batch of 92 cases received before the first deadline;
Group 2 = second batch of 33 cases received after follow up reminders**

Table 5.1.2 T-Tests between Group* 1 and Group 2 for Major Constructs

Constructs	Group *	Mean	SD	t-value	d.f.	Prob.
Marketing participation	Group 1	3.13	.74	.015	111	.988
	Group 2	3.12	.60			
Expert power	Group 1	3.41	.70	1.258	110	.211
	Group 2	3.21	.82			
Department power	Group 1	3.26	.75	.727	111	.469
	Group 2	3.15	.64			
Influence attempt	Group 1	3.19	.82	.510	111	.611
	Group 2	3.10	.73			
Customer orientation	Group 1	3.38	.73	1.587	112	.115
	Group 2	3.13	.69			
Formalization of NPD	Group 1	3.18	.77	.675	112	.501
	Group 2	3.08	.65			
Technology orientation	Group 1	3.08	.77	-.247	112	.805
	Group 2	3.12	.84			
Complexity of new product	Group 1	3.11	.84	-2.458	111	.016
	Group 2	3.53	.62			
Importance of new product	Group 1	3.52	.75	.074	111	.941
	Group 2	3.51	.80			
Manifested influence	Group 1	3.44	.74	1.979	110	.050
	Group 2	3.12	.76			
New product performance	Group 1	3.61	.50	2.594	109	.011
	Group 2	3.30	.64			
Control variable	Group 1	3.73	.59	2.025	111	.045
	Group 2	3.47	.66			

***Group 1 = first batch of 92 cases received before the first deadline;
Group 2 = second batch of 33 cases received after follow up reminders**

5.1.2 Profile of Firms in the Sample

The characteristics of the companies in the achieved sample ($n = 114$) are shown in Table 5.1. The majority (58%) were business units of larger companies. It may have been the case that larger companies had the resources for R&D and so were more likely to be eligible for the survey. Amongst the sampled companies, 19.6% were manufacturers of electronics components, 25.2% were manufacturers of consumer electronics, 23.4% were in software development, and 12.1% were in telecommunications. This shows that the great majority of the sampled firms could be categorised as part of the “high technology” industry, and thus were drawn from the targeted population of firms for the survey.

Around 30% of the sampled firms had 50 employees or fewer, 14.2% had 51 - 100 employees, 25% had 101 - 500 employees and 31% had more than 500 employees. To use the general definition of a “small business” in Hong Kong (Hong Kong Government Industry Department 1995: 9) – a firm that employs less than 50 employees – small businesses made up less than one third of the sample, while larger firms with more than 100 employees made up the majority (56%). Concerning annual turnover of sales, the majority of the responding companies (54%) had a turnover of more than HK\$100 million. It appears then that larger firms, i.e., those with more employees and a higher turnover, were more eligible and willing to participate in the survey. Such firms tend to be more actively involved in R&D, and so have the experience and knowledge necessary to answer the survey questions.

Table 5.1 - Characteristics of the Sampled Organisations

Firm Characteristic	Frequency	Percentage
Structure of the Organisation		
Single Business	48	42.0
Business unit of a large company	65	58.0
Nature of Business		
Electronic Component Manufacturer	22	19.6
Consumer Electronics Manufacturer	27	25.2
Software Development	25	23.4
Telecommunications	13	12.1
Other	21	19.6
Number of Employees		
30 or fewer	30	25.7
31-50	5	4.4
51-100	16	14.2
101-200	13	11.5
201-500	15	13.3
500 or more	35	31.0
Annual Sales Turnover (HK\$)		
Under \$10 million	23	20.5
\$10-50 million	18	16.1
\$51-100 million	11	9.8
\$101-150 million	6	5.4
\$151-200 million	7	6.3
\$201 million or more	47	42.0

5.1.3 Profile of Survey Respondents

Within each sampling unit, the questionnaire was completed by an R&D manager. If the questionnaire was not directly delivered to the R&D managers, the intermediates, for instance, Human Resource or Administration manager, were reminded to redirect the questionnaire to the R&D manager. On the heading of each questionnaire has clearly marked the word “Questionnaire for R&D Manager”. The covering letter together with the questionnaire has also clearly stated that the questionnaire is to be completed by a R&D manager. All these procedures were enacted to ensure the targeted respondent, R&D manager, is to complete the questionnaire. The characteristics of the respondents in the achieved sample are shown in Table 5.2. The respondents were mostly experienced in new product development (i.e. 56% had been involved in NPD for more than 5 years and 53% had been engaged in more than five NPD projects), and most had a high level of educational achievement (i.e. 90% had a university degree). From this finding it can be concluded that the respondents were sufficiently knowledgeable and experienced with NPD projects for their responses to the questionnaires to be considered as informed and accurate. Thus, the incidence of systematic error in the survey responses due to a lack of requisite knowledge and experience amongst the respondents is likely to be low.

Table 5.2 - Characteristics of the Respondents

Respondent Characteristic	Frequency	Percentage
Years Involved in New Product Development		
5 or less	49	44.1
6-10	36	32.4
11-15	15	13.5
16-20	7	5.4
21 or more	5	4.5
Number of New Projects		
5 or fewer	53	47.3
6-10	23	20.5
11-15	17	14.3
16-20	6	5.4
21 or more	14	12.5
Education Level of the Respondent		
High School only	10	9.0
Bachelors Degree	59	53.2
Masters Degree	43	37.8
PhD	0	0

5.1.4 Profile of the New Product Projects in the Sample

The characteristics of the new product projects in the achieved sample are shown in Table 5.3. Of the projects selected by the respondents, the great majority (60%) were considered to be “largely typical” of the firm’s new product projects. Only 7% of the selected projects were considered to be “not so typical”, and none were seen as “not at all typical” of the firm’s new product projects. From this finding, it can be concluded that the sampled projects were representative of the new product projects conducted by the surveyed firms, which indicated that the probability of any biasing effect due to project selection was low.

With regard to team size, the majority of teams were rather small, consisting of 7 or less members (66%). This may have been because, unlike many of their counterparts in the West, Hong Kong NPD teams tend to develop relatively smaller or less complicated products with fewer functions involved in the NPD team (Berger and Lester 1997). The time span for NPD teams working together was largely less than 24 months (88.5%). This could be due to the phenomenon that few companies in Hong Kong invest in longer-term development projects given a marked focus on shorter payback periods and low risk levels in new product investment decisions (Berger and Lester 1997).

Table 5.3 - Characteristics of the Selected New Product Project

Selected New Product Project	Frequency	Percentage
Typical of New Product Projects		
To no extent	0	0
To a little extent	8	7.1
To some extent	37	33.0
To a large extent	44	39.3
To a great extent	23	20.5
Number of Project Team Members		
3 or less	31	27.4
4 - 7	44	38.9
8 - 11	16	14.2
12 - 15	7	6.2
15 or more	15	13.3
Time that Project Team Worked Together		
12 months or less	64	56.6
13 - 24 months	36	31.9
25 - 36 months	7	6.2
37 - 48 months	3	2.7
49 - 60 months	3	2.7
61 months or more	0	0

5.2 Assessment of the Scales Used in the Survey Instrument

The theoretical model discussed in Chapter 3 contained ten constructs, each of which was operationalised to create multi-item measurement scales that constituted the variables in the survey database. To this were added two control variables: team size and respondent's self-perceived influence. Each adopted key scale has been considered under the following four main criteria, using the case of McQuiston and Dickson (1991) as an example:

- 1 Similar theoretical concept. There are different theoretical concepts on *participation* as discussed in the Participation and Influence section of Ch 2 (e.g, Campbell and Campbell 1988; Shetzer 1993; Strauss 1982), however, I consider McQuiston and Dickson's (M&D) concept of participation (please see below for definition) to be the most similar to that of my theoretical concept.
- 2 Passed reliability test. The items have been shown to managers during pilot test and they were well understood and these items have also passed Cronbach Alpha threshold test of 0.60.
- 3 Credible journal. M&D was published in the Journal of Business Research, a business journal with emphasis on research methodology .
- 4 Good Social Sciences Citation Index. SSCI search found that the scale has been cited or adopted in 9 other important studies (1 Journal of Marketing, 1 Management Science, 3 Industrial Marketing Management, 1 Journal of International Marketing and 1 International Journal of Technology Management).

Before the hypotheses were tested, the measures were subjected to a purification process to assess their reliability, unidimensionality, and validity. First, internal consistency tests (Cronbach's alpha) were performed on all scales in the model (Anastasi 1988; Cronbach 1951). The item-to-total correlations for the items in each of the proposed scales were examined, and items with low correlations were deleted. Second, an exploratory factor analysis was conducted to ensure that the resulting scales were uni-dimensional (Anderson and Gerbing 1984). Third, to assess the discriminant validity of the subsets of measures, a procedure recommended by Bagozzi, Yi, and Philips (1991) was applied. A pair of constructs in a series of two-factor confirmatory factor models was evaluated via AMOS. A two-factor confirmatory factor analysis of the constructs in pairs was conducted twice: once by constraining the correlation between the latent variables to unity, and the other by freeing the parameter. A Chi-square difference test was then used to determine whether the Chi-square value of the unconstrained model was significantly lower, in which case discriminant validity would be ascertained. The results of this process are discussed in the following sections.

Table 5.4 Sources of Key Scales and their Items

Construct	Initial (final) no. items in scale	Source	Question type
Marketing's Participation	3 (3)	McQuiston & Dickson (1991)	5-point Likert
Expert Power	4 (4)	Kohli (1989)	5-point Likert
Departmental Power	4 (4)	Kohli (1989)	5-point Likert

Influence Attempt	4 (4)	Kohli (1989)	5-point Likert
Customer Orientation	6 (3)	Deshpande et al (1993)	5-point Likert
Formalisation of NPD	3 (3)	Ruekert & Walker (1987)	5-point Likert
Complexity of New Product	4 (3)	McQuiston (1989)	5-point Likert
Importance of New Product	4 (3)	McQuiston (1989)	5-point Likert
Marketing's Influence	7 (6)	McQuiston & Dickson (1991)	5-point Likert
New Product Performance	6 (5)	Deshpande et al (1993)	5-point Likert
Team size*	1 (1)	Kohli (1989)	Ratio
Self-perceived influence*	5 (5)	Kohli (1989)	5-point Likert

*** Control variables**

5.2.1 Scale Reliability

All construct scales lower than a Cronbach's alpha of 0.60 have been deleted and remaining constructs are equal or above 0.60 and so were considered to be sufficiently reliable (Table 5.5).

Table 5.5 Scale Measurement (n = 114)

Variable	Mean	S. D.	Cronbach's Alpha
Marketing's Participation	3.13	.70	.61
Marketing's Manifested Influence	3.39	.70	.90
New Product Performance	3.64	.58	.79
Expert Power	3.35	.74	.80
Departmental Power	3.25	.71	.74
Influence Attempt	3.17	.80	.89
Customer Orientation	3.24	.80	.76
Formalisation of NPD	3.16	.74	.65
Complexity of New Product	3.22	.83	.60
Importance of New Product	3.54	.83	.73

5.2.2 Scale Unidimensionality

Following the recommendation of Germain, Droge and Daugherty (1994), the items making up each of the ten construct measurement scales were subjected to exploratory factor analysis using principal components analyses. In all cases, as shown in the following tables, a single factor was extracted (using the latent root criterion of eigenvalues greater than one) with all items loading highly on that factor, indicating that the measures were unidimensional.

Table 5.6.1 Marketing's Manifested Influence with Rotated Factor Loadings

Scale Item	Manifest influence
To what extent did her/his participation influence decisions in the project?	.858
To what extent did s/he influence others into adopting certain positions about the various options?	.840
To what extent did s/he influence the criteria used for making the final decision?	.834
How much change did s/he induce in the references of other members?	.822
How much weight did the team members give to her/his input?	.795
How much effect did her/his involvement in the new product team have on how the various options were rated?	.779
Percentage of variance explained	67.5

Extraction Method: Principal Component Analysis with varimax rotation & Kaiser normalisation.

Table 5.6.2 NP Performance with Rotated Factor Loadings

Item	NP performance
Overall company satisfaction with quality of the product.	.781
Quality level of the product relative to competition.	.776
Degree of customer acceptance of the product.	.710
Degree of customer satisfaction with the product.	.704
Quality level relative to other products of the firm.	.684
Profit margin relative to stated objective.	.557
Percentage of variance	49.862

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Table 5.6.3 Marketing's Participation with Rotated Factor Loadings

Item	Marketing's participation
Offered a large amount of relevant information for consideration during the development stage.	.807
Offered a large amount of relevant information for consideration during the discussion of alternatives at the design stage.	.733
Participated fully in every aspect of the new product development process.	.709
Percentage of variance	56.361

Extraction Method: Principal Component Analysis.

Table 5.6.4 Influence Attempt with Rotated Factor Loadings

Item	Influence attempt
Relative to others . . . s/he tried harder to shape the thinking of others.	.889
S/he spent more time impressing her/his views on the team members.	.864
S/he exerted more effort to make sure that the final product reflected her/his view.	.862
S/he exerted more energy in making sure that her/his opinions were taken into account.	.841
Percentage of variance	74.678

Extraction Method: Principal Component Analysis.

Table 5.6.5 Departmental Power with Rotated Factor Loadings

Item	Departmental power
Top management considers the R&D department to be more important than others.	.806
The functions performed by the R&D department are generally considered to be more critical than others.	.743
The R&D department is generally regarded as being more influential than others.	.734
The R&D department tends to dominate others in the affairs of the organisation.	.712
Percentage of variance	56.206

Extraction Method: Principal Component Analysis.

Table 5.6.6 Expert Power with Rotated Factor Loadings

Item	Expert power
They felt s/he was knowledgeable about the company's needs with respect to the product.	.828
They felt s/he was competent to make an assessment of the various options.	.816
They felt s/he knew exactly how the product would be used by customers.	.782
They felt s/he had the expertise to make the best decision.	.740
Percentage of variance	62.732

Extraction Method: Principal Component Analysis.

Table 5.6.7 Customer Orientation with Rotated Factor Loadings

Item	Customer orientation
R&D periodically gets together with other departments to plan responses to changes taking place in the business environment.	.866
R&D periodically reviews product development efforts to ensure that they are in line with what customers want.	.854
R&D meets frequently with other business functions such as marketing to discuss market trends and developments.	.745
Percentage of variance	67.859

Extraction Method: Principal Component Analysis.

Table 5.6.8 Formalisation of NPD with Rotated Factor Loadings

Item	Formalisation of NPD
Clear guidelines exist for functional groups on what role to play.	.804
There are specialised tasks within the new product process for marketing and R&D	.801
Extensive corporate policies and procedures exist for the respective role of each function.	.693
Percentage of variance	58.944

Extraction Method: Principal Component Analysis.

Table 5.6.9 Importance of New Product with Rotated Factor Loadings

Item	Importance of new product
The product was considered critical to the overall success of the firm.	.876
The product was necessary to position the firm in a critical market segment.	.802
We anticipated that the product would make a substantial contribution to the overall profitability of the firm.	.739
Percentage of variance	65.191

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Table 5.6.10 Complexity of New Product with Rotated Factor Loadings

Item	Complexity of new product
The development of this product required changes to company procedures.	.790
The new product development was more complex than we are used to as a company.	.776
We had to gather more information before and during the development of the new product than we usually do.	.683
Percentage of variance	56.409

Extraction Method: Principal Component Analysis.

5.2.3 Construct Validity Assessment

Construct validity testifies the fit between the measures of a construct and the underlying concept it is intended to measure (Cook and Campell 1979). To assess the goodness of measures, Campbell and Fiske's Criteria (1959) proposed two key types of construct validity: Convergent and discriminant validity. Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement, the idea is that two or more measures of the same thing should co-vary highly if they are valid measures of the concept. Discriminant validity is the degree to which measures of different concepts are distinct. The notion is that if two or more concepts are unique, then valid measures of each should not correlate too highly.

Assessing construct validity depends on two processes: first, testing for a convergence across different measures or manipulations of the same "thing" and

second, testing for a divergence between measures and manipulations of related but conceptually distinct “things” (Cook and Campell 1979). The factor correlation matrix is used to measure the estimated relationship of each parameter (Joreskog & Sorbom 1993). Pearson Correlation Matrix is generated to measure the correlation coefficients and their significance. If the correlation coefficients are “sufficiently large” and statistically different from zero, it is concluded that the variables are convergently valid (Campbell and Fiske 1959).

As Table 5.7a illustrates, the scores obtained by different instruments measuring the same concept are highly correlated with one another at a statistically significant level, indicating the convergent validity criterion is met (Bagozzi, Yi and Phillips 1991; Venkatraman, 1986).

Table 5.7a Correlation Matrix of each Parameter

	Part.	Expert.	Dept.	Attempt	Customer	Form	Complex	Import
Part.	1.000	.560**	.147	.385**	.285**	.152	.168	.182
Expert	.560**	1.000	.243**	.585**	.243**	.297**	.070	.263**
Dept.	.147	.243**	1.000	.237*	.242**	.415**	.345**	.202*
Attempt	.385**	.585**	.237**	1.000	.241*	.178	.137	.220*
Customer	.285**	.243**	.242**	.421**	1.000	.577**	.117	.286**
Form.	.152	.297**	.415**	.178	.577**	1.000	.219*	.239*
Complex	.168	.070	.345**	.137	.117	.219*	1.000	.531**
Import.	.182	.263**	.202*	.220*	.286**	.239*	.531**	1.000

In assessing discriminant validity, nine key variables of the study were individually tested with Marketing Participation in pairs as illustrated in Table 5.7b. To satisfy the discriminate validity criteria, a significant Chi-square difference has to be achieved for each pair of constructs. It is because discriminant validity is the degree to which measures of different concepts are distinct. The results indicate that, in all of the cases, the χ^2 difference is statistically significant at $p = 0.01$ level, supporting the discriminant validity criteria (Bagozzi, Yi and Phillips 1991). Thus, one can conclude that the measures in general achieve discriminant validity and that these nine dimensions can be treated as distinct dimensions.

Table 5.7b Discriminant Validity of Measurement Scales

Constructs	X^2	df	X^2 difference	Df difference	p
MARP	215.236	18			
MARP-EXPP	34.574	14	180.663	4	.000
MARP	107.892	18			
MARP-departmental power	50.168	14	57.723	4	.000
MARP	277.661	18			
MARP-influence attempt	34.961	14	242.701	4	.000
MARP	119.476	12			

MARP-customer orientation	46.588	9	72.888	3	.000
MARP	62.495	12			
MARP-formalisation of NPD	40.466	9	22.029	3	.000
MARP	54.606	14			
MARP-complexity of NP	33.894	9	20.712	3	.000
MARP	100.688	12			
MARP-importance of NP	50.175	9	50.513	3	.000
MARP					
MARP-manifested influence	71.382	27			
	428.391	33	357.009	6	.000
MARP	238.082	33			
MARP-NP performance	103.089	27	134.993	6	.000

From these foregoing analyses it was concluded that the measurement scales used in this study were sufficiently reliable and valid to be used in the testing of the proposed research hypotheses.

5.3 Hypotheses Testing

The hypothesis testing process proceeded through three stages. Firstly, the data were tested to ensure that the assumptions for regression analysis were met. Secondly, the main effects of the proposed model, as expressed in hypotheses 1 and 2, were tested using bivariate regression analysis. Thirdly, the contingency effects in the model – as expressed in hypotheses 3 to 9 – were tested using moderated regression analysis following Aiken and West (1991) and Jaccard, Wan and Turrisi (1990). In this latter analysis, significant interactions in the model were examined through the simple slope, a technique that overcomes the need to create subgroups from continuous independent variables (Aiken and West 1991). To minimise multicollinearity amongst the interaction terms and their constituent terms in the regression model, all independent variables were mean centred (Aiken and West 1991; Jaccard, Wan and Turrisi 1990). As all of the hypotheses were directional in the model, one-tailed tests were used to assess the significance of the predictor and moderator variables (Blalock 1979; Pindyck and Rubinfeld 1991). Testing the significance of the control variables was non-directional so a two-tailed test was used for these.

5.3.1 Testing the Assumptions for Linear Regression Analysis

To draw conclusions about a population based on a regression analysis conducted on sample data, Hair et al. (1998) and Berry (1993) emphasise the importance of testing to identify any violations of the underlying assumptions in linear regression analysis. The assumptions of linearity and homoscedasticity, normality of residuals, multicollinearity and residual independence were therefore tested with the survey data.

1. Linearity and Homoscedasticity

Linearity assumes that the relationship between dependent and independent variables should be linear (i.e., the patterns of association between each pair of variables and the ability of the correlation coefficient to adequately represent the relationship). According to Hair et al. (1998), homoscedasticity refers to a dependent variable exhibiting equal levels of variance across the range of predictor variables. It is further assumed that the residuals at each level of the independent variables should have the same variance. Homoscedasticity is desirable because the variance of dependent variable being explained in the dependence relationship should not be concentrated in only a limited range of the independent values. A plot of ZRESID (standardised differences between the observed data and the values that the regression model predicts) against ZPRED (the standardised predicted values of the dependent variable based on the regression model) was used to determine whether

the assumptions of random error and homoscedasticity had been met for each variable as indicated in Figure 5.1.

