CROSS-FUNCTIONAL NEW PRODUCT DEVELOPMENT (NPD) TEAMS: CHARACTERISTICS, DYNAMICS AND NPD PERFORMANCE

by

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Thesis submitted in the fulfillment of the requirements
for the degree of
Doctor of Philosophy

June 2008

ACKNOWLEDGEMENTS

I begin in the name of Allah, the most merciful. Many thanks to Allah for providing me with strength and emotional support throughout my study. This research is not the product of a single individual. It was made possible with the help of many organizations and people. I wish to express my gratitude to all those who helped me in the completion of this study. I am very indebted to my supervisor, Professor Muhamad Jantan for whom I bear high respect and appreciation for his indispensable constructive ideas, sharp critic, insight, guidance and patience. For me these could not have been duplicated. My special appreciation to my dearest parents, Hj. Mat and Hjh Chik for their prayers, endless love, comfort and encouragement throughout my life can never be repaid. Additional thanks to my friends and fellow doctoral students whose humor, enthusiasm and encouragement have been a continual source of motivation. Last but not least, I express my deep appreciation and gratitude to my husband, Mohamad Azuan and my children Afiqah Insyirah, Aqilah Mursyidah and Adibah Zakiyyah for their patience and courageous sacrifice and for being a source love and encouragement to me in meeting the challenges I faced throughout my study. I dedicated this thesis to my eldest sister, Norizan, the real scholar of our family.

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ABSTRAK

Kepentingan pembangunan produk baru dan innovasi meningkat dengan begitu mendadak beberapa dekad lalu dan hari ini ia merupakan penggerak utama persaingan dalam kebanyakan industri di seluruh dunia termasuk Malaysia. Beberapa faktor penyumbang kepada perkembangan ini telah dikenalpasti. Antaranya termasuklah peningkatan dalam tahap persaingan, keperluan pasaran yang sentiasa berubah, kadar keusangan teknial yang semakin tinggi, dan pusingan hayat produk yang semakin pendek. Kajian ini cuba untuk melihat perhubungan di antara cirian, dinamik dan kesan faktor penyederhana iaitu sokongan pengurusan atasan terhadap prestasi pembangunan produk baru. Sebanyak 521 ahli pasukan silang-fungsian dari pelbagai industri dalam sektor pengilangan di Semenanjung Malaysia mengambil bahagian dalam kajian ini mengunakan pendekatan soalselidik. Jumlah ini meliputi 53 syarikat MultiNasional dan 120 pasukan. Hasil kajian menunjukkan terdapat perbezaan impak di antara pembolehubah tak bersandar ke atas pembolehubah bersandar yang berbeza (hasil tugas dan psikososial). Di dapati nilai R^2 untuk psikososial adalah lebih besar (R^2=.60) berbanding nilai R^2 untuk hasil tugas (R^2=.32). Untuk perhubungan langsung di antara pembolehubah tak bersanadar dan bersandar, didapati hanya koordinasi menunjukkan perhubungan langsung dengan kedua-dua hasil tugas dan psikososial. Kepercayaan afektif berhubung langsung dengan psikososial sahaja, tidak ke atas hasil tugas. Untuk perhubungan tidak langsung di antara

pembolehubah tak bersandar dengan bersandar, apabila faktor penyederhana dimasukkan dalam perhubungan tersebut iaitu sokongan pengurusan atasan, didapati sokongan dan pengurusan atasan bertindak sebagai penyederhana kepada perhubungan di antara kepelbagaian fungsian (*squared term),* koordinasi dengan hasil tugas; kepercayaan afektif, komunikasi langsung, dan perhatian secara individu dengan hasil psikososial. Sokongan pengurusan atasan juga bertindak sebagai pembolehubah tak bersandar kepada hasil psikososial, misalnya, sebagai penyederhana quasi. Kajian ini juga mendapati prestasi sentiasa tinggi apabila sokongan pengurusan atasan adalah tinggi tidak kira sama ada sokongan pengurusan atasan bertindak sebagai penyederhana quasi atau penyederhana asli. Implikasi teori dan praktikal serta cadangan kajian selanjutnya dibincangkan.