Marketing's manifested influence on R&D in NPD

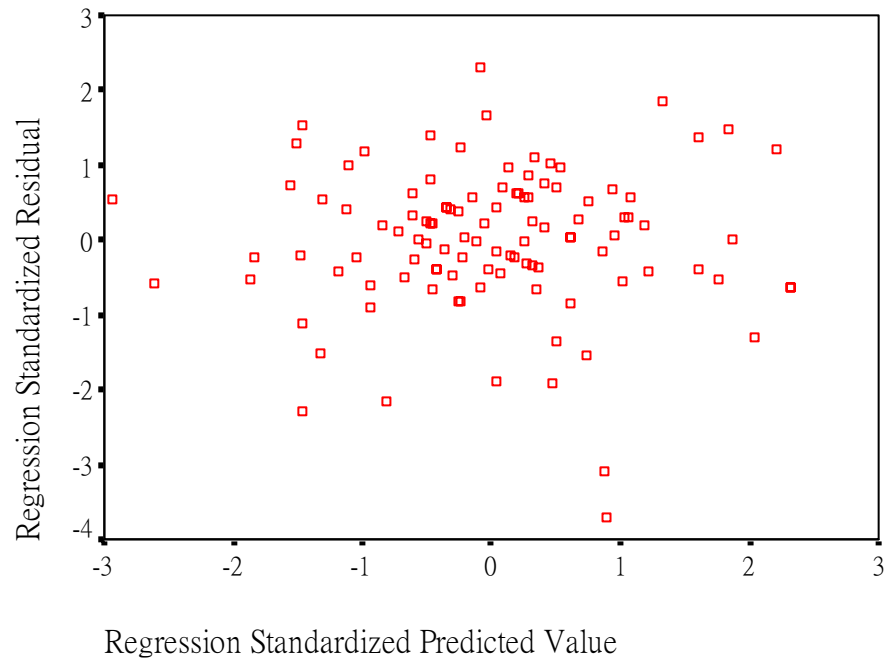


Figure 5.1 Scatterplot of ZRESID against ZPRED

As indicated in Figure 5.1, the points are randomly and evenly dispersed throughout the scatterplot, a pattern indicating that the assumptions of linearity and homoscedasticity have been met (Hair et al. 1998).

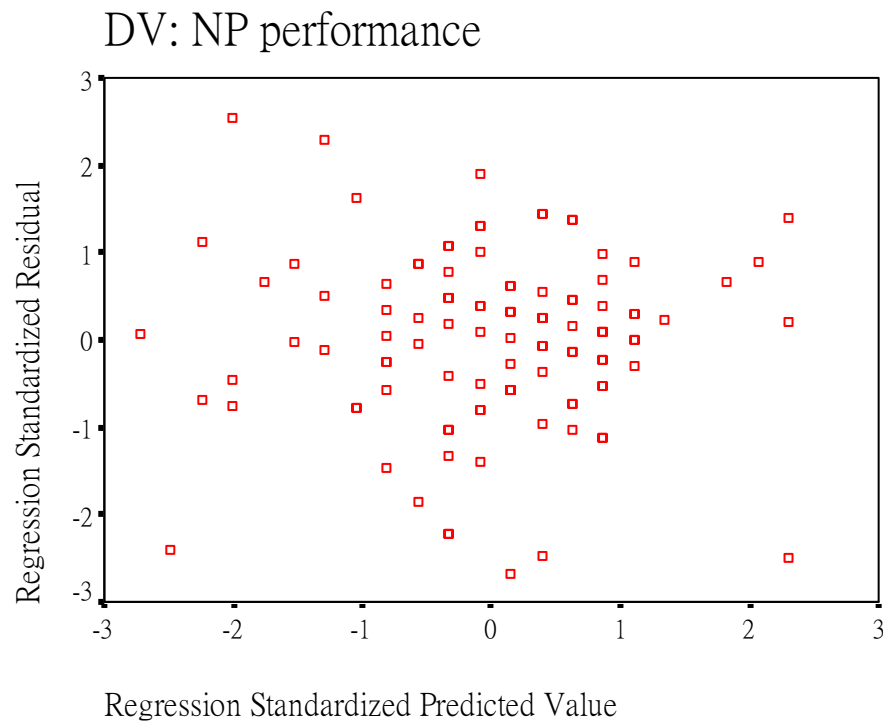


Figure 5.2 Scatterplot of ZRESID against ZPRED

Furthermore, a set of partial regression plots was used to detect whether there were any non-linear relationships and heteroscedasticity; that is, unequal dispersion of variables caused by skewness of one of the variables (Hair et al. 1998). Partial regression plots are scatterplots of the residuals of the dependent variables (i.e., marketing's manifest influence on R&D in NPD) and each of the independent variables when both variables are regressed separately on the remaining independent variables. The partial regression plots for Marketing's participation, Marketing's expert power, R&D's departmental power, Marketing's influence attempt, customer orientation, formalisation of NPD, complexity of NP, and importance of NP are shown in Appendix 5 (Tables 5.3.1-5.3.8). These plots revealed no non-linear patterns, indicating that the assumption of linearity for each independent variable

was met in the survey data, and there was no pattern in the residuals indicating homoscedasticity in the set of independent variables.

2. Normality

Normality refers to the shape of the data distribution for an individual variable and its correspondence to the normal distribution. If the variation from the normal distribution is sufficiently large, the resulting analyses could be rendered invalid (Hair et al. 1998). Normality was diagnosed via a histogram of regression standardised residuals and a normal probability plot of regression standardised residuals. Figures 5.4.1, 5.4.2, 5.5.1 and 5.5.2 show a normal distribution of the weighted independent variables. Therefore, the assumption of normality is met by the data.

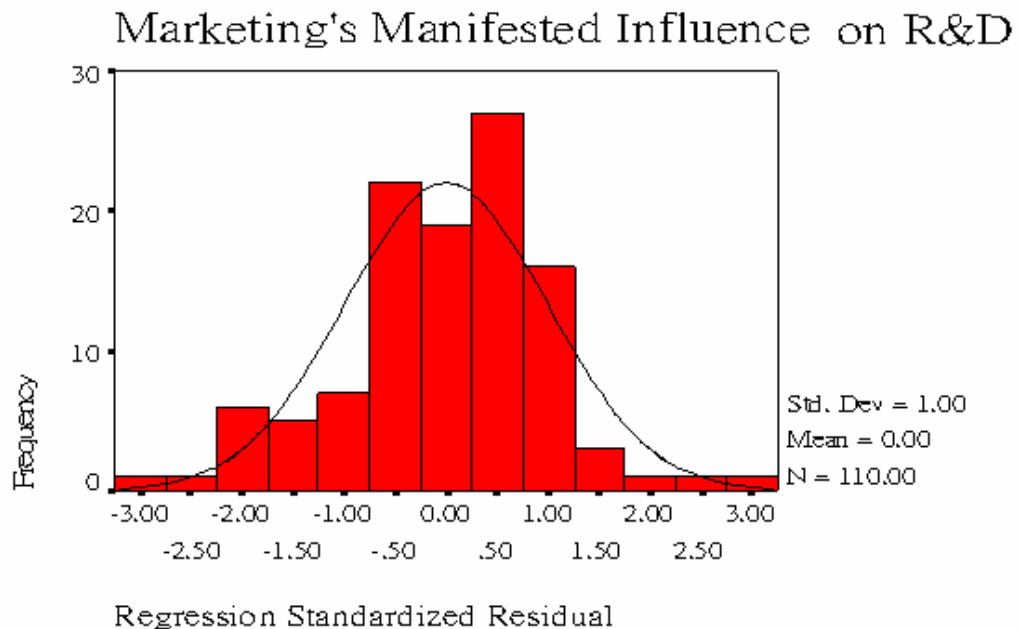


Figure 5.4.1 Histogram of Regression Standardised Residuals for Marketing's Manifested Influence on R&D

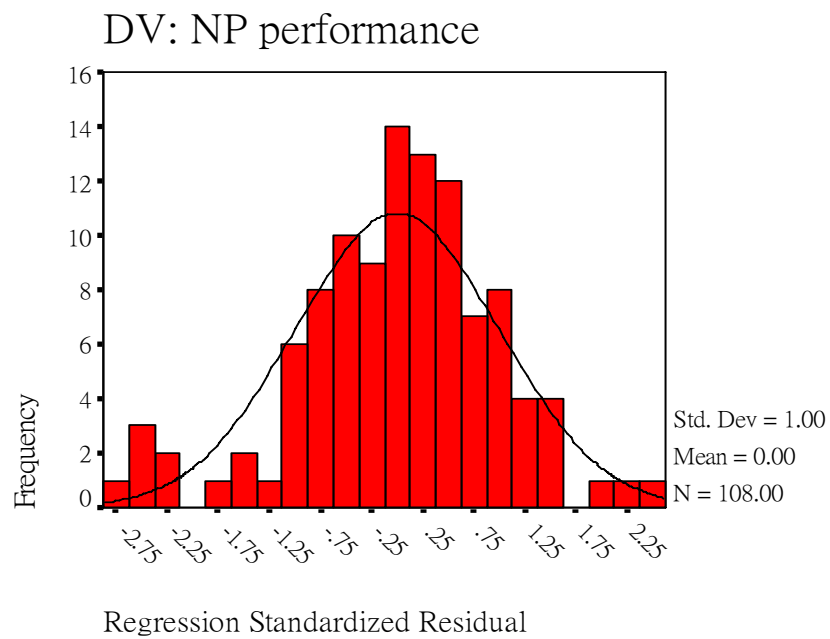


Figure 5.4.2 Histogram of Regression Standardised Residuals for New Product Performance

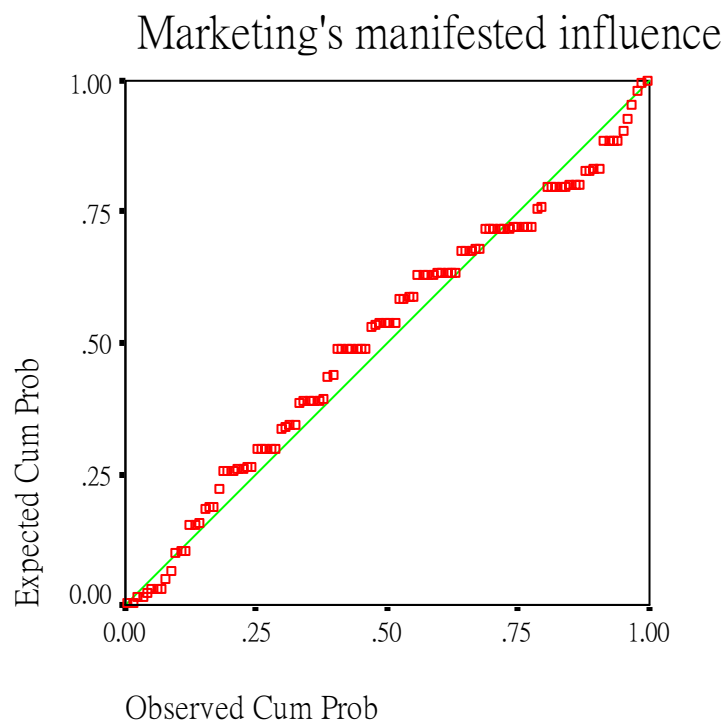


Figure 5.5.1 Normal P-P Plot of Regression Standardised Residuals for Marketing's Manifested Influence on R&D

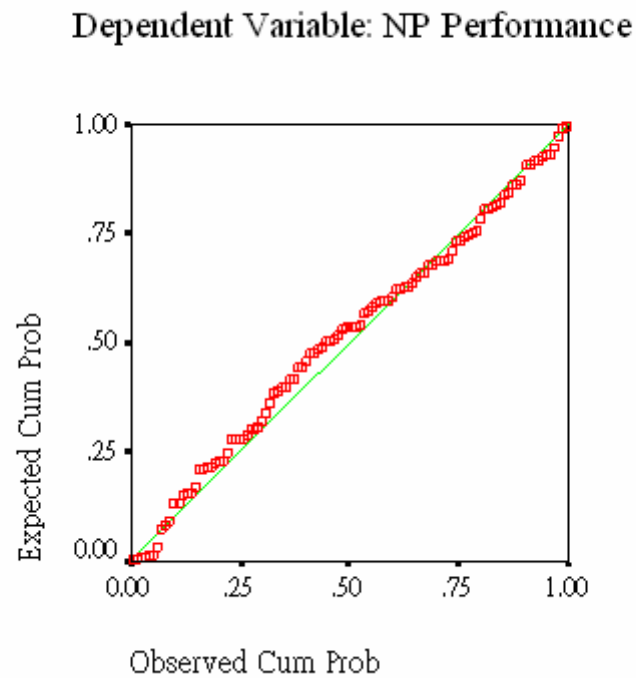


Figure 5.5.2 Normal P-P Plot of Regression Standardised Residuals for NP Performance

3. Multicollinearity

Multicollinearity refers to the extent to which an independent variable can be explained by the other independent variables in the analysis, and if too high this can have harmful effects on multiple regression. The diagnostics of tolerance and the variance inflation factor (VIF) were used to test the multicollinearity of the predictor variables. A tolerance of below .01 or a VIF greater than 10 is considered to indicate a serious problem (Hair et al. 1998; Myers 1990). As indicated in Table 5.8, none of the independent variables exceeded the cut-off thresholds of tolerance and VIF. Thus, the collinearity amongst the predictors of marketing's manifest influence on R&D in NPD was not a problem for the multiple regression analysis.

Table 5.8 Collinearity Statistics

Predictor Variable	Collinearity Statistics	
	Tolerance	VIF
Marketing participation	.597	1.675
Expert power	.488	2.048
Departmental power	.760	1.316
Influence attempt	.663	1.509
Customer orientation	.651	1.536
Formalisation of NPD	.612	1.635
Complexity of NP	.795	1.259
Importance of NP	.776	1.289

a Dependent Variable: MANIFEST

4. Independence of Residuals

A residual is a measure of the predictive fit for a single observation. It plays a key role in determining if the underlying assumptions of regression have been met, and it also serves as a diagnostic tool in identifying outliers (Hair et al. 1998). The Durbin-Watson statistic was used to test whether the assumption of residual independence was met. The Durbin-Watson statistic tests whether adjacent residuals are correlated (Field 2000). The closer this statistic is to 2, then the assumption of independence of the residuals is considered to be met (Field 2000). The results of this test showed (see Tables 5.10-5.14) that the assumption of independence of the residuals was met.

5.3.2 Testing the Main Effects: Hypotheses 1 and 2

Having established that the underlying assumptions for linear regression had been met by the sample data, the next step was to proceed with the analysis by producing a correlation matrix of all variables. Table 5.9 shows the means, standard deviations and correlations amongst the constructs. From the correlation matrix it can be seen that Marketing's participation was significantly and positively correlated with Marketing's manifest influence ($r = .259, p < .01$). As predicted, new product performance was significantly and positively correlated with Marketing's manifest influence ($r = .317, p < .01$), but not significantly correlated with Marketing's participation ($r = .094$). Furthermore, Marketing's manifest influence was significantly and positively correlated with expert power ($r = .523, p < .01$), R&D's departmental power ($r = .204, p < .05$) and Marketing's influence attempt ($r = .551, p < .01$), but not significantly correlated with customer orientation, formalisation of NPD, complexity of new product, or importance of new product.

The testing of H1 concerning the main effect of Marketing's participation and its subsequent influence on R&D in NPD was conducted by using multivariate regression analysis. To remove any possible confounding effects, the control variables (team size and self-perceived influence) and Marketing's participation were put in the regression equation simultaneously. The two control variables were entered in the first model as shown in Table 5.10. They explained 3% of the variance in Marketing's manifest influence on R&D in NPD. The main effect of Marketing's participation was then entered in model 2 as shown in Table 5.10.

As the results indicate, the finding is significant at the level of $p = .01$, and it explains 10.3 percent of variance on Marketing's influence ($R^2 = .103$, Adjusted $R^2 = .077$, F change = 8.573, $d/f = 3/105$). In support of H1, Marketing's participation was positively related to Marketing's manifest influence on R&D in NPD ($\beta = .279$, $p < .01$). Examination of the control variables revealed that team size was not significantly ($\beta = -.093$, $p > .10$) related to Marketing's influence, but self-perceived influence was significantly related to Marketing's influence ($\beta = .170$, $p < 0.10$). To test whether the control variable, self-perceived influence, would affect the significance of the predictor variable, Marketing's participation, a regression analysis was conducted in which self-perceived influence was removed. In this analysis, Marketing's participation was still significant ($\beta = .256$, $p < 0.01$). That means Marketing's participation would have significant influence on R&D with or without the presence of self-perceived influence.

Table 5.9 Means, Standard Deviations and Correlations among the Variables

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. Marketing's participation	3.13	.70									
2. Manifest influence	3.39	.70	.259**								
3. New product performance	3.64	.58	.094	.317**							
4. Expert power	3.35	.74	.572**	.523**	.192*						
5. Departmental power	3.25	.71	.137	.204*	.284**	.243**					
6. Influence attempt	3.17	.80	.386**	.551**	.092	.587**	.235*				
7. Customer orientation	3.24	.80	.321**	.154	.235*	.216*	.256**	.191*			
8. Formalisation of NPD	3.16	.74	.171	.126	.297**	.297**	.415**	.182	.519**		
9. Complexity of new product	3.22	.83	.183	.129	.105	.088	.202*	.140	-.004	.073	
10. Importance of new product	3.54	.83	.157	.095	.183	.222*	.237*	.173	.205*	.269**	.370**

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

In conclusion, the analysis found that the predictor variable, Marketing's participation, had a significant positive relationship with Marketing's influence controlling for the effects of team size and respondent self-perceived influence. Thus, H1 is supported by this analysis: Marketing's participation is related positively to its influence on R&D in the NPD process. In other words, the more that Marketing participates in the NPD process the more it will influence the R&D function in that process.

Table 5.10 The Effect of Marketing's Participation on Marketing's Manifest Influence (Standardised Regression Coefficients)

Variables	Model 1	Model 2
Control Variables:		
Team Size	-.027	-.093
Self Perceived Influence	.170a	.173a
Main Effect:		
Marketing Participation		.279c
R2	.030	.103
Adjusted R2	.011	.077
F Change	.1.623	8.573 c
Durbin-Watson	1.777	

The significance levels shown are one-tailed for hypothesis testing and two-tailed for controls

^a $P < 0.10$; ^b $p < 0.05$; ^c $p < 0.01$; ^d $p < 0.001$

For testing H2, a simple regression model was formulated in which performance of the new product was the dependent variable and Marketing's manifest influence on R&D in NPD was the predictor variable. The result concerning the main effect of

Marketing's manifest influence on new product performance is presented as standardised regression coefficients in Table 5.11.

As shown in Table 5.11, the model is significant at the level of $p = .01$, and it explains 14.4 percent of variance in Marketing's influence ($R^2 = .144$, Adjusted $R^2 = .119$, F value = 5.782, $d/f = 3/103$). The predictor variable, Marketing's manifest influence, was significantly and positively related to new product performance ($\beta = .277$, $p < 0.01$). Thus, H9 is supported: the more that Marketing influences R&D in the NPD process, the more likely it is the resulting new product will perform as desired by the firm.

Table 5.11 The Effect of Marketing's Manifest Influence on New Product Performance (Standardised Regression Coefficients)

Variables	Model 1	t value
Control Variables:		
Team Size	-.023	-.249
Self Perceived Influence	.211 b	2.270
Main Effect:		
Manifest influence	.277c	2.984
R2	.144	
Adjusted R2	.119	
F Change	8.902 c	
Durbin-Watson	1.721	

Significant level shown are one-tailed for hypothesis testing

^a $P < 0.10$; ^b $p < 0.05$; ^c $p < 0.01$; ^d $p < 0.001$

5.3.3 Testing the Contingency Effects: Hypotheses 3 to 9

The contingency hypotheses were tested using hierarchical regression analysis. In the study, the contingent effects of each of the individual factors, organisational factors and new product project characteristics on Marketing's participation and influence on R&D in NPD were tested separately for the following reasons. First, given the sample size ($n = 114$), it was not appropriate to test the prediction by entering all of the predictors, moderators and moderating effects in a single equation. Second, the intent of the contingency hypotheses was to understand whether Marketing's participation would be contingent on each factor. Third, the three moderators are conceptually and empirically independent. Thus, it was feasible to test the contingent relationships between Marketing's participation and influence on R&D in NPD. In support of this method, Gupta and Govindarajan (1984) and Schoonhoven (1981) have also shown that testing the contingency effects of independent variables separately is valid. Therefore, the contingency hypotheses pertaining to the moderators of participation were tested independently.

To examine the significance of the interaction effects of participation and its moderators (the individual factors, organisational factors and new product project characteristics) on Marketing's manifest influence, hierarchical regression analysis was used. Each test used the following steps. Step 1, the two control variables (self-perceived influence and team size) were added as a set. Step 2, the predictor (participation) and moderators (the individual factors, the organisational factors and the new product project characteristics) were entered as a set. This procedure

eliminated the main effects of each of the variables before examining the potential interaction effects. Finally, Step 3 the cross-product of participation with each moderator was entered as a set (e.g. participation by expert power, participation by department power and participation by influence attempt for the individual factors; participation by formalisation and participation by customer-orientation for the organisational factors; and participation by product complexity and participation by importance for the new product characteristics). If the interaction terms of the respective variables were found to be statistically significant, it could be concluded that the moderating effects of the respective variables had been supported. Interaction effects would be indicated if the F-value was significant and the R^2 in the full model (with interaction effects) increased significantly when compared with the reduced model (without interaction effects). Following Cronbach (1987), the creation of the interaction terms, the independent and moderating variables were mean-centred to reduce the potential problem of multicollinearity in regression analysis.

1. Individual Factors

The contingency effects of the individual factors on the relationship between Marketing's participation and influence involved three hypotheses: H3, H4 and H5. The results relating to these hypotheses are presented in Table 5.12. As shown in the table, the full model that includes the control variables, the independent variable, the moderators and the interaction effects is significant at the .001 level ($R^2 = .455$, Adjusted $R^2 = .404$, F change = 8.984, $d/f = 3/97$). Compared with the reduced model, which only includes the control variables, predictors and moderators (step 2), the addition of interaction terms in the full model significantly increases the R^2 (Increased $R^2 = .083$, $p < .01$), showing the existence of moderating effects that

improve the model's goodness of fit. The hypothesized contingency model explains 45.5% of the variance in marketing influences in NPD.

H3, which states that the positive relationship between Marketing's participation and Marketing influence is stronger when R&D perceives the expert power of Marketing to be greater, is supported. In other words, the moderating effect of expert power on the relationship between participation and influence is significant and positive ($\beta = .301, p < .01$).

H4, which states that the positive relationship between Marketing's participation and Marketing's influence is weaker when R&D's perceived departmental power is higher (and hence Marketing's departmental power as perceived by R&D is weaker), is supported. The interaction effect of participation and R&D's departmental power on influence is significant and positive ($\beta = .149, p < .10$).

H5 proposes that the positive relationship between Marketing's participation and Marketing's influence is stronger when R&D perceives that Marketing's influence attempts are greater, but this is not supported. The moderating effect of Marketing's participation and influence attempt on Marketing's manifest influence is significant but negative ($\beta = -.302, p < .01$). This means that if R&D perceives that Marketing's influence attempts are higher, then Marketing's participation will weaken rather than strengthen its influence on R&D in the NPD process as originally hypothesised.

The control variables: Team Size and Self-Perceived Influence, were not significant in the three models tested. That means that the moderating effects of individual contingency factors were not affected by the introduction of these control variables.

In other words Team Size and Self-Perceived Influence had no significant impact on the findings of individual contingency factors.

Table 5.12 Hierarchical Regression Analysis of the Moderating Effects of the Individual Factors on Marketing's Participation and Influence on R&D in NPD (Standardised Coefficient)

Variables	Model 1	Model 2	Model 3
Step 1			
- Team Size	-.051	-.139	-.109
- Self-Perceived Influence	.148	.090	.041
Step 2			
- Participation		-.060	-.170
- Expert Power		.367 a	.346 c
- Departmental Power		.029	.066
- Influence Attempt		.333 a	.415 d
Step 3			
- Participation X Expert Power			.301 c
- Participation X Departmental Power			.149 a
- Participation X Influence Attempt			-.302 c
R2	.025	.372	.455
Adjusted R2	.006	.334	.404
ΔR^2	---	.347 c	.083 c
F change	1.325	13.823 d	4.895 d
Durbin-Watson	1.888		

The significance levels shown are one-tailed for hypothesis testing and two-tailed for control testing

^a $P < 0.10$; ^b $p < 0.05$; ^c $p < 0.01$; ^d $p < 0.001$.

2. Organisational Factors

The contingency effects of the organisation factors on the relationship between Marketing's participation and Marketing's influence involved two hypotheses: H8 and H9. The results relating to these hypotheses are presented in Table 5.13. As shown, the full model is significant at $p < .01$ ($R^2 = .193$, F change = 5.540, $d/f = 2/101$). Compared with the reduced model, the increase in R^2 (Increased $R^2 = .089$) by adding interaction terms in the full model was significant. This indicates that the moderating effects of the organisation factors are significant. The hypothesised contingency model explains 19.3% of the variance in Marketing's influence on NPD.

H8 states that the positive relationship between Marketing's participation and influence is stronger when R&D perceives that the firm's customer orientation is greater. The results from the full model show that the moderating effects between Marketing's participation and customer orientation is positively related to Marketing influence ($\beta = .321$, $p < .01$). Thus, H7 was supported.

H9 states that the positive relationship between Marketing's participation and influence is stronger when R&D perceives that the degree of formalisation of Marketing role's in NPD is greater. The results from the full model show that the moderating effects between Marketing's participation and formalisation has no significant relationship with Marketing influence ($\beta = -.148$, $p = .123$). Thus, H9 was not supported.

The control variable team size was not significant in the three models tested and thus did not affect the organisational moderating effects on Marketing's participation and influence on R&D in the NPD process. However, the other control variable of self-perceived influence was found to be significant in Model 1, and so did affect the moderating effects in that model. But this effect became insignificant in Models 2 and 3 meaning that it did not affect the moderating effects in these two models. As will be explained in the next section, this result had been allowed for with the design of the survey questionnaire which measured R&D's perception of Marketing's influence rather than Marketing's own perception of its influence.

Table 5.13 Hierarchical Regression Analysis of the Moderating Effects of Marketing Participation and Influence on R&D in NPD (Standardised Coefficient)

Variables	Model 1	Model 2	Model 3
Step 1			
- Team Size	-.027	-.094	-.098
- Self-Perceived Influence	.170 ^a	.163	.132
Step 2			
- Participation		.272 ^c	.307 ^c
- Formalisation		.038	-.026
- Customer-Orientation		.001	.103
Step 3			
- Participation X Formalisation			-.148
- Participation X Customer-Orientation			.321 ^c
R ²	.030	.104	.193
Adjusted R ²	.011	.061	.137
ΔR^2	---	.075 ^b	.089 ^c
F Change	1.623	2.589 ^b	5.540 ^c
Durbin-Watson	1.826		

The significance levels shown are one-tailed for hypothesis testing and two-tailed for control testing

^a P < 0.10; ^b p < 0.05; ^c p < 0.01; ^d p < 0.001

3. New Product Project Characteristics

The contingency effects of the new product project characteristics on the relationship between Marketing's participation and influence involved two hypotheses: H6 and H7. The results relating to these hypotheses are presented in Table 5.14. The control variable of team size did not have any impact on the three models. However, the introduction of the other control variable of self-perceived influence did have a significant impact on the moderating effects of new product project characteristics on Marketing's participation and influence on R&D in the three models tested.

Table 5.14 Hierarchical Regression Analysis of the Moderating Effects of Marketing Participation and Influence on R&D in NPD – On New Product Project Characteristics (Standardised Coefficient)

Variables	Model 1	Model 2	Model 3
Step 1			
- Team Size	-.027	-.105	-.118
- Self-Perceived Influence	.170 ^a	.167 ^a	.159 ^a
Step 2			
- Participation		.262 ^c	.273 ^c
- Importance		.029	-.004
- Complexity		.081	.153
Step 3			
- Participation X Importance			.033
- Participation X Complexity			.184 ^a
R ²	.030	.112	.146
Adjusted R ²	.011	.068	.086
ΔR^2	---	.082 ^b	.034
F Value	1.623	3.164 ^b	2.012
Durbin-Watson	1.847		

The significance levels shown are one-tailed for hypothesis testing and two-tailed for control testing

^a P < 0.10; ^b p < 0.05; ^c p < 0.01; ^d p < 0.001

As shown in Table 5.14, the full model is significant at $p < .05$ ($R^2 = .146$, F change = 2.012, $d/f = 2/101$). The hypothesised contingency model explains 14.6% of the variance in Marketing's influence on R&D in NPD. Compared with the reduced model, the increase in R^2 (Increased $R^2 = .034$) by adding the interaction terms in the full model was not significant.

H6 proposes that the relationship between Marketing's participation and its influence on R&D is stronger when R&D perceives that the complexity of the new product is greater. The results from the full model show that the interaction between Marketing's participation and complexity has a positive (but not highly significant) relationship with Marketing's influence ($\beta = .184$, $p < .10$). Thus, H6 is refuted. This means when R&D perceives the complexity of a new product to be higher, Marketing's participation will lead to a strengthening rather than weakening influence on R&D as originally hypothesised. In other words, H6 is not supported.

H7 states that the relationship between Marketing's participation and influence is stronger when R&D perceives that the importance of the new product project is greater. The results from the full model show that the interaction between Marketing's participation and importance has no significant relationship with Marketing's influence ($\beta = .033$, $p > .10$). Thus, H7 is not supported.

5.4 Summary of Main Findings

This chapter has reported the results of the testing of the hypotheses that were formulated in Chapter 3. The testing process began by testing the main effects of, firstly, Marketing's participation and its subsequent influence on R&D, and secondly, Marketing's manifest influence on new product performance. Both hypothesised main effects were supported. The contingency effects of the individual factors, organisational factors and the new product project characteristics were then tested. The hypothesised individual and departmental power factors were supported. However, the moderating effect of influence attempt was refuted. The hypothesised moderating effects of the two project characteristics (i.e., new product complexity and project importance) have different results. The product complexity was refuted while the project importance was not supported. Finally, the hypothesised customer orientation factor was significantly supported, but the formalisation of the NPD factor was not supported. A summary of the results for each of the hypotheses tested is reported in Table 5.15.

These results will be discussed in the next and final chapter. The implications of the study, its limitations and suggestions for future research will also be discussed in that chapter.

Table 5.15 Summary of Research Hypotheses

Hypotheses	Expected Sign	Regression Coefficient	Empirical Conclusion
<u>Main Effect of Marketing's Participation on Marketing's Manifest Influence</u>			
H1: Marketing's participation is positively related to its influence on R&D in the NPD process.	+	.279	Supported
<u>Main Effect of Marketing's Manifest Influence on New Product Performance</u>			
H2: Marketing's manifest influence is positively related to new product performance.	+	.277	Supported
<u>Contingency Effects of Individual Factors on Participation</u>			
H3: When R&D perceives that the expert power of marketing is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process.	+	.301	Supported
H4: When R&D perceives that its departmental power is higher, Marketing's participation will lead to weaker influence on R&D in the NPD process.	+	.149	Supported
H5: When R&D perceives that the influence attempts of Marketing are greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process.	+	-.302	Not Supported
<u>Contingency Effects of NPPC on Participation</u>			
H6: When R&D perceives that the complexity of the new product is greater, Marketing's participation will lead to a weaker influence on R&D in the NPD process	-	.184	Not Supported
H7: When R&D perceives that the importance of the new product project is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process	+	n.s.	Not Supported
<u>Contingency Effects of Organisational Factors on Participation</u>			
H8: When R&D perceives that the degree of the customer orientation of the firm is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process	+	.321	Supported
H9: When R&D perceives that the degree of formalising Marketing's role in the NPD process is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process	+	n.s.	Not Supported

CHAPTER 6 DISCUSSION AND CONCLUSIONS

Preamble

This final chapter discusses the findings reported in Chapter 5 with reference to the literature and research questions presented in Chapters 2 and 3. The chapter is divided into six sections. The first section reviews the objectives and purpose of the study. The second section analyses in more detail the findings from Chapter 5, and relates these to the relevant NPD research literature. The third section discusses the implications of the findings for both researchers and managers. The fourth section discusses the limitations of the study and proposes directions for future research. The fifth and concluding section reflects on the salient issues raised by this study.

6.1 Review of Research Purpose and Objectives

The purpose of this study was to contribute to the body of management knowledge on new product development in three ways. First, as discussed in Chapters 1 and 2, cross-functional interaction in the field of NPD, particularly between Marketing and R&D personnel, is a very important topic that widely attracts the attention of both academics and practitioners. In the past two decades, many studies of cross-functional interaction have shown that cooperation and communication between the Marketing and R&D functions is one of the most important determinants of new product success. However, few studies have empirically tested the efficacy of the participation of functional team members in the NPD process. Furthermore, it is usually implied that manifest influence is an expected outcome of participation. However, given the importance of interaction in the NPD process, this assumption is

both questionable and even counterproductive to NPD studies. It has been argued here that participation, although a necessary main construct in cross-functional team interaction, is not by its mere existence bound to generate influence that results in intended outcomes. In some cases participation in a decision-making process can even lead to influence that creates undesirable consequences. Therefore, the relationship between participation and influence warrants a systematic investigation.

Second, there have been controversial findings about Marketing's influence on R&D, and researchers strongly advocate the adoption of a contingency perspective to examine the contextual factors that may moderate Marketing's influence in the NPD process. In response to that appeal, this study was designed - with particular reference to information processing, resource dependence and socio-political theories of cross-functional relationships - to empirically examine three sets of moderators (new product project characteristics, individual factors and organisational factors) on the relationship between the participation of Marketing personnel in NPD and the influence they achieve with R&D personnel (manifest influence). The aim of the investigation was to help understand what contingency factors can moderate the efficacy of marketing's participation in the NPD process.

Third, apart from lacking a contingency perspective, existing research on cross-functional interaction suggests that participants in a decision-making process are likely to overstate the efficacy of their own influence. To remedy that weakness, this study used a questionnaire to collect the self-report of R&D personnel about their perceptions of Marketing's influence on them arising from the participation of Marketing personnel in the NPD process, instead of the self-reports of Marketing

personnel. By doing so, it is argued that the research findings of this study will more accurately reflect participation and influence of Marketing personnel in the NPD process, and will more likely be free of any self-reported biases.

In Chapter one, two research questions were posed to focus the study reported here.

These questions were:

1. What are the effects of Marketing's participation on its manifest influence in the new product development process?
2. How do the contingencies, such as organisational, individual and project factors, moderate the relationship between Marketing's participation and its manifest influence in the new product development process?

The study has addressed these questions through preliminary case study research and through empirical testing of a theoretical model which explains the contingency effects of Marketing's participation and its manifest influence on R&D personnel in the NPD process. The model was formulated by synthesising the relevant literature, and the hypotheses so derived were tested using data from a survey of R&D managers. The research was aimed at knowledge gaps identified in the literature, most notably those relating to the participation/influence, contingencies, and the political nature of NPD process. The findings of the hypotheses testing were presented in the previous chapter (and summarized in Table 5.15), and in the following sections the implications of these findings will be discussed thereby clarifying the contribution this study has made to knowledge in the field of NPD management.

6.2 Discussion of the Findings

6.2.1 The Relationship between Marketing's Participation and Influence

The results support the first hypothesis, which states that Marketing's participation is related positively to its influence on R&D in the NPD process. That means, generally, when the R&D respondents were not considering any contingency factors, they believed the more that Marketing personnel participate in the NPD process, the more they will have an influence on R&D in the NPD process. This supports previous research findings that individuals who have a high degree of participation are more likely to have a high degree of influence (McQuiston 1989; Silk and Kalwani 1982; Song and Parry 1997; Stogdill 1974), as discussed in Chapter 3. However, although participation and influence are positively related, Marketing's participation does not necessarily generate the intended outcomes of influence on R&D. Testing of the contingency factor hypotheses revealed that there are moderating effects on Marketing's participation. This is important for researchers and practitioners because managers need to be aware of factors that can moderate the efficacy of participation, otherwise their influence attempts will not achieve their intended outcomes. Rather, Marketing's attempts to exert influence in the NPD process (e.g., through argument, persuasion and bargaining) may actually lead to weaker actual influence on their R&D counterparts (e.g. Marketing's arguments may carry no "weight", persuasion attempts may fail, and bargaining may prove ineffective). The contingency effects on influence will be discussed later in this section.

6.2.2 The Relationship between Marketing's Manifest Influence and NPD Performance

As discussed in Chapter 3, drawing on the information processing and resource dependence perspectives, it can be seen that Marketing and R&D (the two key functions in the NPD process) require information and resources from each other to enhance their collective efforts. Marketing's influence should enable the NPD team to more effectively address identified market opportunities with effective marketing strategies and to better understand the needs and wants of customers in target markets (Moenaert and Sounder 1990; Ruekert and Walker 1987). The results support the hypothesis that Marketing's manifest influence is positively related to new product performance, i.e., R&D personnel perceived that Marketing's influence positively contributed to the new product project's performance in terms of company goals. This finding is consistent with the rationale that the information exchange and resource dependence required between Marketing and R&D are conducive to new product success, and thus with the findings of previous research (e.g., Gupta, Raj and Wilemon 1986; Moenaert and Sounder 1990; Parry and Song 1993; Ruekert and Walker 1987).

6.2.3 A Contingency Perspective on Marketing and R&D Interaction

One of the main objectives of this study was to investigate what and how the contingency factors moderate the relationship between Marketing's participation and its influence on R&D in the NPD process. Three sets of contingency factors – new product project characteristics, individual factors and organisational factors – were selected after reviewing the relevant literature as discussed in Chapters 2 and 3. The factors were separately tested for their moderating effects on the participation and

influence relationship as noted in the previous chapter. The findings are now discussed below.

1. The Effect of Individual Factors

This group of factors is related to the sources of power and influence attempts exercised by the members of the NPD team, and were derived from the socio-political and resource dependence literatures (e.g., Frost and Egri 1991; Maute and Locander 1994; Pfeffer and Salancik 1978). These factors were hypothesised to have positive moderating effects on the participation and influence relationship.

The Moderating Effects of Expert Power

Expert power refers to the valuable professional knowledge that is critical to NPD success. This study hypothesised that if R&D personnel perceive that the expert power of Marketing is greater, then Marketing's participation will lead to a stronger influence on R&D in the NPD process. The results indicate a significantly positive relationship for this hypothesis, meaning that R&D pay high regard to Marketing personnel who are professionally competent and able to provide salient market and customer information to R&D in order to enhance NPD effectiveness. This finding is also consistent with the tenets of social-political and resource dependence theories (e.g., Patchen 1974; Speckman 1979).

The Moderating Effects of Departmental Power

Departmental power refers to the relative importance of power accorded to an individual's department by senior management. The findings reveal a significant moderating effect of department power in the hypothesised relationship. That means when R&D perceives Marketing is dominating in the company, Marketing's participation would exert stronger influence on the NPD decisions. This result is consistent with arguments of the socio-political theorists that innovation is essentially shaped by organisation power and politics and decisions made in the innovation process were usually played out through the exercise of power and influence (Frost and Egri 1991; Maute and Locander 1994). It is also consistent with the researcher's observation in the pilot case study that the R&D engineers would have quite a different product development decision if they were free from Marketing's influence. (Appendix 1).

The Moderating Effects of Influence Attempts

Influence attempts are regarded as the degree of effort that an individual exerts to achieve influence on a targeted individual or group. Such effort involves applying pressure and attempting strong persuasion. This study focused on R&D's perception of how much effort or pressure that Marketing exercises in an attempt to influence R&D's decisions in the NPD process. The study hypothesised that if R&D perceives the influence attempts of Marketing are greater, then Marketing's participation will lead to a stronger influence on R&D in the NPD process. The analysis revealed a

significant moderating effect, but one which was opposite to the one hypothesised. That is, the findings suggest that greater influence attempts by Marketing led to a weaker rather than stronger influence on R&D, as perceived by R&D. This result supports the findings of Kohli (1989) and Yukl et al. (1996), who have found that increased effort and pressure by individuals who are perceived by others to have expertise in a decision-making process actually leads to less influence because the pressure exerted undermines the credibility of the information conveyed. A plausible explanation for the finding in the study reported here is that the R&D personnel, who usually have an engineering or other technical background (with an emphasis on systematic quantitative analysis and rigorous problem-solving methods) have stronger professional pride and resist being manipulated by what they see are relatively “less disciplined salespeople”. “Face” issues in Chinese project teams could also explain why R&D personnel may be offended by Marketing’s zealous influencing behaviour (Leung and Chan 2003).

The Moderating Effects of New Product Project Characteristics

In this group of factors, two moderators – complexity and importance of the new product – were tested for their effects on the relationship between participation and influence.

The Moderating Effect of New Product Complexity

Previous research findings suggest that increased product *complexity* leads to greater uncertainty for the members of the decision-making team (McQuiston 1989). Individuals who bring critical information to help solve development problems are

perceived as best able to cope with this uncertainty, and thus have greater influence on the team. In the study, it was expected that product complexity would entail a need for new information and knowledge, both technological and marketing, to enable the project team to make accurate decisions in the NPD process. The study hypothesised that when R&D perceives the complexity of a new product is greater, Marketing's participation will lead to a weaker influence on R&D in the NPD process.

Although the results of the analysis on the moderating effects were significant, it was opposite to what had been predicted. That is, when R&D perceives there is greater product complexity, Marketing's participation actually leads to a stronger rather than weaker influence on R&D. This result is the opposite to that found by Adler (1995) and Frost and Egri (1991). It is possible that complexity induces greater uncertainty in NPD outcomes, and R&D engineers have to rely more on detailed input from Marketing to facilitate a more customer-focused product design. Another plausible explanation is that many of the sampled companies were small to medium in size, and many were only newly transformed from original equipment manufacturers (OEMs) to original design manufacturers (ODMs). Consequently, many of the R&D engineers in the sample were not very experienced in handling complicated projects, so they had to rely on Marketing's inputs in terms of information about similar products on sale in the market, the required product specifications, and customer preferences.