CROSS-FUNCTIONAL NEW PRODUCT DEVELOPMENT (NPD) TEAMS: CHARACTERISTICS, DYNAMICS AND NPD PERFORMANCE

ABSTRACT

The importance of new product development and innovation has grown dramatically over the last few decades, and is now the dominant driver of competition in many industries all over the world including Malaysia. A multitude of factors contribute to an increase feeling of urgency to improve the processes for developing new products. Examples of such factors are increased levels of competition, rapidly changing market requirements, higher rate of technical obsolescence, and shorter product life-cycles. This study examined the relationship between NPD team characteristics, dynamics and the moderating effect of top management support on NPD performance. A total of 521 team members in various industries within the manufacturing companies in Peninsular Malaysia participated in this study by completing the survey questionnaire. This figure comprised of 53 participating companies and 120 teams. The study results found the difference in impact of independent variables on different dependent variables (task-outcomes and psychosocial-outcomes). The R^2 value is higher for psychosocial-outcomes (R^2=.60) as opposed to task-outcomes (R^2=.32). Regarding the direct relations between independent variables and dependent variables, only coordination was found to directly relate to both task and psychosocial outcomes. Affective trust has direct relations with psychosocial-outcomes only but not on task-outcomes. Regarding the indirect relations between the independent and the dependent variables when moderating variable was incorporated in the relationships, it was found that top management support

and recognition moderated the relations between functional diversity (squared term), coordination with task-outcomes; affective trust, directness of communication, and individualized consideration with psychosocial-outcomes. It was also found that top management support act as an independent for psychosocial-outcomes, i.e. quasi moderator but not for task-outcomes. It was further noted that irrespective of whether top management support and recognition acts as pure or quasi moderator, when top management support is high, performance is always high. Theoretical and practical implications of the study as well as suggestions for future research were discussed.

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter introduces innovation in general and its important contribution to the successful development of new product. It also discusses some types or dimensions of innovation found in organizational setting. Last but not least, it discusses the Malaysian experience in managing R&D and innovation at the national level through mechanism such as The Malaysian National Innovation System (NIS) and firm level innovation. Finally, the knowledge gap and the need for this research are established.

1.1 Definitions of Innovation

There have been many and varied definitions of innovation found in the literature. One of the most commonly cited definitions is that given by Zaltman et al. (1973) which says that an innovation is “an idea, practice, or material artifact perceived to be new by the relevant adoption unit”. A similar definition to this has been adopted by other researchers (Anon, 1991; Daft, 1982; Damanpour & Evan, 1984). Freeman (1982) and Rickards (1985) point out that, however, innovation is often confused with invention. An invention is an idea, a sketch or model for a new or improved device, product, process or system whereas an innovation in the economic sense is accomplished only with the first commercial transaction involving the new product, process,

system or device. The OECD (1981, pp. 15-16) expanded this assertion by proposing that innovation consists of all those scientific, technical, commercial and financial steps necessary for the successful development and marketing of new or improved manufactured product, the commercial use of new or improved processes or equipment or the introduction of a new approach to a social service. R&D is only one of these steps.

Nystrom (1990) broadly defines innovation as “the creation of the future”. It is the process of bringing new ideas (new products, processes, services, management techniques, etc.) into use in order for the organization to continue its existence, to be competitive, to grow, and to be in line with the ever changing future. In order to achieve this broad objective, every organization needs to be sensitive to its environment. Nystrom’s definition of innovation is quite similar to the one given by Schumpeter (1950), who has been widely recognized as one of the earliest and most significant contributors to the theory of innovation (Rickards, 1985). Schumpeter was also regarded as the first person to recognize the importance of innovation in competition amongst firms in the evolution of industrial organizations, and in the process of economic growth. His concept of innovation encompasses not just new products or processes, but also new forms of organization, new markets, and new sources of raw materials (Nystrom, 1990). Innovation therefore includes everything that leads to sustained growth and future profitability (Wood, 1988).

1.2 Importance of Innovation to Business Performance

The long-term survival of a business hinges upon its ability to successfully introduce superior products into the marketplace, 'innovate or die'. The importance of new product development and innovation has grown dramatically over the last few decades, and is now the dominant driver of competition in many industries. In industries such as automobiles, biotechnology, consumer and industrial electronics, computer software, and pharmaceuticals, companies often depend on products introduced within the last five years for more than 50 percent of their annual sales. However, new product failure rates are still high. Many R&D projects never result in a commercial product, and between 33 percent and 60 percent of all new products that reach the market place fail to generate an economic return (Schilling & Hill, 1998).

Recently, Cooper (2007) revealed that NPD productivity is actually in decline. The most recent figures show that overall sales from new product- a generally applied measure of NPD performance has fallen from 32.6% of total company sales in the mid 1990s to 28 percent in 2004. With R&D investment remaining relatively constant at about 2.8 percent of sales, the result is a 14 percent drop in R&D output per spending in less than a decade. He identified that one of the most effective ways for all companies to improve their NPD productivity would be to focus on picking the better mix of projects through portfolio management.