The Moderating Effects of New Product Importance

Importance here is defined as the degree to which the new product project is perceived to significantly influence the company's performance in terms of profitability and targeted sales. It was hypothesised that when R&D perceives that the importance of a new product project is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

The results show that the importance of the new product project as perceived by R&D did not have a significant effect on the influence exerted by Marketing. These findings can be explained by the assertion of social-political theory that if members of a team lack mutual recognition of each other's role in the NPD process, that tendency will be intensified when the new product project is perceived as important to the company (Frost and Egri 1991). With reference to the resource dependence and social-political theories, another possible explanation is that because the project is considered as important to the company, Marketing and R&D will not easily acquiesce to each taking the leading role, which usually entails the concession of organisational resources (Bacharach and Lawler 1981; Salancik and Pfeffer 1974).

3. The Contingency Effects of Organisational Factors

The final group of contingency factors derive from organisational characteristics. Two moderating factors, customer orientation and formalisation of NPD, were selected as being particularly salient.

The Moderating Effects of Customer Orientation

Customer orientation is a strategy that focuses on better identifying customer characteristics and their needs to more efficiently and effectively serve them. Customer-centred organisations typically have three common practices: company-wide efforts to collect customer information, the analysis and dissemination of information amongst functions, and direct organisational responses to the issues identified. It was hypothesised that when R&D perceives the degree of customer orientation of the firm is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

The findings indicate that significant positive moderating effects shape the relationship between R&D's perceptions of the customer orientation of the firm and its perceptions of Marketing's influence. In customer-oriented organisations, Marketing's participation can create a stronger influence on R&D in the decision-making process. Similar to the case of departmental power, in a customer-centred organisation, which has the formal practices noted above, Marketing plays a major role in planning and conducting these activities. In this circumstance, the outcomes are consistent with the main assertions of the resource dependence, information processing and social-political theories (Deshpande and Webster 1989; Kohli and Jaworski 1990; Ruekert 1992).

The Moderating Effects of Formalisation of NPD

Formalisation in this context connotes the legitimacy or credibility of NPD activities and practices in an organisation. Typically, it entails formal policies and procedures that govern the behaviour and practices of the members of a cross-functional team in the NPD process (Ruekert and Walker 1987). It was hypothesised that when R&D perceives the degree of formalisation of Marketing's role in the NPD process is greater, Marketing's participation will lead to a stronger influence on R&D in that process.

The findings indicate that the formalisation of Marketing's role did not have a significant moderating effect on the hypothesised relationship. This is perhaps not surprising, because previous studies have produced conflicting results. On the one hand, several studies have found that increased formalisation leads to lower information use because it engenders a sense of autonomy amongst individuals and departments that eventually leads to an increased tendency for territorial behaviour and organisational conflict (Corwin 1969; Pondy 1967; Deshpande and Zaltman 1982). This means that although senior management has clearly specified each function's roles and practices in the NPD process, R&D has no obvious reason to acquiesce to Marketing, and vice versa. On the other hand, other research findings suggest that formalisation leads to greater participation and influence for Marketing because it allows greater recognition and acceptance of the importance of its role in the NPD process (e.g., Ruekert and Walker 1987). Information process theory suggests that formalisation accords greater legitimacy or creditability to functions,

which leads to greater participation and influence. For instance, Fombrun (1983) and Ronchetto et al. (1989) have found that an individual's formal position is strongly related to influence.

A plausible explanation for the result of this study is that, with reference to the observation of the researcher in the pilot case, if Marketing's role is more formalized, its influence in the NPD process would have been governed by company policies and rules. In the pilot case, R&D would be less likely yield to Marketing if there were company policy, for instance, a stipulated profit margin governed a project has to cover. Marketing could influence R&D to attain their desirable NPD project objectives was not due to its formalized role. Arguably just because lacking such formality, Marketing could have more leeway to leverage its departmental power to influence R&D.

4. Summary of the Contingency Effects

In summary, the findings of the study supported most of the contingency hypotheses. The relationship between Marketing's participation in the NPD process and its manifest influence on R&D in that process is largely moderated by the effects of the three groups of contingency factors, namely new product project characteristics, individual factors and organisational factors. The introduction of control variables (i.e. team size and self-perceived influence) did not change the significance of the moderating effects of the contingency factors.

For the group of individual contingency factors, the moderators of expert power and department power had significant positive effects on the relationship between

Marketing's participation in the NPD process and its influence on R&D in that process. For expert power, the findings indicate that when R&D considers Marketing to have greater expert power, Marketing will have a stronger influence on R&D. For department power, when R&D perceives that Marketing has less departmental power, marketing has a weaker influence on R&D. However, the moderator of influence attempt had a significant negative impact on the relationship, which is contrary to what was expected. Rather, it was found that when R&D perceives Marketing is making greater influence attempts, Marketing's participation in the NPD process will lead to a weaker influence on R&D.

For the group of new product project characteristics, the moderator of new product complexity has a significant positive rather than the expected negative effect on the relationship between Marketing's participation in the NPD process and its influence on R&D in that process. When R&D perceives that a new product is more complex, Marketing's participation will lead to a stronger influence on R&D. However, the hypothesised moderator of project importance had no significant effect on the relationship.

Lastly, for the organisational contingency factors, two moderators were tested. The first moderator was customer orientation, which had a significant positive effect on the relationship between Marketing's participation in the NPD process and its influence on R&D in that process. If R&D perceives that the organisation has a greater tendency to be customer orientated, Marketing's participation in the NPD process will lead to a stronger influence on R&D. The second moderator is the formalisation of Marketing's role. The findings indicate that this did not have a

significant effect on the relationship between Marketing's participation in the NPD process and its influence on R&D in that process. Thus, the hypothesis was not supported by the data.

6.3 Contributions of the Study

As indicated in the introduction chapter, this study has made the following contributions to both theory and practice.

6.3.1 Theoretical Contributions

The major theoretical contribution of this study is that it has conceptualised and empirically investigated the relationship between Marketing's participation in the NPD process and its influence on R&D in that process. This relationship is usually taken for granted, and influence is considered as a natural extension of participation. The study strongly argues that mere participation does not automatically lead to the intended influence. A series of hypotheses to support this argument were developed drawing from both the marketing and organisational behaviour literatures, and notably from information exchange, resource dependence and social-political theories (e.g., Bacharach and Lawler 1998; Frost and Egri 1991; Pfeffer and Salancik 1978; Tushman and Nadler 1978).

The second theoretical contribution is that this study uses a contingency perspective to empirically examine three groups of contingency factors – new product project characteristics, individual factors and organisational factors. Before this study, very

little was known about what factors moderate the strength of influence of the members of NPD teams. The findings indicate that researchers should pay more attention to the positive or negative effects of these moderators. For instance, the hypotheses for two moderators – influence attempt and complexity of the new product – actually turned out to be the opposite of what other studies had found (e.g., Adler 1995; Yukl, Kim and Falbe 1996).

The accurate and reliable measurement of the efficacy of influence amongst key function team members is crucial for cross-functional interaction studies. However, previous studies (e.g., Kohli 1989; McQuiston and Dickson 1991; Yukl et al. 1996) have cautioned that participants in a team decision-making process are likely to overstate the efficacy of their own influence. The third contribution of this study is that the survey instrument was designed to remedy this weakness, as it set out to measure R&D's perception of Marketing's influence on the NPD process. In this way, it is contended the study's findings are more reliable and accurate than those of studies that use the self-reporting of Marketing personnel.

Lastly, very few studies have been conducted in Hong Kong on new product development, particularly from a management perspective (Sun and Wong 2005). As already discussed, that some hypotheses were not supported or found to be non-significant may reflect Hong Kong Chinese cultural issues. The study findings will help researchers to better understand the implications of such cultural issues in Hong Kong. Of particular note, this study is perhaps of special value to Hong Kong as it strives to develop itself as “the hub of innovation and design” for the Pearl River Delta (*International Herald Tribune*, Jan 20, 2005: 2). It is envisaged that, as a result

of this initiative, more research funding and interest will be dedicated to the areas of innovation and NPD.

A summary of research hypotheses and theoretical implications is illustrated in Table 5.15 below.

Table 5.16 Summary of Research Hypotheses and Theoretical Implications

Hypotheses	Empirical Conclusion	Theoretical Implications
<u>Main Effect of Marketing's Participation on Marketing's Manifest Influence</u>		It is theoretically significant to alert researcher that participation does not necessarily lead to manifest influence, although people tend to conveniently believe so.
H1: Marketing's participation is positively related to its influence on R&D in the NPD process.	Supported	The finding confirms those of McQuiston (1989), Silk and Kalwani (1982), Song and Parry (1997) and Stogdill (1974), however, this study argued and found that even though participation and influence are positively related, Marketing's participation does not necessarily generate the intended outcomes of influence on R&D. If this important fact is ignored, increased influence from Marketing may even be counterproductive to the NPD outcome. Researchers who respect this implication will be interested in finding the possible factors that can moderate the influence outcomes.
<u>Main Effect of Marketing's Manifest</u>		

Influence on New Product Performance

H2: Marketing's manifest influence is positively related to new product performance.	Supported	The finding supports those of Moenaert and Souder (1990), Ruekert and Walker (1987). The logic is quite straight forward, Marketing is presumed to inform the NPD team with the latest information about market and customer needs thereby R&D is more likely to develop a marketable product. Although the logic may be obvious to R&D, it should be cautioned that if Marketing's influence is perceived as improperly exerted, it may again be counterproductive as suggested by the socio-political theorists.
--	-----------	--

Contingency Effects of Individual Factors on Participation

H3: When R&D perceives that the expert power of marketing is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process.

Supported

The finding is consistent with the tenets of social-political and resource dependence theories (e.g., Patchen 1974; Speckman 1979). It also supports similar tests done by Gupta, Raj and Wilemon (1986) and Souder (1988). It entails that Chinese managers, like their counterparts in the West, also respect colleagues with strong expertise and knowledge.

H4: When R&D perceives that its departmental power is higher, Marketing's participation will lead to weaker influence on R&D in the NPD process.

Supported

The finding supports the resource dependency theory's argument that if a department is vested with higher power, it tends to be more influential in resource allocation. An employee may be attributed influence simply on the basis of membership of a powerful department (Blau and Alba 1982; Brass 1984). It is also consistent with the socio-political theorist's argument that innovation is essentially shaped by organisation power and politics (Frost and

		Egri 1991; Maute and Locander 1994). It may infer that office politics is not culturally bound.
H5: When R&D perceives that the influence attempts of Marketing are greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process.	Not Supported	As cautioned in the discussions on H1 and H2, it is an important finding that although Marketing's participation is positively related to its influence on R&D and Marketing's manifest influence is positively related to new product performance, if R&D perceived Marketing as too zealous in exerting its influence, it will actually weaken its influence on R&D. It is possibly due to "face" issues that R&D's professional pride is offended. Such subtle factors are worth noting when westerners deal with their Chinese counterparts as suggested by Lung and Chan (2003).
<u>Contingency Effects of NPPC on Participation</u>		It was a first attempt to have an empirical test on such a contingency framework
H6: When R&D perceives that the complexity of the new product is greater, Marketing's participation will lead to a weaker influence on R&D in the NPD process	Not Supported	The result is the opposite to that found by Adler (1995) and Frost and Egri (1991). It offers an interesting future research opportunity to test the plausible explanations of 1) complexity induces greater uncertainty in NPD outcomes and R&D engineers have to rely more on detailed inputs from Marketing to facilitate a more customer-oriented product design; 2) company size matters, cautioned in the Limitations section, the samples of this study were from a relatively smaller sized company as compared to those in the western studies, SME engineers are more dependent on Marketing's input in designing complex products.

		It can also be a measurement problem as the Scale Measurement (p.106) indicated it also scored an Alpha of 0.60.
H7: When R&D perceives that the importance of the new product project is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process	Not Supported	It is an interesting finding again as it contradicts conventional belief. A possible explanation, which is worth confirming with future research, is that because the project is considered as important to the company, Marketing and R&D will not easily acquiesce to each other in taking the leading role as that entails a concession of organisational resources as suggested by social-political and resource dependence theorists (Bacharach and Lawler 1981; Salancik and Pfeffer 1974). It is more likely to happen in Hong Kong or economies where technology component in a NPD project is not as strong as those in the US. The boss tends to pay more attention to the sales performance of that project and thereby Marketing & Sales can exert more influence.
<u>Contingency Effects of Organisational Factors on Participation</u>		
H8: When R&D perceives that the degree of the customer orientation of the firm is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process	Supported	Despite differences in culture and company size, the finding is consistent with similar tests of several studies (e.g., Deshpande and Webster 1989; Kohli and Jaworski 1990; Ruekert 1992). The result is logical as a customer orientation firm tends to be more likely dominated by Marketing, as social-political theory infers, strong department power will possess higher influence.

H9: When R&D perceives that the degree of formalising Marketing's role in the NPD process is greater, Marketing's participation will lead to a stronger influence on R&D in the NPD process	Not Supported	<p>This is another interesting and arguably important finding that the formalisation of Marketing's role did not have a significant moderating effect on the hypothesised relationship. A plausible explanation is that in a cross-functional team, departmental identity is purposefully vague to avoid territorial behaviour, however, when Marketing's role is formalised in the team, that may weaken the team-based spirit and R&D becomes defensive and mindful not to acquiesce to Marketing in any NPD decisions.</p> <p>Another possible reason may be due to company size, smaller companies are typically simple in organisational structure. A formalised role may mean bureaucracy and inflexibility which R&D may consider as undesirable. As it scored only 0.65 Alpha in scale measurement, it is possible that the result is caused by a measurement error. It warrants future research to find out a more reliable explanation.</p>
---	---------------	---

6.3.2 Managerial Contributions

As Clark and Wheelwright (1993) have argued, many elements are necessary to achieve success in NPD, including access to technology, the understanding of customer requirements, expertise and knowledge in the key functions of the NPD team, and the effective definition of key NPD concepts. However, in and of themselves, these elements are insufficient for achieving product development

success. Most importantly, as this and other studies have shown, effective cross-functional integration is essential for superior development performance.

Most companies routinely form multifunctional teams, especially for more innovative projects. Yet, many NPD projects fail or under perform because Marketing and R&D professionals cannot or will not work together well. Every case study of team success is contrasted by an equally illustrative case of failure. Managing NPD teams is not easy; managing multifunctional NPD teams is even harder. No longer is a team manager's effectiveness judged by his or her ability to pilot the bureaucratic labyrinth of formal channels and vertical lines of authority. Rather, effectiveness is now judged by his or her ability to put together and run individual teams and networks of teams (Leenders et al. 2002).

The quest for NPD team effectiveness is a key concern for managers. While it cannot be claimed that this study answers all of the questions related to this concern, it does provide important insights that can help managers understand what factors can positively or negatively affect the performance of the NPD team, with a special focus on the Marketing and R&D personnel therein. More specifically, the main argument of the study, which is particularly relevant to this issue, is that the participation of members of functional teams is a necessary but not sufficient condition for the success of NPD projects. Even though many studies have identified the positive relationship between influence and NPD project performance, few studies have examined the relationship between participation and the manifest influence of NPD project members. If this critical relationship is not well managed, then it will inevitably increase the uncertainty of NPD projects. The main effects examined in

this study indicate the importance of this relationship to managers. But this is not all: they then have to identify the main factors that can affect this relationship.

Let us now turn to the study's findings relating to the hypotheses and assess their implications for managers. Management should be aware that it is essential for individual NPD members from different functions to participate in the NPD process and so influence the decision-making of personnel from other functions. The findings indicate that the manifest influence of Marketing personnel has a significant effect on the new product project's performance. However, mere participation or involvement in the NPD process, although necessary, is not sufficient to induce desired influence and in some case, influence attempts could weaken the influence they actually achieve. Therefore, if managers want to exert desirable influence in the NPD process, it is advisable for them to examine the moderating effects of the key contingency factors that can weaken or strengthen their influence.

The study identified three groups of contingency factors, namely new product characteristics, individual and organisational factors, which were found to have moderating effects on the strength of influence exerted by Marketing personnel on R&D in the NPD process.

The first group, related to the individual team member, comprises influence attempts and power factors, namely expert power and departmental power. For expert power, if Marketing wants to effectively influence R&D, Marketing personnel have first to convince R&D that they possess the high levels of expertise (e.g., relating to deep understanding about customer needs, strong new product commercialization skills)

needed in the NPD process. However, it is advisable that Marketing personnel demonstrate this tactfully and subtly, because in Chinese culture, outright demonstration of expertise might be considered as arrogant and egotistical.

Another power factor is departmental power. If the departmental power of Marketing is weak in an organisation, then Marketing personnel will need to use their political and interpersonal skills to influence R&D in the NPD process. Without these skills, Marketing personnel will find their voices frequently ignored. Therefore, it is important for Marketing to diagnose the political environment at the departmental and senior management levels. Equally important to senior management is that they should allow valuable ideas or opinions to freely move through NPD teams in spite of unbalanced political conditions.

The final individual contingency factor is influence attempts. Contrary to conventional wisdom, the study found that R&D does not necessarily yield to Marketing if it perceives that Marketing is making greater attempts to influence the NPD process. As explained earlier, this may be a “face” issue. The lesson for Marketing is that, again, in Chinese culture such influence attempts should be subtle and tactful.

The second group of contingency factors is related to project characteristics, in particular the complexity of the new product. The findings indicated the rather surprising outcome that Marketing’s influence on R&D increases with the complexity of the new product instead of decreasing as originally assumed. Therefore, Marketing should see product complexity as an opportunity to exert

greater influence on R&D rather than a reason to retreat from attempts at influencing. However, the importance of the new product to the firm appeared to have no significant effect on the relationship between Marketing's participation and its influence on R&D. As argued previously, if the project is considered to be important to the company, R&D will not easily acquiesce to Marketing taking the leading role as it practically entails a concession of organisational resources. Therefore, Marketing personnel, instead of competing for the leading role, should strive to forge a constructive partnership with R&D in order to achieve the project goals.

Organisational factors comprise the third group of contingency factors. This group includes customer orientation and the formalisation of NPD. It is rather unsurprising to find that Marketing's influence grows with the intensity of the customer orientation of the organisation. The senior management of customer-orientated firms should note this outcome and ensure that the constructive ideas and suggestions of R&D and other key functions are effectively expressed in the NPD decision-making process. Formalising the role of Marketing, however, appeared to have no significant moderating effect. This finding implies Marketing should not waste time and effort to campaign for a formalised NPD process in the organisation. Perhaps, extrapolating from this study's findings, Marketing should seek to exert influence through more informal ways (e.g., social and other after-work activities such as sports, parties, clubs, etc.).

Apart from the above contributions to the knowledge of cross-functional interaction for practitioners, it can be further deduced that to effectively manage the intended influence of functional groups and the NPD process, management must control three

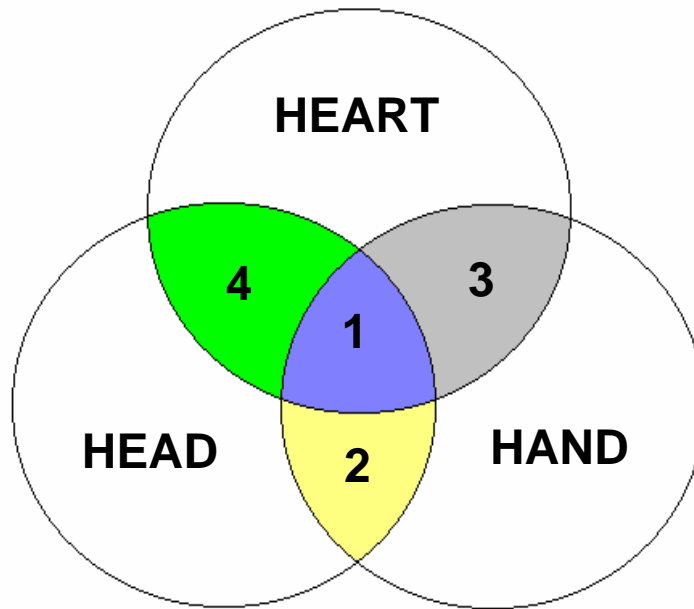
main factors (related to the three groups of contingency factors). For easier understanding, the three groups of contingency factors can be metaphorically represented as the “Heart, Head and Hand”. This is the “3-H” perspective as shown in Figure 6.1. “Heart” is about managing the individual contingency factors, “Head” is about managing organisational contingency factors, and “Hand” is about the operational skills of managing a new product project. The 3-H perspective explains that the effectiveness of Marketing’s influence on R&D as it participates in the NPD process, and consequently new product performance, depends on the magnitude of interception amongst the three Hs. The rationale is that “Heart” is related to the ability of managers to extract genuine commitment, respect and devotion from the other members of the NPD team, i.e. an emotional appeal. During the pilot study stage of this research, many NPD project leaders named this as the most important factor in NPD project success. Yet, they also concurred that it was the most difficult to manage. “Head” refers to the ability to plan an organisational environment with emphasis on the formalisation of the planning and controlling of NPD activities that are conducive to Marketing’s influence on other members of the NPD team, and thereby to achieving the NPD project goals. This appeals to rational thinking. “Hand” is related to senior management’s functional expertise and skills for implementing day-to-day NPD activities. This appeals to operational thinking.

The 3-H perspective advocates that due to the complexity of the NPD environment and the nature of the tasks (as discussed in Chapter Two) senior management has to address all three H dimensions throughout the NPD process. It appears that the operational expertise (Hand) is easier to identify and secure. A more demanding task is the project planning capabilities (Head), i.e. senior management needs to establish

the context and structure in which functional members interact. But a successful fulfilment of both Hs can only tackle the “how to” and “ought to” mind sets of the NPD team members. These are necessary mentalities but not sufficient to ensure genuine team collaboration and effective NPD performance. The most critical, and arguably most challenging factor, for management is getting all NPD team members committed to the project goals, to the extent that they “want to” conscientiously implement the other two H activities.

The 3-H perspective can also be used by NPD project leaders to predict the likelihood of realising their intended influence on the NPD project and hence contribute to success in the initial stages and during the process of development. This can be done by assessing the individual states of the H factors, and then focussing on the overlapped areas of the three Hs. By plotting the information collected, managers will be able to identify four scenarios. As Figure 6.1 depicts, the best or ideal scenario is Case 1 – wherein the multifunctional members of NPD teams are committed to well-articulated project goals and are capable of achieving them effectively and efficiently. In the remaining scenarios there are deficient or weakened H factors that management has to strengthen, otherwise they will become major stumbling blocks to NPD team collaboration and the attainment of project goals. By analysing the intersection of the 3 Hs, senior managers will be in a clearer position to manage NPD teams and projects.

Figure 6.1 Three-H Perspective of Effective Participation in NPD Project



Scenarios resulting from
different H factors'
interceptions

<div style="background-color: blue; color: white; text-align: center; width: 40px; height: 40px; line-height: 40px;">1</div>	<p>Case 1 – Committed participation and capable of doing the right thing.</p> <p>Ideal scenario, the NPD team's participation is most likely to achieve intended outcomes.</p>
<div style="background-color: yellow; text-align: center; width: 40px; height: 40px; line-height: 40px;">2</div>	<p>Case 2 – Compliant and capable of doing the right thing but participation is not committed.</p> <p>Remedy: management should inculcate a corporate culture and establish a reward system that supports cooperation amongst members of the NPD team.</p>
<div style="background-color: grey; text-align: center; width: 40px; height: 40px; line-height: 40px;">3</div>	<p>Case 3 – Committed and capable, but not certain to do the right thing.</p> <p>Remedy: management should review business strategy to ensure that the project team is doing the right thing.</p>
<div style="background-color: green; color: white; text-align: center; width: 40px; height: 40px; line-height: 40px;">4</div>	<p>Case 4 – Committed but incapable of doing the right thing.</p> <p>Remedy: management must strengthen recruitment and staff training plans and programmes to ensure that NPD team members are equipped with the appropriate qualifications and experience for the tasks assigned.</p>

6.4 Limitations and Areas for Future Research

The results of this study need to be interpreted with some caution due to the following limitations. The first limitation was the study's data collection procedure. As explained in Chapters 4 and 5, convenience sampling had to be used rather than random sampling, and this might have resulted in biases in the data. However, based on the characteristics of the sample presented in Table 5.1.1, the sample selected was reasonably representative across different businesses in the high technology industry. Moreover, as shown in Table 5.1.2, over 55% of the respondents had over five years of NPD experience, over 50% had developed over five new product projects and over 90% possessed university degrees. Hence, the respondents appeared to have been suitable for providing relevant and appropriate information which was required for this study. Furthermore, the new product projects that the respondents referred to were considered as, to very large extent, the new product projects that the firms typically engaged (as shown in Table 5.1.3).

The second limitation is that due to the exploratory nature of this study, the survey sample was intentionally limited to a specific industry, and sampled firms were limited to those registered in Hong Kong. The relatively small and homogeneous sample size limits the generalisability of the study findings. However, as discussed earlier, the collected data appears to be representative of the targeted population and relevant to the study. Future research with samples including different industries and different Asian economies would be helpful to determine the generalisability of the results of this study.

The third limitation is that this study focused on influence at the initiation stage of the NPD process. We do not know the degree to which the results differ at subsequent stages, such as the commercialisation phase of the NPD process. Thus, future research should focus on other stages of the NPD process to investigate any differences.

The fourth limitation of this study is that although Marketing and R&D are generally recognised as the key departments in the NPD process, given that process innovation is increasing in Chinese firms (Yu et al., 2003), it will be meaningful to study other departments, such as Manufacturing and Operations, to compare their findings with those of this study.

The fifth limitation, readers should also be mindful that this study has been conducted in a business context that is characterised by six distinctive features discussed in the Introduction. Therefore, generalisation of the findings can be limited by these features, in particular, the macro political factors such as government industrial policy, and micro or firm-based factors, such as scale and size of the firm, nature and technological components of NPD projects, history and hence experience in managing cross-functional NPD teams.

Two other possible limitations to address: (a) the date of the survey (probably not an issue for reasons we have rehearsed but recommend survey could be repeated to check for any temporal effects), and (b) the limitations of questionnaire-based surveys (broad-brush approach not able to address issues and understandings in

depth) and the possibility of measurement error (need to for further studies and development to ensure valid and reliable instruments to measure the key constructs deployed in this area).

Finally, the hypothesis that tested influence attempts indicated that when R&D perceives that the influence attempts of Marketing are greater, Marketing's participation will lead to weaker instead of stronger influence, as originally hypothesized, on R&D. However, it should be cautioned that this study only measured the generic or broad influence attempts, instead of testing individual influence tactics. Therefore, as suggested in the findings of the pilot case, it is possible that if Marketing skilfully exerted certain influence tactics, for example, assertiveness, upper management appeal, reason, bargaining, as suggested by Goebel, Marshall and Locander (2006) on R&D, this may generate positive results. So, further study to examine the effectiveness of individual influence tactics in a similar contingency context would be both interesting and meaningful.

6.5 Conclusions

The primary goal of this study was to contribute to the knowledge of new product development in three main areas, namely the interaction between Marketing and R&D in NPD, the contingency effects on such interaction, and the efficacy of participation as measured by the intended manifest influence of such interaction. Given the exploratory nature of this research, the goal of this study has been achieved. As Casti (1987) suggests, research involves ideas, not answers.

Developing a deep understanding of a question itself is a worthwhile experience for the building of knowledge.

On reflection, apart from satisfying the research objectives, several key ideas have been developed in this study and a much more holistic perspective on the question has been gained. In conclusion, it is argued that managers must make broad holistic overviews and examine the entire NPD process, from product/market strategy to new product commercialisation and post-launch support. The three-H perspective can help them better manage the NPD process in such a holistic way. Managers can better predict the efficacy of the participation of NPD team members by managing the quality of all three Hs in the team. However, this insight is still at the conceptual stage. In the future, it will be an interesting yet challenging task for researchers to empirically test the constructs, such as the “Heart” factor of the three-H perspective.

Bibliography

- Adler, P. S. (1995). Interdepartmental interdependence and coordination: The case of the design/manufacturing interface. *Organization Science*, 6(2), 147.
- Adler, P. S., Mandelbaum, A., Nguyen, V., & Schwerer, E. (1995). From project to process management: An empirically-based framework for analyzing product development time. *Management Science*, 41(3), 458.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
- Akgun, A. E., Lynn, G. S., & Byrne, J. C. (2006). Antecedents and consequences of unlearning in new product development teams. *The Journal of Product Innovation Management*, 23(1), 73.
- Allen, T. J. (1986). Organizational structure, information technology, and R D productivity. *IEEE Transactions on Engineering Management*, EM33(4), 212.
- Allen, T. J. (1970). Communications networks in R&D laboratories. *R&D Management*, 1, 14-21.
- Anastasi, A. (1988). Explorations in human intelligence: Some uncharted routes. *Applied Measurement in Education*, 1(3), 207.
- Ancona, D. G., & Caldwell, D. (1990). Improving the performance of new product teams. *Research Technology Management*, 33(2), 25.
- Ancona, D. G., & Caldwell, D. F. (1992). Bridging the boundary: External activity and performance in. *Administrative Science Quarterly*, 37(4), 634.

- Anderson, J. C., & Gerbing, D. W. (1984). The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis. *Psychometrika*, 49(2), 155-173.
- Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *JMR, Journal of Marketing Research*, 14(3), 396.
- Arnold, H. J. (1982). Moderator variables: A clarification of conceptual, analytic, and psychometric issues. *Organizational Behavior and Human Performance*, 29(2), 143.
- Atuahene-Gima, K. (1996). Market orientation and innovation. *Journal of Business Research*, 35(2), 93.
- Atuahene-Gima, K. (1995). An exploratory analysis of the impact of market orientation on new product performance: A contingency approach. *The Journal of Product Innovation Management*, 12(4), 275.
- Atuahene-Gima, K., & Evangelista, F. (2000). Cross-functional influence in new product development: An exploratory study of marketing and R&D perspectives. *Management Science*, 46(10), 1269.
- Atuahene-Gima, K., & Li, H. (2000). Marketing's influence tactics in new product development: A study of high technology firms in china. *The Journal of Product Innovation Management*, 17(6), 451.
- Atuahene-Gima, K., & Yu, E. (1998). Marketing's political influence strategies in new product development in high technology firms: An investigation of antecedent factors and outcomes. *Achieving Excellence in New Product Development & Management, Annual Conference of the PDMA*, Atlanta, US. 25-30.

- Baark, Erik and So, Alvin Y. (2006). The political economy of Hong Kong's quest for high technology innovation, *Journal of Contemporary Asia*, Vol. 36, No. 1.
- Bacharach, S. B., & Lawler, E. J. (1980). *Power and politics in organizations*. San Francisco: Jossey-Bass.
- Bacharach, S. B., & Lawler, E. J. (1981). *Bargaining: Power, tactics, and outcomes*. San Francisco, CA: Jossey-Bass.
- Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, 36(3), 421.
- Baker, N. R., Souder, W. E., Shumway, C. R., Mahler, P. M., & Rubenstein, A. H. (1976). A budget allocation model for large hierarchical R&D organizations. *Management Science*, 23(1), 59-70.
- Balachandra, R., & Friar, J. H. (1997). Factors for success in R&D projects and new product innovation: A contextual framework. *IEEE Transactions on Engineering Management*, 44(3), 276.
- Bartölke, K., Eschweiler, W., Flechsenberger, D., & Tannenbaum, A. S. (1982). Workers' participation and the distribution of control as perceived by members of ten German companies. *Administrative Science Quarterly*, 27(3), 380.
- Bentler, P. M., & Cho, C. (1988). Practical issues in structural modeling. In J. S. Long (Ed.), *Common Problems/Proper solutions: Avoiding error in quantitative research* (pp. 161-192). Newbury Park, CA: Sage.

- Berry, W. D. (1993). *Understanding regression assumptions*. Thousand Oaks, CA: Sage.
- Blalock Jr., H. M. (1979). The presidential address: Measurement and conceptualization problems: The major obstacle to integrating theory and research. *American Sociological Review*, 44(6), 881-894.
- Blau, J. R., & Alba, R. D. (1982). Empowering nets of participation. *Administrative Science Quarterly*, 27(3), 363.
- Booz, Allen & Hamilton. (1982). *New products management for the 1980s*. Chicago:
- Brass, D. J. (1984). Being in the right place: A structural analysis of individual influence in an organization. *Administrative Science Quarterly*, 29(4), 518.
- Brass, D. J., & Burkhardt, M. E. (1993). Potential power and power use: An investigation of structure and behavior. *Academy of Management Journal*, 36(3), 441.
- Brown, S. L., & Eisenhardt, K. M. (1995). Product development: Past research, present findings, and future directions. *Academy of Management Review*, 20(2), 343.
- Burns, T., & Stalker, G. M. (1961). *The management of innovation*. London: Tavistock: Oxford University Press.
- Calantone, R. J., & di Benedetto, C. A. (1990). Canonical correlation analysis of unobserved relationships in the new product process. *R & D Management*, 20(1), 3.
- Caldwell, D. F., & Ancona, D. G. (1988). Beyond task and maintenance defining external functions in groups. *Group & Organization Studies (1986-1998)*, 13(4), 468.

- Casti, J. (1987). System similarities and the existence of natural laws. *European Journal of Operational Research*, 30(2), 135.
- Chen, H. L., Spyarakos, C. C., & Venkatesh, G. (1995). Evaluating structural deterioration by dynamic response. *Journal of Structural Engineering*, 121(8), 1197.
- Child, J. (1984). *Organisation: A guide to problems and practice* (2nd ed.). London: Harper & Row.
- Churchill, G. A., Jr. (1979). A paradigm for developing better measures of marketing constructs. *JMR, Journal of Marketing Research (Pre-1986)*, 16(1), 64.
- Clark, K. B., & Wheelwright, S. C. (1993). *Managing new product and process development*. New York: Free Press.
- Clark, K. B., & Fujimoto, T. (1991). Heavyweight product managers. *McKinsey Quarterly*, (1), 42-60.
- Clark, K. B., & Fujimoto, T. (1991). *Product development performance: Strategy, organization, and management in the world auto industry*. Boston, Mass: Harvard Business School Press.
- Cook, K. S., & Emerson, R. M. (1978). Power, equity and commitment in exchange networks. *American Sociological Review*, 43(5), 721-739.
- Cooper, R. G. (1984). New product strategies: What distinguishes the top performers? *The Journal of Product Innovation Management*, 1(3), 151.

- Cooper, R. G., & Kleinschmidt, E. J. (1995). Benchmarking the firm's critical success factors in new product development. *The Journal of Product Innovation Management*, 12(5), 374.
- Cooper, R. G., & Kleinschmidt, E. J. (1993). Major new products: What distinguishes the winners in the chemical industry? *The Journal of Product Innovation Management*, 10(2), 90.
- Cooper, R. G., & Kleinschmidt, E. J. (1987). New products: What separates winners from losers? *The Journal of Product Innovation Management*, 4(3), 169.
- Corwin, R. G. (1969). Patterns of organizational conflict. *Administrative Science Quarterly*, 14(4), 507.
- Cotton, J. D., Froggatt, V. K., Lengnick-Hall, M., & Jennings, K. (1988). Employee participation: Diverse forms and different outcomes. *Academy of Management Review*, 13, 8-22.
- Covin, J. G., & Slevin, D. P. (1989). Strategic management of small firms in hostile and benign E. *Strategic Management Journal*, 10(1), 75.
- Craig, A., & Hart, S. (1992). Where to now in new product development research? *European Journal of Marketing*, 26(11), 1.
- Crawford, C. M. (1997). *New products management* (5th ed.). Boston: Irwin.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297-334.
- Cronbach, L. J. (1987). Statistical tests for moderator variables: Flaws in analyses recently proposed. *Psychological Bulletin*, 102(3), 414.

- Daft, R. L., & Weick, K. E. (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review*, 9(2), 284.
- De Vaus, David A. (1996). *Surveys in social research* (4th ed.). London: University of London Press.
- Deshpande, R., Farley, J. U., & Webster, F. E., Jr. (1993). Corporate culture, customer orientation, and innovativeness. *Journal of Marketing*, 57(1), 23.
- Deshpande, R., & Webster, F. E., Jr. (1989). Organizational culture and marketing: Defining the research. *Journal of Marketing*, 53(1), 3.
- Deshpande, R., & Zaltman, G. (1982). Factors affecting the use of market research information: A path analysis. *JMR, Journal of Marketing Research (Pre-1986)*, 19(1), 14.
- Dougherty, D. (1992a). Interpretive barriers to successful product innovation in large firms. *Organization Science*, 3(2), 179-202.
- Dougherty, D. (1992b). A practice-centered model of organizational renewal through product innovation. *Strategic Management Journal*, 13, 77.
- Dougherty, D. (1990). Understanding new markets for new products. *Strategic Management Journal (1986-1998)*, 11(5), 59.
- Douglas, M. (1987). *How institutions think*. London: Routledge and Kegan Paul.
- Dowling, M. J., & McGee, J. E. (1994). Business and technology strategies and new venture performance. *Management Science*, 40(12), 1663.

- Dwyer, L., & Mellor, R. (1991). Organizational environment, new product process activities, and project outcomes. *The Journal of Product Innovation Management*, 8(1), 39.
- Eisenhardt, K. M., & Bourgeois, L. J.,III. (1988). Politics of strategic decision making in high-velocity environment. *Academy of Management Journal*, 31(4), 737.
- Farmer, S. M., Maslyn, J. M., Fedor, D. B., & Goodman, J. S. (1997). Putting upward influence strategies in context. *Journal of Organizational Behavior*, 18(1), 17.
- Ference, T. P. (1970). Organizational communications systems and the decision process. *Management Science (Pre-1986)*, 17(2), B83.
- Field, A. (2000). *Discovering statistics using SPSS for windows: Advanced techniques for beginners*. Thousand Oaks, CA: Sage.
- Firat, A. F., Dholakia, N., & Venkatesh, A. (1995). Marketing in a post modern world. *European Journal of Marketing*, 29(1), 40-56.
- Foddy, W. (1993). *Constructing questions for interviews and questionnaires*. London: Cambridge University Press.
- Fombrun, C. J. (1983). Attributions of power across a social network. *Human Relations*, 36(6), 493.
- French, John R. P., Jr., & Raven, B. (1959). The bases of social power. In D. Cartwright (Ed.), *Studies in social powers* (pp. 150-167). Ann Arbor: University of Michigan Press.
- Frost, P. J., & Egri, C. P. (1991). The political process of innovation. *Research in Organizational Behavior*, 13, 229.

- Galbraith, J. R. (1982). Designing the innovating organization. *Organizational Dynamics*, 10(3), 5.
- Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: A literature review. *The Journal of Product Innovation Management*, 19(2), 110.
- Germain, R., Droge, C., & Daugherty, P. J. (1994). The effect of just-in-time selling on organizational structure: An empirical investigation. *JMR, Journal of Marketing Research*, 31(4), 471.
- Gorlin, H., & Schein, L. (1984). *Innovations in managing human resources*. New York, N.Y.: Conference Board.
- Gresov, C., & Stephens, C. (1993). The context of interunit influence attempts. *Administrative Science Quarterly*, 38(2), 252.
- Griffin, A., & Hauser, J. R. (1996). Integrating R&D and marketing: A review and analysis of the literature. *The Journal of Product Innovation Management*, 13(3), 191.
- Griffin, A., & Hauser, J. R. (1993). The voice of the customer. *Marketing Science* (1986-1998), 12(1), 1.
- Griffin, A., & Hauser, J. R. (1992). Patterns of communications among marketing, engineering and. *Management Science*, 38(3), 360.
- Griffin, A., & Page, A. L. (1996). PDMA success measurement project: Recommended measures for product development success and failure. *The Journal of Product Innovation Management*, 13(6), 478.

- Griffin, A., & Page, A. L. (1993). An interim report on measuring product development success and failure. *The Journal of Product Innovation Management*, 10(4), 291.
- Guba, E. G., & Lincoln, Y. S. (1981). *Effective evaluation: Improving the usefulness of evaluation results through responsive and naturalistic approaches*. San Francisco, CA: Jossey-Bass Inc.
- Gupta, A. K., Raj, S. P., & Wilemon, D. (1987). Managing the R&D-marketing interface. *Research Management*, 30(2), 38.
- Gupta, A. K., Raj, S. P., & Wilemon, D. (1986a). A model for studying R&D-marketing interface in the product innovation process. *Journal of Marketing*, 50(2), 7.
- Gupta, A. K., Raj, S. P., & Wilemon, D. (1986b). R&D and marketing managers in high-tech companies: Are they different? *IEEE Transactions on Engineering Management*, EM33(1), 25.
- Gupta, A. K., Raj, S. P., & Wilemon, D. (1985). The R&D-marketing interface in high-technology firms. *The Journal of Product Innovation Management*, 2(1), 12.
- Haddad, C. J. (1996). Operationalizing the concept of concurrent engineering: A case study from the U.S. auto industry. *IEEE Transactions on Engineering Management*, 43(2), 124.
- Hage, J., & Aiken, M. (1969). Routine technology, social structure, and organization goals. *Administrative Science Quarterly*, 14(3), 366.
- Haggbloom, T., Calantone, R. J., & Di Benedetto, C. Anthony. (1995). Do new product development managers in large or high-market-share firms perceive marketing-R D

interface principles differently? *The Journal of Product Innovation Management*, 12(4), 323.

Hair, Joseph F., Jr., Anderson, R. E., Tatham, R. L., & Black, W. C. (1988). *Multivariate data analysis* (5th ed.). New Jersey: Prentice Hall.

Hambrick, D. C. (1981). Environment, strategy, and power within top management teams. *Administrative Science Quarterly*, 26(2), 253.

Hare, a. P. (1981). Group size. *The American Behavioral Scientist (Pre-1986)*, 24(5), 695.

Harrigan, K. R. (1983). Research methodologies for contingency approaches to business strategy. *Academy of Management Review*, 8(3), 398.

Hickson, D. J., Hinings, C. R., Lee, C. A., Schneck, R. E., & Pennings, J. M. (1971). A strategic contingencies theory of interorganization power. *Administrative Science Quarterly*, 16(2), 216.

Hise, R. T., O'Neal, L., Parasuraman, A., & McNeal, J. U. (1990). Marketing/R&D interaction in new product development: Implications for new product success rates. *The Journal of Product Innovation Management*, 7(2), 142.

Hitt, M. A., Hoskisson, R. E., & Nixon, R. D. (1993). A mid-range theory of interfunctional integration, its antecedents and outcomes. *Journal of Engineering and Technology Management*, 10(1,2), 161.

Holak, S. L., Parry, M. E., & Song, X. M. (1991). The relationship of R&D/Sales to firm performance: An investigation of marketing contingencies. *The Journal of Product Innovation Management*, 8(4), 267.