A multitude of factors contribute to an increase feeling of urgency to improve the processes for developing new products. Examples of such factors are: significant pressures from increased levels of competition, rapidly changing market requirements, higher rates of technical obsolescence, shorter product life-cycles and the heightened importance of meeting the needs of increasingly sophisticated customers (Gordon et al., 1995 & McGrath et al., 1992). Added to this are visibly decreasing product development lead times, more frequent development of new technologies and increasing product development costs and complexity. The ways in which companies meet these challenges depend largely on the nature of the business they are in, the dynamic forces of the market in which they operate, and the resources and skills that can be applied to ensure their business objectives are met (Shepherd & Ahmed, 2000).

During the 1970s and early 1980s, one of the major features of an industrial economy was the increasing emphasis placed on internal quality of execution, rather than price, as a major competitive tool. During this time “quality” was viewed as a key market differentiator, resulting in many organizations defining and improving processes, adopting and implementing total quality management systems, and attaining quality standard accreditation. Customer requirements and sophistication were relatively low, allowing organizations to flourish using an inwardly focused strategy (where quality accreditation appeared to assume paramount importance and many industrial products were released via “technology push” strategies (Shepherd & Ahmed, 2000).

During the early 1990s, an apparent shift from the “technology push” environment of previous years to that of “market pull” was observed. Customer needs became increasingly more sophisticated and complex. This forced companies to focus more on product quality (effective identification, validation, communication and delivery of customer needs and wants) than on the internal company execution efficiencies (Shepherd & Ahmed, 2000).

Today, markets are experiencing the internationalization of technology-driven competition, globalization of manufacturing due to faster transitional flows of materials and money, compression of product life cycles, need for greater integration of technologies and increasingly sophisticated customers (Shepherd & Ahmed, 2000).

More applied researchers have examined numerous factors that influence the success/ failure rate of new products including (but not limited to) pre-development activities, resource allocation, new idea generation and screening, the presence or absence of team leaders and champions, interfunctional coordination, the R&D and marketing interface, marketing and manufacturing interface, prototype design, test marketing activities, and strategic partnering (Barczak & Wilemon, 1992; Cooper & Kleinschmidt, 1988; Coughland & Wood, 1991; Gordon et al., 1995; Hausman et al., 2002; Rochford, 1991; Saghafi et al., 1990; Slowenski et al., 1993; Vessey, 1992). Among these factors, the creation of cross-functional teams around key value-adding processes is an increasingly common organizational response to the

above mentioned pressures (Leenders et al., 2003; Wheelwright & Clark, 1993). Competition is increasingly fought on the basis of intangible organizational competencies (Clark & Wheelwright, 1993) - it is not so much what firms do as how they do it which determines their ability to compete. Such competencies are embedded within the structure, processes and culture of the organization. Since product development is typically executed in a project-management approach, the organizational nucleus is the product development team or the cross-functional team.

A 1995 survey of US firms found that over 84% of more innovative product development projects used cross-functional teams (Griffin, 1997). This popularity reflects numerous anecdotal reports of their effectiveness (Parker, 1994). A large benchmarking study of 103 new product projects in 21 divisions of major chemical companies found ‘true’ cross-functional teams to be the top driver of project timeliness, and an important driver of profitability (Cooper, 1995). In another benchmarking study of the 244 firms responsible for 80% of R&D spending in Western Europe, Japan and North America, ‘multifunctional teams’ had the greatest impact on time to market for new products (Roberts, 1995).

Cross-functional new product teams are thought to facilitate the product development and marketing process because they solve an information-processing problem. That is, they bring together people from different disciplines and functions that have pertinent expertise about the proposed innovation problem (Galbraith, 1977; Kanter, 1988). The team

consists of a “core” team of people whose primary focus is the specific product under consideration and an ‘extended’ team that supports several products but does not need to be as directly involved in this development. Core teams vary in size but typically have 4 to 10 members. The key functions of marketing; Design Engineering/Development, Manufacturing, Procurement and/or Materials, Quality, and service or customer support should be represented on the core team. The project team leader can be from any function. This person must have the support of the team and management, knowledge of the business and market, technical knowledge of the products, leadership, and management skills, and the commitment and ownership for success of the project. Team leaders typically are from Design or Development Engineering, Marketing, Product Managers and manufacturing Engineering Managers are the next most frequent team leaders.

Such teams have high absorptive capacity, as their members’ differing expertise allows them to tap a broad array of external information and new knowledge (Cohen & Levinthal, 1991; Dahlin & Weingart, 1996). The combination of individuals with different expertise can also facilitate creativity (Woodman, Sawyer, & Griffin, 1993). And including marketing and manufacturing representatives in new product teams can facilitate product transfer, or the handoff of the newly developed innovation to manufacturing for its production and to marketing and sales for its distribution (Griffin, 1997). A team’s members can typically serve as liaisons between the team and their functional areas, ensuring that critical functional issues (for instance, the capacity to manufacture the specific product) are addressed during the entire

design process, rather than later, when redesign is likely to be costly. Thus speed to market is likely to be increased.