- Homburg, C., Workman, J. P., Jr., & Krohmer, H. (1999). Marketing's influence within the firm. *Journal of Marketing*, 63(2), 1.
- Hong Kong Productivity Council (2004). *From OEM to ODM*, Final Report.
- Huber, G. P., & Power, D. J. (1985). Retrospective reports of strategic-level managers: Guidelines for increasing their accuracy. *Strategic Management Journal*, 6(2), 171.
- Huberman, A. M., & Miles, M. B. (1983). Drawing valid meaning from qualitative data: Some techniques of data reduction and display. *Quality & Quantity*, 17(4), 281.
- Industry Department, Hong Kong. (1996). *Hong Kong manufacturing industries*. Hong Kong: Hong Kong Government Press.
- Jaccard, J., Wan, C. K., & Turrisi, R. (1990). The detection and interpretation of interaction effects between continuous variables in multiple regression. *Multivariate Behavioral Research*, 25(4), 467.
- Jassawalla, A. R., & Sashittal, H. C. (1999). Building collaborative cross-functional new product teams. *The Academy of Management Executive*, 13(3), 50.
- Jaworski, B. J., & Kohli, A. K. (1993). Market orientation: Antecedents and consequences. *Journal of Marketing*, 57(3), 53.
- Johne, F. A., & Snelson, P. A. (1988). Success factors in product innovation: A selective review of the literature. *The Journal of Product Innovation Management*, 5(2), 114.
- Johnston, W. J., & Bonoma, T. V. (1981). The buying centre: Structure and interaction patterns. *Journal of Marketing*, 45(3)

- Jones, O., & Stevens, G. (1999). Evaluating failure in the innovation process: The micropolitics of new product development. *R & D Management*, 29(2), 167.
- Justis, R. T. (1975). Leadership effectiveness, a contingency approach. *Academy of Management Journal*, 18(1), 160.
- Kanter, R. M. (1979). Power failure in management circuits. *Harvard Business Review*, 57(4), 65.
- Kohli, A. K. (1989). Effects of supervisory behavior: The role of individual dif. *Journal of Marketing*, 53(4), 40.
- Kohli, A. K., & Jaworski, B. J. (1990). Market orientation: The construct, research propositions, and managerial implications. *Journal of Marketing*, 54(2), 1.
- Kotler, P. (1997). *Marketing management* (9th ed.). New Jersey: Prentice Hall.
- Krishnan, V. (1996). Managing the simultaneous execution of coupled phases in concurrent product development. *IEEE Transactions on Engineering Management*, 43(2), 210.
- Krohmer, H., Homburg, C., & Workman, J. P. (2002). Should marketing be cross-functional? Conceptual development and international empirical evidence. *Journal of Business Research*, 55(6), 451.
- Lawrence, P. R., & Lorsch, J. W. (1967). Differentiation and integration in complex organizations. *Administrative Science Quarterly*, 12(1), 1.
- Leenders, Mark A A M., & Wierenga, B. (2002). The effectiveness of different mechanisms for integrating marketing and R&D. *The Journal of Product Innovation Management*, 19(4), 305.

- Li, H., & Atuahene-Gima, K. (1996). R&D and marketing interaction in new product development: Review, assessment and future research. *Proceedings of Product Development Management Association Conference*, 77-91.
- Li, H., & Atuahene-Gima, K. (2001a). The impact of interaction between R&D and marketing on new product performance: An empirical analysis of Chinese high technology firms. *International Journal of Technology Management*, 21(1,2), 61.
- Li, H., & Atuahene-Gima, K. (2001b). Product innovation strategy and the performance of new technology ventures in China. *Academy of Management Journal*, 44(6), 1123.
- Li, H., & Atuahene-Gima, K. (1999). Marketing's influence and new product performance in Chinese firms. *Journal of International Marketing*, 7(1), 34.
- Lincoln, Y. S., & Guba, E. E. (1986). Research, evaluation, and policy analysis: Heuristics for disciplined inquiry. *Policy Studies Review*, 5(3), 546-565.
- Locke, E. A., & Schweiger, D. M. (1979). Participation in decision-making: One more look. In B. M. Staw (Ed.), *New directions in organizational behavior* (pp. 265-339). Greenwich: CT: JAI Press, Inc.
- March, J. G., & Simon, H. A. (1958). *Organizations*. New York: Wiley.
- Maute, M. F., & Locander, W. B. (1994). Innovation as a socio-political process: An empirical analysis of influence behavior among new product managers. *Journal of Business Research*, 30(2), 161.

- McMillan, C. J., Hickson, D. J., Hinings, C. R., & Schneck, R. E. (1973). The structure of work organizations across societies. *Academy of Management Journal*, 16(4), 555.
- McQuiston, D. H. (1989). Novelty, complexity, and importance as causal determinants. *Journal of Marketing*, 53(2), 66.
- McQuiston, D. H., & Dickson, P. R. (1991). The effect of perceived personal consequences on participation and influence in organizational buying. *Journal of Business Research*, 23(2), 159.
- Miles, M., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.
- Miller, K. I., & Monge, P. R. (1986). Participation, satisfaction, and productivity: A meta-analytic review. *Academy of Management Journal*, 29(4), 727.
- Mintzberg, H. (1983). The case for corporate social responsibility. *The Journal of Business Strategy*, 4(2), 3.
- Mintzberg, H. (1979). The manager's job: Folklore and fact-part II. *The Canadian Banker & ICB Review*, 86(3), 44.
- Moenaert, R. K., Souder, W. E., De Meyer, A., & Deschoolmeester, D. (1994). R D - marketing integration mechanisms, communication flows, and innovation success. *The Journal of Product Innovation Management*, 11(1), 31.
- Moenaert, R. K., De Meyer, A., Souder, W. E., & Deschoolmeester, D. (1995). R&D/marketing communication during the fuzzy front-end. *IEEE Transactions on Engineering Management*, 42(3), 243.

- Moenaert, R. K., & Souder, W. E. (1996). Context and antecedents of information utility at the R&D/marketing interface. *Management Science*, 42(11), 1592.
- Moenaert, R. K., & Souder, W. E. (1990). An analysis of the use of extrafunctional information by R&D and marketing personnel: Review and model. *The Journal of Product Innovation Management*, 7(3), 213.
- Moenaert, R. K., & Souder, W. E. (1990). An information transfer model for integrating marketing and R&D personnel in new product development projects. *The Journal of Product Innovation Management*, 7(2), 91.
- Moenaert, R. K., Souder, W. E., De Meyer, A., & Deschoolmeester, D. (1994). R&D - marketing integration mechanisms, communication flows, and innovation success. *The Journal of Product Innovation Management*, 11(1), 31.
- Mohr, J. (1996). The management and control of information in high technology firms. *Journal of High-Technology Management Research*, 7(Fall), 245-268.
- Mohr, J. J., Fisher, R. J., & Nevin, J. R. (1996). Collaborative communication in interfirm relationships: Moderating effects of integration and control. *Journal of Marketing*, 60(3), 103.
- Montoya-Weiss, M. M., & Calantone, R. (1994). Determinants of new product performance: A review and meta-analysis. *The Journal of Product Innovation Management*, 11(5), 397.
- Moorman, C. (1995). Organizational market information processes: Cultural antecedents and new product outcomes. *Journal of Marketing Research*, 32(3), 318.

Myers, J. L., & well, A. D. (2002). *Research design and statistical analysis*. New Jersey: Lawrence Erlbaum Associates.

Narver, J. C., & Slater, S. F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing*, 54(4), 20.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company*. New York: Oxford University Press.

Nunnally, J. C. (1978). *Psychometric theory*. New York: McGraw-Hill.

Olson, E. M., Walker, O. C., Jr, & Ruekert, R. W. (1995). Organizing for effective new product development: The moderating role of product innovativeness. *Journal of Marketing*, 59(1), 48.

Olson, E. M., Walker, O. C., Jr, Ruekert, R. W., & Bonner, J. M. (2001). Patterns of cooperation during new product development among marketing, operations and R&D: Implications for project performance. *The Journal of Product Innovation Management*, 18(4), 258.

O'Reilly, Charles A., III. (1982). Variations in decision makers' use of information sources: The impact of quality and accessibility of information. *Academy of Management Journal*, 25(4), 756.

O'Reilly, C. A., III. (1989). Corporations, culture, and commitment: Motivation and social control in organizations. *California Management Review*, 31(4), 9.

O'Reilly, C. A., III. (1980). Individuals and information overload in organizations: Is more necessarily better? *Academy of Management Journal*, 23(4), 684.

- Parry, M. E., & Song, X. M. (1993). Determinants of R&D-marketing integration in high-tech Japanese firms. *The Journal of Product Innovation Management*, 10(1), 4.
- Patchen, M. (1976). Participation in decision-making and motivation. In E. Williams (Ed.), *Participative management: Concepts, theory, and implementation* (pp. 31-41). Atlanta: Georgia State University.
- Perrow, C. (1967). A framework for the comparative analysis of organizations. *American Sociological Review*, 32(2), 194-208.
- Peter, J. P. (1979). Reliability: A review of psychometric basics and recent marketing practices. *JMR, Journal of Marketing Research*, 16(1), 6.
- Pettigrew, A. M. (1995). Longitudinal field research on change: Theory and practice. In G. P. Huber, & Van De Ven, A. H. (Eds.), *Longitudinal field research methods* (pp. 91-125). Thousand Oaks, CA: Sage.
- Pfeffer, J., & Salancik, G. R. (2003). *The external control of organizations: A resource dependence perspective*. 2nd ed. Stanford. CA: Stanford University Press.
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York: Harper & Row.
- Pfeffer, J. (1997). Pitfalls on the road to measurement: The dangerous liaison of human resources with the ideas of accounting and finance. *Human Resource Management* (1986-1998), 36(3), 357.
- Pfeffer, J. (1992). Understanding power in organizations. *California Management Review*, 34(2), 29.

- Pfeffer, J., & Ross, J. (1981). Unionization and female wage and status attainment. *Industrial Relations*, 20(2), 179-184.
- Pindyck, R. S., & Rubinfeld, D. L. (1991). *Econometric models and economic forecasts* (3rd ed.). New York: McGraw-Hill.
- Pinto, M. B., & Pinto, J. K. (1990). Project team communication and cross-functional cooperation in new program development. *The Journal of Product Innovation Management*, 7(3), 200.
- Pondy, L. R. (1967). Organizational conflict: Concepts and models. *Administrative Science Quarterly*, 12(2), 296.
- Punnett, B. J., & Shenkar, O. (1994). International management research: Toward a contingency approach. *Advances in International Comparative Management*, 9, 39.
- Reinertsen, D. G., & Smith, P. G. (1991). The strategist's role in shortening product development. *Journal of Business Strategy*, 12(4), 18.
- Reve, T., & Johansen, E. (1982). Organizational buying in the offshore oil industry. *Industrial Marketing Management*, 11(4), 275.
- Roberts, J. V., & Gebotys, R. J. (2001). Prisoners of isolation: Research on the effects of administrative segregation. *Canadian Journal of Criminology*, 43(1), 85.
- Ronchetto, J. R., Jr., Hutt, M. D., & Reingen, P. H. (1989). Embedded influence patterns in organizational buying system. *Journal of Marketing*, 53(4), 51.
- Rubenstein, A. H., Chakrabarti, A. K., O'Keefe, R. D., Souder, W. E., & Young, H. C. (1976). Factors influencing innovation success at the project level. *Research Management*, 19(3), 15-20.

- Ruekert, R. W. (1992). Developing a market orientation: An organizational strategy perspective. *International Journal of Research in Marketing*, 9(3), 225.
- Ruekert, R. W., & Walker, O. C., Jr. (1987a). Marketing's interaction with other functional units: A conceptual framework and empirical evidence. *Journal of Marketing*, 51(1), 1.
- Ruekert, R. W., & Walker, O. C., Jr. (1987b). Interactions between marketing and R&D departments in implementing different business strategies. *Strategic Management Journal*, 8(3), 233.
- Salancik, G. R., & Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. *Administrative Science Quarterly*, 23(2), 224.
- Salancik, G. R., & Pfeffer, J. (1977). Who gets power - and how they hold on to it - a strategic contingency model of power. *Organizational Dynamics*, 5(3), 2.
- Salancik, G. R., & Pfeffer, J. (1974). The bases and use of power in organizational decision- making - the case of the university. *Administrative Science Quarterly*, 19(4), 453.
- Saxberg, B. O., & Jr, J. W. S. (1968). The management of scientific manpower. *Management Science (Pre-1986)*, 14(8), B473.
- Schoonhoven, C. B. (1981). Problems with contingency theory: Testing assumptions hidden within the language of contingency "theory". *Administrative Science Quarterly*, 26(3), 349.

- Schoonhoven, C. B., Eisenhardt, K. M., & Lyman, K. (1990). Speeding product to market: Waiting time to first product I. *Administrative Science Quarterly*, 35(1), 177.
- Sethi, R., & Nicholson, C. Y. (2001). Structural and contextual correlates of charged behavior in product development teams. *Journal of Product Innovation Management*, 18(3), 154-168.
- Sethi, R., Smith, D. C., & Park, C. W. (2001). Cross-functional product development teams, creativity, and the innovativeness of new consumer products. *Journal of Marketing Research (JMR)*, 38(1), 73-85.
- Sharma, S., Durand, R. M., & Gur-Arie, O. (1981). Identification and analysis of moderator variables. *Journal of Marketing Research*, 18(3), 291.
- Shetzer, L. (1993). A social information processing model of employee participation. *Organization Science*, 4(2), 252.
- Silk, A. J., & Kalwani, M. U. (1982). Measuring influence in organizational purchase decisions. *JMR, Journal of Marketing Research*, 19(2), 165.
- Simon, H. A. (1973a). Applying information technology to organization design. *Public Administration Review*, 33(3), 268.
- Simon, H. A. (1973b). Organization man: Rational or self-actualizing? *Public Administration Review*, 33(4), 346-353.
- Smith, P. G., & Reinertsen, D. G. (1992). Shortening the product development cycle. *Research Technology Management*, 35(3), 44.

- Smith, P. G., & Reinertsen, D. G. (1998). Faster to market. *Mechanical Engineering*, 120(12), 68.
- Song, X. M., Benedetto, C. A. D., & Song, L. Z. (2000). Pioneering advantage in new service development: A multi-country study of managerial perceptions. *The Journal of Product Innovation Management*, 17(5), 378.
- Song, X. M., & Parry, M. E. (1997). A cross-national comparative study of new product development processes: Japan and the united states. *Journal of Marketing*, 61(2), 1.
- Song, X. M., & Parry, M. E. (1993). R&D-marketing integration in Japanese high-technology firms: Hypotheses and empirical evidence. *Academy of Marketing Science.Journal*, 21(2), 125.
- Song, X. M., & Parry, M. E. (1997). Teamwork barriers in Japanese high-technology firms: The sociocultural differences between R&D and marketing managers. *The Journal of Product Innovation Management*, 14(5), 356.
- Souder, W. E. (1988). Managing relations between R D and marketing in new product development projects. *The Journal of Product Innovation Management*, 5(1), 6.
- Souder, W. E. (1987). Stimulating and managing ideas. *Research Management*, 30(3), 13.
- Souder, W. E. (1981). Disharmony between R & D and marketing. *Industrial Marketing Management*, 10(1), 67.
- Souder, W. E. (1978). Effectiveness of product development methods. *Industrial Marketing Management*, 7(5), 299.

- Souder, W. E. (1978). A system for using R&D project evaluation methods. *Research Management*, 21(5), 29.
- Souder, W. E. (1977). Effectiveness of nominal and interacting group decisions processes for integrating R&D and marketing. *Management Science*, 23(6), 595.
- Souder, W. E. (1975). Achieving organizational consensus with respect to R&D project selection criteria. *Management Science (Pre-1986)*, 21(6), 669.
- Souder, W. E., & Chakrabarti, A. K. (1979). Industrial innovations: A demographical analysis. *IEEE Transactions on Engineering Management*, EM26(4), 101.
- Souder, W. E., & Moenaert, R. K. (1992). Integrating marketing and R&D project personnel within innovation projects: An information uncertainty model. *The Journal of Management Studies*, 29(4), 485.
- Souder, W. E., & Song, X. M. (1998). Analyses of U.S. and Japanese management processes associated with new product success and failure in high and low familiarity markets. *The Journal of Product Innovation Management*, 15(3), 208.
- Souder, W. E., & Bethay, D. (1993). The risk pyramid for new product development: An application to complex aerospace hardware. *Journal of Product Innovation Management*, 10(3), 181-194.
- Spekman, R. E. (1979). Influence and information: An exploratory investigation of the boundary role person's basis of power. *Academy of Management Journal*, 22(1), 104.
- Stogdill, R. M. (1974). Historical trends in leadership theory and research. *Journal of Contemporary Business*, 3(4), 1.

- Strauss, G. (1982). Workers participation in management: An international perspective. *Research in Organizational Behavior*, 4, 173.
- Sun, H. S., & Wong, C. W. (2005). *Critical Success Factors for New Product Development in the Hong Kong Toy Industry*
- Swink, M. L., Sandvig, J. C., & Mabert, V. A. (1996). Customizing concurrent engineering processes: Five case studies. *The Journal of Product Innovation Management*, 13(3), 229.
- Tannenbaum, A. S. (1976). Systems of formal participation. In G. Strauss, R. E. Miles, C. C. Snow & A. S. Tannenbaum (Eds.), *Organizational behavior, research and issues* (pp. 77-105). Belmont, CA: Wadsworth.
- Tatikonda, M. V., & Rosenthal, S. R. (2000). Successful execution of product development projects: Balancing firmness and flexibility in the innovation process. *Journal of Operations Management*, 18(4), 401.
- Thompson, J. D. (1967). *Organization in action*. New York: McGraw-Hill.
- Tracey, M. (2004). A holistic approach to new product development: New insights. *The Journal of Supply Chain Management*, 40(4), 37.
- Tuan, Chyau and Ng, Linda F.Y. (1995), Evolution of Hong Kong's electronic industry under a passive industry policy. *Managerial and Decision Economics*, Vol. 16, 509-523.
- Tushman, M. L., & Nadler, D. A. (1978). Information processing as an integrating concept in organizational design. *Academy of Management Review*, 3(3), 613.

- Valle, S., & Avella, L. (2003). Cross-functionality and leadership of the new product development teams. *European Journal of Innovation Management*, 6(1), 32.
- Venkatesh, R., Kohli, A. K., & Zaltman, G. (1995). Influence strategies in buying centers. *The Journal of Marketing*, 59(4), 71.
- Wagner III, J. A. (1994). Participation's effects on performance and satisfaction: A reconsideration of research evidence. *Academy of Management Review*, 19(2), 312-330.
- Wagner, J. A., III, & Gooding, R. Z. (1987). Effects of societal trends on participation research. *Administrative Science Quarterly*, 32(2), 241.
- Wallace, K. M. (1984). The use and value of qualitative research studies. *Industrial Marketing Management*, 13(3), 181.
- Wind, J., & Mahajan, V. (1997). Issues and opportunities in new product development: An introduction to the special issue. *JMR, Journal of Marketing Research*, 34(1), 1.
- Wind, Y., & Mahajan, V. (1981). Designing product and business portfolios. *Harvard Business Review*, 59(1), 155-165.
- Woodside, A. G., & Wilson, E. J. (2003). Case study research methods for theory building. *The Journal of Business Industrial Marketing*, 18(6/7), 493.
- Workman, J. P., Jr. (1995). Engineering's interactions with marketing groups in an engineering-driven organization. *IEEE Transactions on Engineering Management*, 42(2), 129.
- Workman, J. P., Jr. (1993). Marketing's limited role in new product development in one computer systems firm. *JMR, Journal of Marketing Research*, 30(4), 405.

- Wrong, D. H. (1968). Some problems in defining social power. *American Journal of Sociology*, (73), 673-681.
- Yin, R. K. (1994). *Case study research*. Thousand Oaks, CA: Sage.
- Yu, E. F. K., Ko, A. C. K., & Chu, P. (2003). The new breed of Chinese traders. *Strategic Management Society Conference Proceedings*,
- Yukl, G. (1989). Managerial leadership: A review of theory and research. *Journal of Management*, 15(2), 251.
- Yukl, G., & Falbe, C. M. (1990). Influence tactics and objectives in upward, downward, and lateral influence attempts. *The Journal of Applied Psychology*, 75(2), 132.
- Yukl, G., Kim, H., & Falbe, C. M. (1996). Antecedents of influence outcomes. *The Journal of Applied Psychology*, 81(3), 309.
- Yukl, G., & Tracey, J. B. (1992). Consequences of influence tactics used with subordinates, peers, and the boss. *The Journal of Applied Psychology*, 77(4), 525.
- Zikmund, W. G. (1997). *Business research methods* (5th ed.). Orlando, Fla: Harcourt Brace.
- Zirger, B. J., & Maidique, M. A. (1990). A model of new product development: An empirical test. *Management Science*, 36(7), 867.

Appendix 1: Pilot Case Study Report

Objective of the study

The key objectives of the this pilot case study were two folds: firstly, to gain a better understanding of the nature of the NPD process in the context of high technology firm in Hong Kong; secondly, through direct observation and in depth interviews with the R&D and Marketing personnel, the researcher was better informed in developing the survey instrument (questionnaire) and subsequently the study's theoretical model and its related hypotheses.

Timeframe

It was a three-month part-time internship arrangement running from May to July 1996.

Methodology

A Case study research methodology has been employed in this study. The case study research methodology has been highly recommended by many researchers (e.g, Guba 1985; Yin 2003) as an ideal tool for improving conceptual and descriptive understanding of complex phenomena.

The data of this study was generated through multiple methods including the researcher's observations and constant interactions with the OEFS project team members during the development period. With the Managing Director's consent, the researcher was able to interview concerned Marketing and R&D staff, got access to the company's documents and operations reports.

The researcher collected primary information from in depth, semi-structured interviews with Marketing and R&D project team staff and through attending weekly project development progress meetings. At the end of each interview, the researcher summarized and read out the key points to the interviewees for confirmation before closing the interview. The researcher has also taken notes during the meetings and subsequently reconciled with minutes of the meetings.

Introduction of the company

The company, APEX (the names of the company and all characters are pseudonyms) was a high technology firm employed 12 marketing staff and 45 R&D engineers. Kevin, the founder and Managing Director of the company was a marketer, entrepreneur rather than a technical person. He wanted to foster a strong customer-oriented culture in the company. The company had three business units – Accounting System, Data Management, and Electronic Filing System. The researcher had been interned in the Optical Electronic Filing System (OEFS) Unit. The Unit's business was providing customized system programming to convert client's manual filing into electronic filing system. Instead of keeping hard copies of documents in different files and stored them in big cabinets, APEX OEFS programming engineers were able to customize client's filing needs to design a filing system to store the hard copies of document into optical disks or hard disks. These optical files were retrievable and printable in internally connected personal computers. The optical files could be electronically transferred via internet lines. As filing systems varied from one company to another, therefore, it was important for Marketing personnel understand the design of the manual filing systems that the client was currently using and to assess their needs to be fulfilled by a newly design OEFS. The OEFS R&D engineers heavily relied on Marketing's inputs to work out the project specifications and they in turn developed the system to satisfy client's needs accordingly.

Key characters

The key characters that the researcher was frequently interacted and observed included: Richard, the General Manager, John, Marketing & Sales Manager, David and Bob were Sales Engineers. Steve, R&D Manager, Paul, Ben, Simon and Chris were R&D Engineers.

Key guiding questions

The interview questions were essentially related the proposed hypotheses. Several sections of the questions proposed in the questionnaire of this study were read to the interviewees to ask if they thought those were relevant questions for the understanding the enquiring issues.

Section A - questions were related to the characteristics of the new product project. Interviewees were asked to describe the product, its customer, length of development time, and project size etc.

Section B – questions were related to the performance of the new product. Questions proposed, e.g., quality, sales objective, customer satisfaction, market share target and financial target, time to market.

Section C - questions were related to the roles of Marketing personnel in the NPD project in the initial phase (i.e., idea generation, screening and concept development and testing) and implementation phase (i.e., actual product development, marketing and product launch).

Section D - questions were related to the environment for NPD, e.g., degree of formalization of NPD, degree of customer orientation in the process of NPD.

Section E – questions were related to the probing the behaviour of the Marketing personnel during the NPD process, e.g., questions related different influence tactics, powers and influence attempt that Marketing personnel exerted in the NPD process.

Section F - questions were related to interviewee's own assessment in the NPD project, sample questions e.g., “how much weight did the project team members gave to your opinions,” “to what extent did your participation influence the NPD decisions eventually reached, to what extent did the final decisions reflect your views.”

Key observations and main points noted

Perhaps due to the questions have been revised in the previous pilot test, the interviewees were generally considered the questions were related to the enquiring issues. They understood the questions and they have not proposed any major changes to the questions asked.

Initially, the researcher has made careful steps to ensure the NPD projects in study were actually new product project (i.e., belong to one of the four suggested criteria in terms of newness). That whenever they discussed the questions they were referring to the projects in study rather than their general experiences or opinions.

The key project in study

The new product development project is an optical electronic filing system (OEFS) which was being developed for Paediatric Ward for a public hospital for the purposes of

improving its filing systems in terms of storing, retrieving, transferring and managing the patients' medical records in digital form rather than hard copies.

This was a new product to the company, and it was very important to the company as the client was the largest public hospital in Hong Kong, if the project was successful APEX would have a high chance to develop the OEFS for other wards of the hospital and other 42 public hospitals. John (Marketing & Sales Manager), David and Bob (Sales Engineers) were assigned to understand client's needs and coordinate the project development between the client and R&D team. R&D team comprised Steve (R&D Manager), Paul, Ben, Simon and Chris (R&D Engineers). Both teams were reported to Richard (General Manager) on a weekly basis. The researcher attended most of the weekly meetings.

The Interactions of Project Team

Participation in the formal weekly NPD meeting enabled the researcher to monitor closely on the interactions of both the Marketing and R&D team members. Typically, the meeting lasted for about an hour. In the beginning, both the managers of R&D and Marketing reported the progress of the project to the General Manager. As the project development encountered a severe delay almost since its first scheduled delivery, most time of the meetings was spent in explaining causes of delays and discussion of remedial measures to catch up the delay.

Sampled remarks made by Marketing:

John: I thought the Head of the Paediatric Ward and I had clearly specified the project scope but his subordinates always demanded something extra... As our company strives to become customer oriented, we need to be more accommodating.... Given the huge sales potential, we need to make our customer of the first project fully satisfied, otherwise we may lose it to our competitors.

Paul: The doctors are very keen to help develop the OEFS to be more useful to assist their diagnosis. Nothing wrong with this mentality, don't we want to build a flagship product at the client's site to capitalize on the huge public hospital market? ... The R&D colleagues are rather too ready to say No to our customer. They should be having a more customer-oriented attitude.... They should not deliver product that has not been

well tested. I was very embarrassed by the numerous bugs in the programme during demonstration.

Sampled remarks made by R&D:

Steve: The R&D project team just cannot manage the moving target. It seems that Marketing never reject major changes initiated by the client... They don't have a slightest idea about the complexity of the project. The present contract price and time scheduled are ridiculously unrealistic.

Ben: I wish Marketing was more knowledgeable on technical requirements of the client. When I met the client they told me the speed required to process a medical report was far higher than what had been written down by our Marketing. Our current programme and hardware specifications are just inappropriate. The case is like the client wanted a Porsche and our Marketing told us that the client wanted a Beetle!

Simon: The complexity of the project is far greater than the Marketing expected. None of us in the entire company has any experience in such project. We have tried our very best to catch up learning but no way we can meet the present delivery schedule.... We are quite displeased with Marketing's pushy attempt. However, we do understand the project has great potential and our company has put up high hope selling more similar projects to the entire public hospital system.

Chris: We just can't say no to Marketing or the client. We have no alternative but to try our very best to catch up. It is so disappointing that when we managed to deliver on schedule, the client revised the contract and demanded additional features. Can't our Marketing ever say no?

Sampled remarks by the General Manager:

Richard: I know it's tough to the R&D team, but given the potential order size, we have to bite the bullet to develop a flagship product even though we are going to incur loss in this project.... I believe Marketing has done their best to coordinate the project, of course, it is easy to say no, but would it do any good to us? Surely, there are rooms for improvement in communication between our Marketing and client, and between

Marketing and R&D. I would suggest Steve to go with Marketing to meet the client more often.

Reflections on Observations

Having participated in the OEFS development project for three months, the researcher has collected the following reflections.

First, in a customer-oriented firm, Marketing's active participation was instrumental in influencing R&D to satisfy customer's needs even though it was perceived as too demanding and unreasonable requests by the latter party.

Second, in the case of this customer-oriented firm, Marketing appeared to be more powerful in mobilizing company's resources to achieve its business goals at the expense of R&D's resources, e.g., despite the hospital's project was vastly under estimated the man day charge and development time required, Steve (Marketing Manager) convinced Richard (GM) to support Marketing to push through the project. Eventually, the customer's additional job requests were entertained and delivered without surcharge. The hospital administrator was of course happy with the service.

Third, due to the nature of the project which was technically complicated and new to the company, R&D was under tremendous pressure in developing the system which they had no experience. The Marketing was lack of necessary technical competence to understand well customer's requirements and properly translated them to R&D. Consequently, R&D had to meet with the customer to redefine the project specifications and reset the delivery schedule. Understandably, they were not happy with Marketing's performance which was expressed in the meetings and in social occasions to me privately.

Fourth, in this case, R&D had a feeling that because of Marketing's incompetence made their life difficult. They thought they were exploited to satisfy Marketing's departmental goals rather than company's.

Fifth, the situation could be better managed if Richard was more sensitive to the potential conflicts between Marketing and R&D and directed R&D to involve in the project specification with the customer earlier. Richard should also explain clearly to R&D on the importance of the project to appeal for R&D's hearty support. After all, if the product can be installed in all public hospitals, it would be a major achievement and

honour for all participated R&D personnel. This is a very motivational thinking and thus should be promoted by the GM to yield R&D's commitment.

In summary, this pilot study offered a very valuable experience to the researcher in appreciating the dynamic interactions between Marketing and R&D personnel in a NPD process. His participation in project meetings, interviews and reviewing project related documents are very helpful to validate his proposed questions for the questionnaire and theoretical model.

Appendix 2: Survey Introductory Letter

Dear R&D Manager/New Product Project Engineer,

Invitation to Take Part in a Survey

It has been empirically evidenced that innovation is the main source of competitive advantage and corporate growth. Despite government and private sector have had repeatedly emphasized the importance of product innovation for Hong Kong firms, few empirical studies on the subject have conducted so far. Consequently, we only know a limited amount of knowledge on product innovation, especially in local context of development environment. The aim of this research is to help close this knowledge gap, specifically to explore the interaction between R&D engineer and Marketing personnel in the new product development process to see how the participation of Marketing impacts on the new product performance.

I am writing to invite you to take part in this study by completing and returning the questionnaire with the pre-paid envelope attached. My pretest shows that you will need approximately 30 minutes to complete the questionnaire.

Your responses would be invaluable contribution to my study and they are anonymous and confidential. Neither you nor your company will be identified in any way. The results of the survey will be used for academic purposes only.

If you would need any clarifications about my study, please feel free to contact me at
or email .

Thank you for your time and I appreciate very much your contribution to my PhD study and to our better understanding of new product development in Hong Kong. As a token of appreciation, a summary report will be submitted to your provided address at the completion of the study.

Very sincerely,

(PhD Candidate)
Department of Management
University of Wollongong, Australia

Appendix 3: Questionnaire Sample

Questionnaire for R&D Manager/ New Product Project Engineer Only

In this study, R&D refers to those engineering and other technical activities involving the design, modification and development of products for the company. Marketing refers to those activities involving the collection and use of market information in the new product process.

1. Does your company have different functional groups for R&D and Marketing?

1 Yes ☐

2 No ☐

Please, select the most recent new product introduced to market for a minimum of 12 months by your firm as a focus for answering the questionnaire.

2. Name of the product: _____

Section A Characteristics of the New Product Project

- 3a. Which of the following statements best describes the product?

1 ☐ New-To-The-World Product

3 ☐ Line Extension

2 ☐ New-To-The-Company Product

4 ☐ Product Modification/Improvement

- 3b. Number of potential customers for the product.

Very Few 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Many

- 3c. Degree to which each order is customized for the customer.

Not Customized 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Highly Customized

- 3d. The extent of direct sales in distributing the product.

No Extent 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ Great Extent

- 3e. The dollar value of each order.

Low 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ High

4. Please SELECT ONLY ONE of the following statements that best describes the market in which the new product was introduced.

- 1 ☐ Primary demand for product was just starting to grow, products and services were still unfamiliar to many potential customers.
- 2 ☐ Demand was growing at 10% or more annually in real terms, technology and competitive environment was still changing.
- 3 ☐ Product and services were familiar to vast majority of prospective users; technology and competition reasonably stable.
- 4 ☐ Product and services viewed as commodities, weaker competitors beginning to exit technology very stable and just to be superseded.

5. How long ago was the product introduced to market? _____ Years _____ Months

6. Considering your firm's new product operations and the nature of the product you have selected, to what extent is this product representative of new product projects of your firm?

- | | | |
|---|--|--|
| 1 <input type="checkbox"/> To no extent | 3 <input type="checkbox"/> To some extent | 5 <input type="checkbox"/> To a great extent |
| 2 <input type="checkbox"/> To a little extent | 4 <input type="checkbox"/> To a large extent | |

7. How many team members worked on this project?

- | | | |
|--------------------------------------|------------------------------------|---------------------------------------|
| 1 <input type="checkbox"/> 3 or less | 3 <input type="checkbox"/> 8 - 11 | 5 <input type="checkbox"/> 15 or more |
| 2 <input type="checkbox"/> 4 - 7 | 4 <input type="checkbox"/> 12 - 15 | |

8. How long did the team work together before the product was introduced to the market?

- | | | |
|--|---|--|
| 1 <input type="checkbox"/> 12 months or less | 3 <input type="checkbox"/> 25 - 36 months | 5 <input type="checkbox"/> 49 - 60 months |
| 2 <input type="checkbox"/> 13 - 24 months | 4 <input type="checkbox"/> 37 - 48 months | 6 <input type="checkbox"/> 61 months or more |

9. How many new products has your firm introduced to market in the past three years?

- | | | |
|--------------------------------------|------------------------------------|------------------------------------|
| 1 <input type="checkbox"/> 5 or less | 3 <input type="checkbox"/> 11 - 20 | 5 <input type="checkbox"/> Over 30 |
| 2 <input type="checkbox"/> 6 - 10 | 4 <input type="checkbox"/> 21 - 30 | |

10. Please indicate the extent to which each of these statements is an accurate description of the product.

	Strongly Disagree			Strongly Agree	
Because of the complex nature of this product, we had to involve more people than we usually do for new product projects.	1	2	3	4	5
Customer did not understand own needs.	1	2	3	4	5
Customer's needs had to be defined by project team.	1	2	3	4	5
The product was considered critical for the overall success of the firm.	1	2	3	4	5
The product was necessary to position the firm in a critical market segment.	1	2	3	4	5
Technology involved in the product represented a major change from previous new products.	1	2	3	4	5
Customer could translate their needs into project specifications.	1	2	3	4	5
The new product development was more complex than we are used to as a company.	1	2	3	4	5
We considered the product more important than others we have developed in the past.	1	2	3	4	5
The development of this product required change of company procedures.	1	2	3	4	5
The new product represented a major advance in the state-of-the-art of technology for this firm.	1	2	3	4	5
Customer lacked in-depth knowledge about the development of the new product.	1	2	3	4	5
Customer understood the product specifications.	1	2	3	4	5
As a technological development, the product had major impact on the capabilities of the firm.	1	2	3	4	5
Customer understood the technical means of developing the product.	1	2	3	4	5
We anticipated the product would make a substantial contribution to overall profitability of the firm.	1	2	3	4	5
We had to gather more information before and during the development of the new product than we usually do.	1	2	3	4	5

Section B Performance of the New Product

11. Please indicate the degree to which each of the following statements describes your assessment of the performance of the new product.

	Low				High
Overall company satisfaction with quality of the product.	1	2	3	4	5
Quality level of the product relative to competition.	1	2	3	4	5
Quality level relative to other products of the firm.	1	2	3	4	5
Sales relative to stated objective of the product.	1	2	3	4	5
Degree of customer acceptance of the product.	1	2	3	4	5
Degree of customer satisfaction of the product.	1	2	3	4	5
Market share relative to stated objective.	1	2	3	4	5
Profit margin relative to stated objective.	1	2	3	4	5

12. Please indicate the degree to which each of the following statements describes your assessment of the performance of the new product.

	Not At All On Schedule				Very Much On Schedule
To what extent did the project adhered to a specific time schedule?	1	2	3	4	5
	To No Extent				To A Great Extent
To what extent was the project done in a time efficient manner?	1	2	3	4	5
	Very Long				Very Short
The time required to bring the product to marker relative to other products commercialized by your firm in the past.	1	2	3	4	5

13. During the development process, to what extent did member(s) of the project team understand the following things about the project ?

	To No Extent				To a Great Extent
Who the key customers were.	1	2	3	4	5
Cost and risks involved in the development of the product.	1	2	3	4	5
Factors which interfere with output quality of the team.	1	2	3	4	5
The customer need being satisfied.	1	2	3	4	5
Major road blocks preventing improved operations.	1	2	3	4	5
Risks to the customer in buying and using the product.	1	2	3	4	5
Where, when and how customers will use the product.	1	2	3	4	5
The competition you faced in filling the need.	1	2	3	4	5
Factors which interfere with the operations reliability.	1	2	3	4	5

Section C The Roles of Marketing Personnel in the Product Development Project

New product development process can be broken into two main phases: the Initiation Phase involving idea generation, screening and concept development and testing and the Implementation Phase involving the actual product development, marketing and product launch.

14. Please respond to the following questions with reference to a Marketing person in your product development team whose behavior during the Initiation Phase is most familiar to you.

	Little				A Lot
To what extent did the activities of the person you are focusing on representative of the activities of Marketing personnel in your team?	1	2	3	4	5
How much weight did the team members give to her or his input?	1	2	3	4	5
How much impact did she/he have on the thinking of the other members?	1	2	3	4	5
To what extent did she/he influence the criteria used for making the final decision.	1	2	3	4	5
How much effect did her or his involvement in the new product team have on how the various options were rated?	1	2	3	4	5
To what extent did she/he influence others into adopting certain positions about the various options?	1	2	3	4	5
How much change did she/he induce in the preference of other members?	1	2	3	4	5
To what extent did her or his participation influence decision on the project?.	1	2	3	4	5

15. Please respond to the following questions with reference to a Marketing person in your product development team whose behavior during the Initiation Phase is most familiar to you.

	Strongly Disagree					Strongly Agree				
Relative to others,										
... she/he spent more time to impress her/his views on the team members.	1	2	3	4	5					
... she/he tried harder to shape the thinking of others.	1	2	3	4	5					
... she/he spent more energy to make sure her/his opinions were taken into account.	1	2	3	4	5					
... she/he exerted more effort to make sure the final product reflected her/his view.	1	2	3	4	5					
They felt she/he had the expertise to make the best decision.	1	2	3	4	5					
He/She served as a communication link among the team members.	1	2	3	4	5					
They felt she/he was knowledgeable about the company's needs with respect to the product to be produced.	1	2	3	4	5					
Participated fully in every aspect of the new product development process.	1	2	3	4	5					
She/he was responsible for obtaining information for the team members.	1	2	3	4	5					
She/he held independent discussions with the various outsiders on behalf of the team.	1	2	3	4	5					
Offered a large amount of relevant information for consideration during the development stage.	1	2	3	4	5					
They felt the new product decision should reflect her/his preferences because she/he has had more stake than others.	1	2	3	4	5					
They felt she/he knew exactly how the product would be used by customers.	1	2	3	4	5					
The total amount of communication offered by her/him to the team for consideration during the entire process was negligible.	1	2	3	4	5					
Offered a large amount of relevant information for consideration during the discussion of alternatives at the design stage.	1	2	3	4	5					
If the product did not succeed, her/his status in the organization would fall.	1	2	3	4	5					
The success or failure of the product would have greater effect on her/his reputation than any other person.	1	2	3	4	5					
The success or failure of the product would have major consequences for her/his future role in new product development.	1	2	3	4	5					
They felt she/he was competent to make an assessment of the various options.	1	2	3	4	5					
They felt they ought to comply with her/him because the decision would affect her/him more than other.	1	2	3	4	5					
If the product did not succeed, she/he would be blamed.	1	2	3	4	5					
If the product worked well, then she/he would receive most of the credit.	1	2	3	4	5					
She/he was in direct contact with the important outsiders (such as top management, suppliers, customers) for the team.	1	2	3	4	5					

Section D Environment for New Product Development

16. Considering the new product projects in your company, to what extent do you agree or disagree with the following statements?

	Strongly Disagree				Strongly Agree
R&D is slow to respond to Marketing requests for product changes or new product introductions.	1	2	3	4	5
Clear boundaries exist between functional groups on what role to play.	1	2	3	4	5
The functions performed by R&D department are generally considered to be more critical than others.	1	2	3	4	5
16. Conti..					
The R&D department tends to dominate others in the affairs of the organization.	1	2	3	4	5
Senior management often encourages R&D people to be sensitive to the activities of our competitors.	1	2	3	4	5
Senior management emphasizes that R&D should interact and collaborate with Marketing and Manufacturing during the early phases of new product development.	1	2	3	4	5
R&D is slow to respond to changes in customers' needs, complaints or taste changes.	1	2	3	4	5
Top management considers the R&D department to be more important than others.	1	2	3	4	5
Senior management constantly reminds R&D people to focus their research and development efforts on the needs of the customers.	1	2	3	4	5
R&D interacts with customers regularly to find out what products or services they will need in future or how to improve existing products.	1	2	3	4	5
Extensive corporate policies and procedures existed for the respective role of each function.	1	2	3	4	5
There are specialized tasks within the new product process for marketing and R&D.	1	2	3	4	5

	Strongly Disagree			Strongly Agree	
The R&D department is generally regarded as being more influential than others.	1	2	3	4	5
R&D meets frequently with other business functions such as Marketing to discuss market trends and developments.	1	2	3	4	5
R&D periodically reviews product development efforts to ensure that they are in line with what customers want.	1	2	3	4	5
R&D periodically gets together with other departments to plan a response to changes taking place in the business environment.	1	2	3	4	5
Our R&D plans are driven more by technological advances than by customer needs.	1	2	3	4	5
Senior management repeatedly emphasizes to R&D that this organization's survival depends on its ability to develop new products that customers want and value.	1	2	3	4	5
R&D people think their job is to design a technically state-of-the-art product; Marketing should worry about finding customers for it.	1	2	3	4	5
Marketing personnel spend time discussing customers' future needs with R&D or customer satisfaction data.	1	2	3	4	5
Senior management believes that focusing on technological breakthrough is more important than working on continuous incremental innovations.	1	2	3	4	5
Senior management in this organization believes that the job of R&D people is to design a technically state-of-the-art product; Marketing should worry about finding customers for it.	1	2	3	4	5
Marketing functions are performed only by marketing people.	1	2	3	4	5

Section E

Behavior of the Marketing Personnel during the New Product Development Project

17. Considering decisions that were critical to the outcome of the new product project, how frequent would the Marketing person engage in the following behaviors.

	Never				Always
Attempted to change the team's perspective by looking at how our decisions are affected by the market environment.	1	2	3	4	5
Requested our compliance with her or his suggestion(s) <i>without</i> indicating any positive or negative outcome of our response.	1	2	3	4	5
Provided a clear picture of the anticipated positive impact on our operations her or his recommended course of action will have.	1	2	3	4	5
Made it explicit, when making a suggestion, that it was intended for the good of our operation.	1	2	3	4	5
Requested our cooperation in implementing her or his suggestion(s) <i>without</i> mentioning rewards or punishments.	1	2	3	4	5
Emphasized critical market information that could lead the team making effective decisions.	1	2	3	4	5
Requested us to accept certain ideas without an explanation of what effect they would have on our firm.	1	2	3	4	5
Made it clear they by following her or his recommendation(s), our business would benefit.	1	2	3	4	5
Obtained the support of customers or dealers to back up her/his requests.	1	2	3	4	5
Stated her or his wishes <i>without</i> implying any consequences of compliance or non-compliance.	1	2	3	4	5
Outlined the logic and/or evidence for expecting success from the specific action(s) suggested by him or her.	1	2	3	4	5
Indicated that a better decision would be made by following her or his suggestion(s).	1	2	3	4	5
Discussed the issues without making specific statements about what she/he would like others to do.	1	2	3	4	5
Obtained the support of superior members of the organization to back up her/his point of view.	1	2	3	4	5
Obtained informal support from superiors for her/his position.	1	2	3	4	5
Got superiors in the firm to argue her/his case to other members.	1	2	3	4	5
Attempted to influence the team by presenting market information related to the various options.	1	2	3	4	5
Focused on <i>general</i> market information for making our team work more effective.	1	2	3	4	5
Obtained the support of other departmental personnel to back up her/his request.	1	2	3	4	5
Asked the team members to come to a formal conference at which she/he makes the request.	1	2	3	4	5
Made a formal appeal to higher levels to back up her/his request.	1	2	3	4	5

Section F Your Influence in the New Product Development Project

18. As an R&D/Engineering person, please state your influence in the new product development project.

	Little				A Lot
How much weight did the project team members give to your opinions?	1	2	3	4	5
To what extent did you influence the criteria used for making final decision?	1	2	3	4	5
How much effect did your involvement in the project team have on how the various options were rated?	1	2	3	4	5
To what extent did your participation influence the decisions eventually reached?	1	2	3	4	5
To what extent did final decisions reflect your views?	1	2	3	4	5

Section G Particulars of You and Your Company/Business Unit

19. Is your firm a single company or business unit of a larger firm?

- 1 ☐ Single company
2 ☐ Business unit of a larger company

20. How many new products has your firm introduced to market in the past three years?

- 1 ☐ Electronic components manufacturing
2 ☐ Consumer electronics manufacturing
3 ☐ Software development
4 ☐ Telecommunications
5 ☐ Others (Please specify) _____

21. What is the number of employees of your company/business unit?

- 1 ☐ 30 or less
2 ☐ 31 - 50
3 ☐ 51 - 100
4 ☐ 101 - 200
5 ☐ 201 - 500
6 ☐ 501 or more

22. What is the annual sales turnover (HK\$) of your company/business unit?

- 1 ☐ Under \$10m
2 ☐ \$10m - 50m
3 ☐ \$51m - 100m
4 ☐ \$101m - 150m
5 ☐ \$151m - 200m
6 ☐ \$201m or more

23. Approximately, what percentage of annual sales turnover is spent on R&D by your firm?

- 1 ☐ 1% or less
2 ☐ 1% - 1.9%
3 ☐ 2% - 2.9%
4 ☐ 3% - 3.9%
5 ☐ 4% - 4.9%
6 ☐ 5% or more

24. How many years have you been involved in new product development?

- 1 ☐ 5 or less
2 ☐ 6 - 10
3 ☐ 11 - 15
4 ☐ 16 - 20
5 ☐ 21 or more

25. How many new product projects have you been engaged in this company/business unit?

- 1 ☐ 5 or less 3 ☐ 11 - 15 5 ☐ 21 or more
2 ☐ 6 - 10 4 ☐ 16 - 20

26. What is the highest level of education you have completed?

- 1 ☐ High school 3 ☐ Master degree
2 ☐ Bachelor degree 4 ☐ Ph.D.

27. Please indicate your position in the company.

End of the questionnaire, please return it to us directly in the pre-paid envelope attached.

THANK YOU VERY MUCH FOR YOUR HELP!

Appendix 4: Survey Reminder

Dear R&D Manager/New Product Project Engineer,

Invitation to Take Part in a Survey: Reminder Letter

About two weeks ago, I send you a survey questionnaire together with the covering letter below. If you have already completed and returned the questionnaire to me, please accept my sincere thanks and ignore this letter. If not, please complete and return it to me at your earliest convenience.

Introduction on the Survey

It has been empirically evidenced that innovation is the main source of competitive advantage and corporate growth. Despite government and private sector have had repeatedly emphasized the importance of product innovation for Hong Kong firms, few empirical studies on the subject have conducted so far. Consequently, we only know a limited amount of knowledge on product innovation, especially in local context of development environment. The aim of this research is to help close this knowledge gap, specifically to explore the interaction between R&D engineer and Marketing personnel in the new product development process to see how the participation of Marketing impacts on the new product performance.

I am writing to invite you to take part in this study by completing and returning the questionnaire with the pre-paid envelope attached. My pretest shows that you will need approximately 30 minutes to complete the questionnaire.

Your responses would be invaluable contribution to my study and they are anonymous and confidential. Neither you nor your company will be identified in any way. The results of the survey will be used for academic purposes only.

If you would need any clarifications about my study, please feel free to contact me at
or email .

Thank you for your time and I appreciate very much your contribution to my PhD study and to our better understanding of new product development in Hong Kong. As a token of appreciation, a summary report will be submitted to your provided address at the completion of the study.

Very sincerely,

(PhD Candidate)
Department of Management
University of Wollongong, Australia

Appendix 5: Scatterplot Figures

In connection with the analyses discussed in Chapter 5, the partial regression plots for Marketing participation, expert power, departmental power, influence attempt, customer orientation, formalisation of NPD, complexity of NP and importance of NP are shown in Figures 5.3.1-5.3.8.

The title of the figures is Scatterplot of ZRESID against ZPRED.

Where **ZRESID** means the standardised differences between the observed data and the values that the regression model predicts.

ZPRED means the standardised predicted value of the independent variable based on the regression model

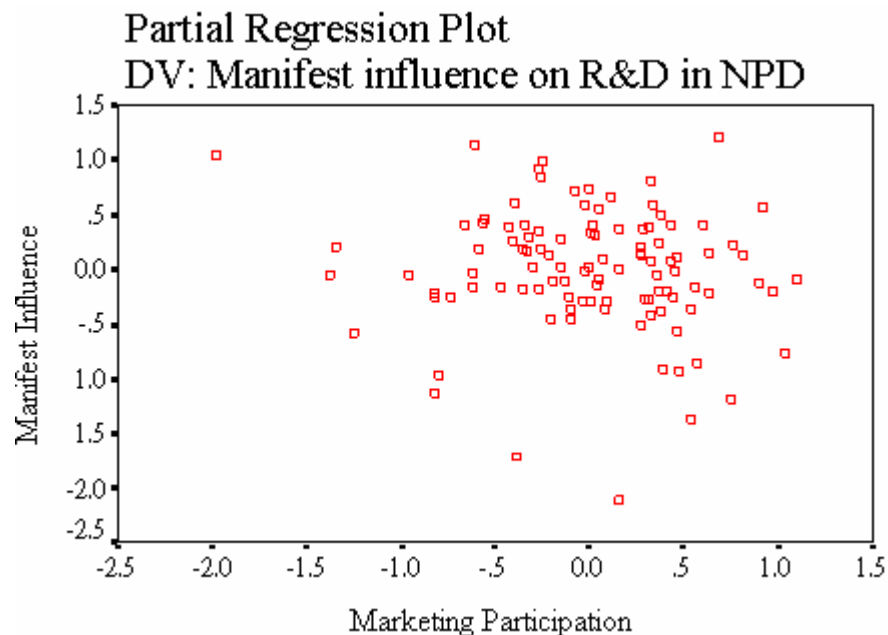


Figure 5.3.1 Scatterplot of ZRESID against ZPRED (Marketing Participation on Manifest Influence)

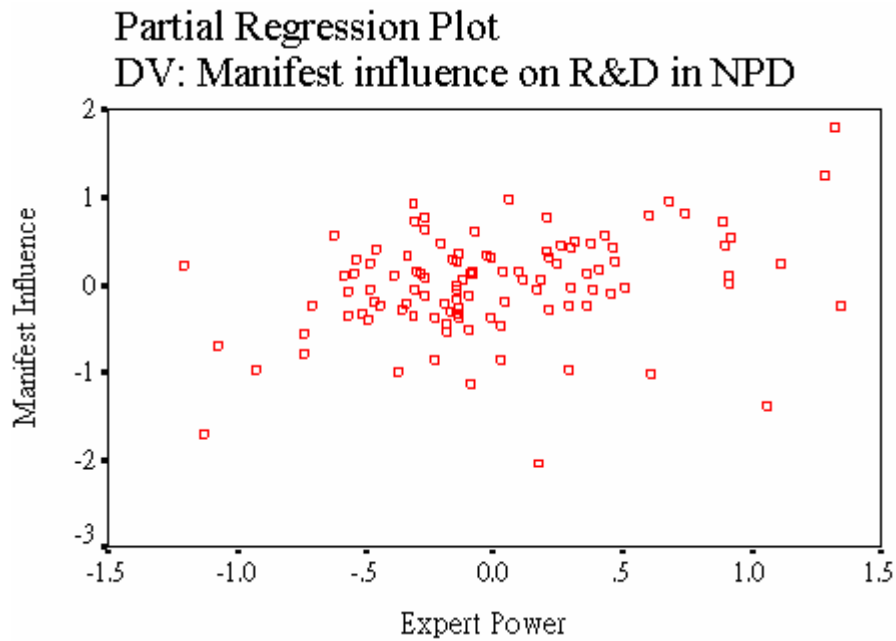


Figure 5.3.2 Scatterplot of ZRESID against ZPRED (Expert Power on Manifest Influence)

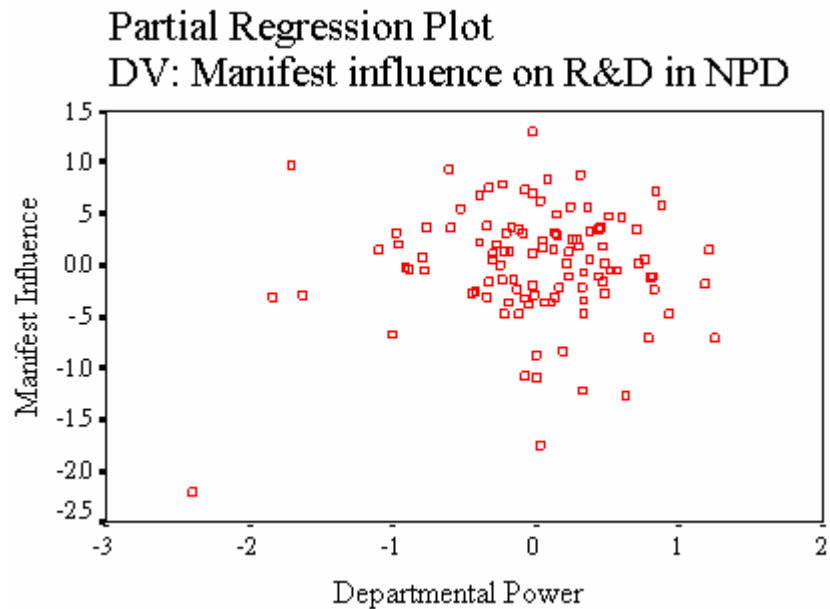


Figure 5.3.3 Scatterplot of ZRESID against ZPRED (Departmental Power on Manifest Influence)

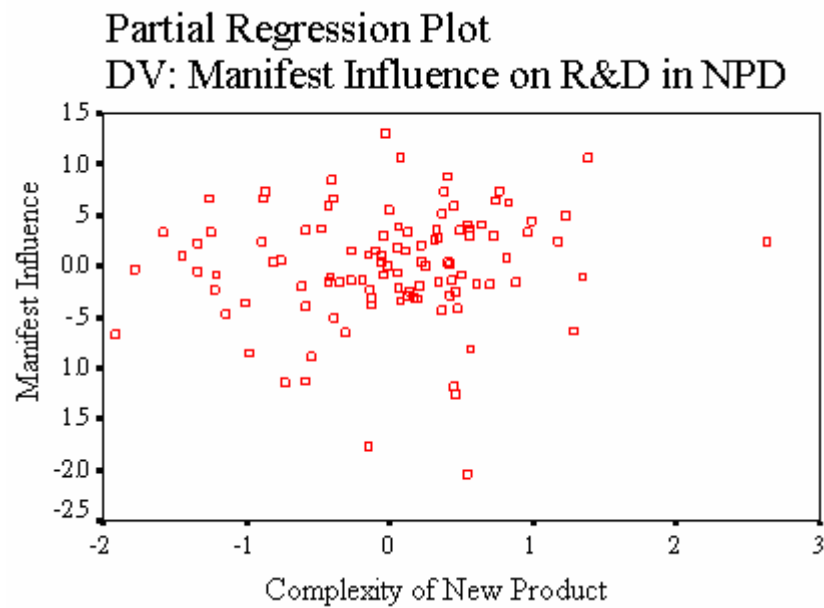


Figure 5.3.4 Scatterplot of ZRESID against ZPRED (Complexity of New Product on Manifest Influence)

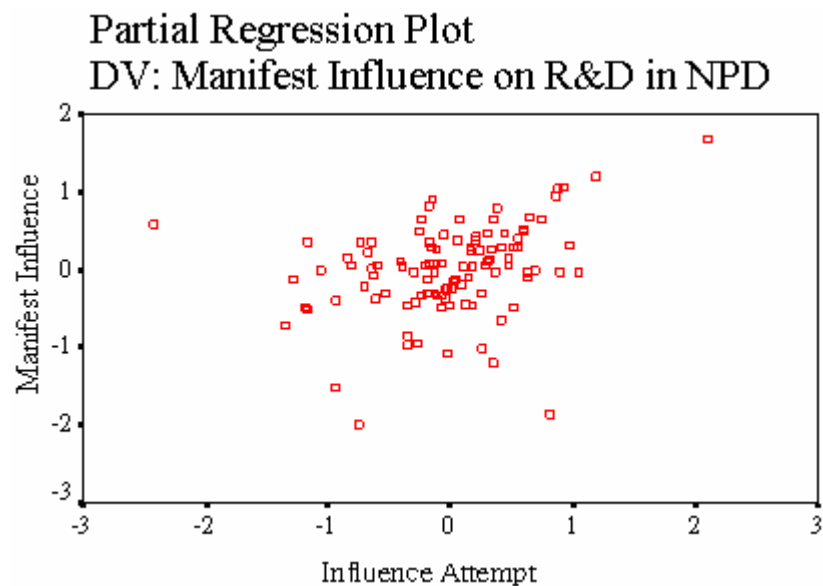


Figure 5.3.5 Scatterplot of ZRESID against ZPRED (Influence Attempts on Manifest Influence)

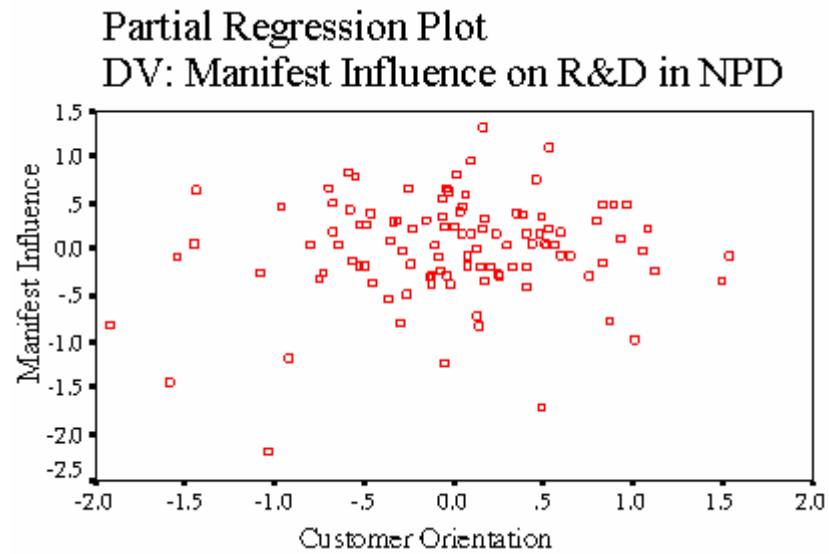


Figure 5.3.6 Scatterplot of ZRESID against ZPRED (Customer Orientation on Manifest Influence)

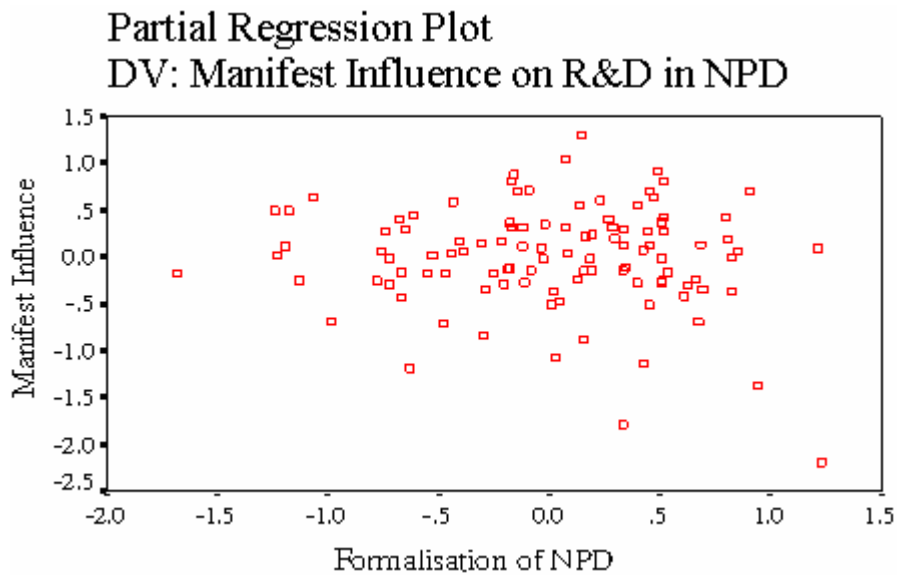


Figure 5.3.7 Scatterplot of ZRESID against ZPRED (Formalisation of NPD on Manifest Influence)

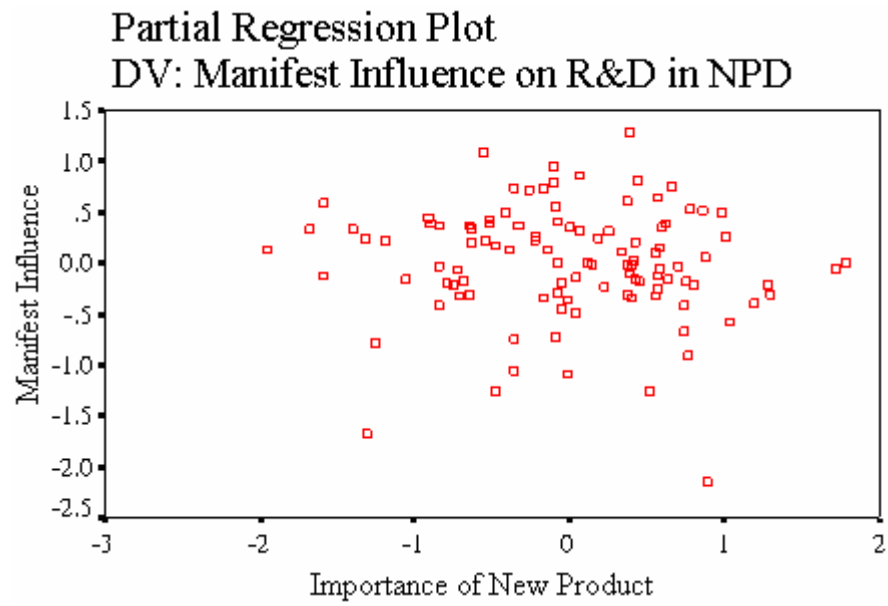


Figure 5.3.8 Scatterplot of ZRESID against ZPRED (Importance of new product on Manifest Influence)