1.3 Types of Innovation in Organization

Regardless of the definition used to identify organizational behaviors that constitute innovation, it is widely agreed that innovation comes in many forms. Cooper (1998) has presented a taxonomy of innovation from multiple dimensions. These include the combination of radical against incremental innovations, technological vs administrative innovations, and product vs process innovations.

1.3.1 Radical vs Incremental Innovation

The crucial factor in traditional distinctions between radical and incremental innovation is the degree of strategic and structural change that the firm must undergo to accommodate the innovation in question. Incremental changes enhance and extend the underlying technology and thus reinforce the established technical order. Radical innovations, on the other hand represent advances so significant that revolutionary alteration of the organization and its support networks must occur to accommodate and implement change. As innovations become more radical or competence destroying, they entail clear, risky departures from existing practices (Cooper, 1998).

1.3.2 Technological vs Administrative Innovation

The distinction between technological and administrative innovation involves the proximity of the change in relation to the organization's operating core. Technological innovation involves the adoption of an idea that directly influences the basic output processes, while administrative innovations include changes that affect the policies, allocation of resources, and other factors associated with the social structure of the organization (Cooper, 1998).

1.3.3 Product vs Process Innovation

Product innovation reflects change in the end product or service offered by the organization, while process innovation represents changes in the way firms produce end products or services (Cooper, 1998).

This research highlights only on product innovation as the main organizational capabilities that strengthen the organizations' position against competitors and which allow a long-term competitive position to be maintained.

1.4 R&D and Innovation in Malaysia

1.4.1 Historical Development

Malaysian R&D activities had their beginnings in the agricultural sector where many of the outputs have been very successfully disseminated to the farmers and planters. Since the colonial days, various government policies were enacted to facilitate cooperative public-private sector technology development in export-oriented commercial production. In rubber production,

the colonial government undertook research in new breeding and planting techniques to increase yields. The rubber planters benefited tremendously from subsequent governmental efforts on related extension activities. After independence, the Malaysian government continued these efforts, expanding into other agricultural exports such as palm oil and cocoa. These efforts continued to seek improved yields and new uses for agricultural produce.

Some of the early research activities recorded dated back to the formation of The Forest Research Institute, under the Forestry Department in 1879. In 1985, The Malaysian Forestry and Development Board Act were passed which enabled the Institute to become a statutory body called the Forest Research Institute Malaysia (FRIM). Other early research institutions are the Rubber Research Institute (established in 1925) and Institute of Medical Research established in 1901 (Hamzah, 1997).

As the country's economy diversified and transformed itself from agriculture-based to manufacturing-based, Science and Technology (S&T) development also evolved accordingly. In order to support and stimulate the Malaysian industrialization process, the government, in the early 1980s established the Standards and Industrial Research Institute of Malaysia (SIRIM) and the National Productivity Centre (NPC). SIRIM and NPC were given the responsibility to test and validate products for quality maintenance and to help improve productivity (Rasiah, 1999). The role of SIRIM was later expanded towards enhancing Malaysia's international competitiveness

through partnerships in industrial technology and quality. In achieving this, industrial research became a major component of SIRIM's establishment.

The major breakthrough in the Information and Communication Technology has resulted in the rapid global growth of the industry. In response to such development, the government moved to mobilize the Malaysian Institute of Microelectronics Systems (MIMOS), established in 1985, into a corporatised body in 1996. Later, the Multimedia Development Corporation (MDC) was established to implement specialized fields under the ICT scope, i.e. multimedia content development.

As an effort to spur and nurture the STI based industries and technopreneurs, technology incubation was given emphasis. In this regard, technology incubator programmes were implemented by SIRIM Berhad, Technology Park Malaysia (TPM), Malaysian Technology Development Corporation (MTDC), Multimedia Development Corporation (MDC) and Kulim Hi-Tech Park. Several institutions of higher education such as Universiti Sains Malaysia (USM) and Universiti Teknologi Malaysia (UTM) also established incubator programmes to commercialise their R&D output.

In an increasingly competitive global economy, the ability to leverage on STI will become strategically more important in national development. Rapid advancements and the pervasive role of STI in the global economy require that the nation build upon and enhance its capability and capacity in STI in order to tap into potential wealth creating opportunities. Towards this

end, the target will be to increase national R&D expenditure to 1.5 per cent of GDP by 2010 with private sector expenditure of more than 70 per cent (Ninth Malaysia Plan 2006-2010).

1.4.2 The Malaysian National Innovation System (NIS)

The NIS holds as its ultimate objective knowledge advancement, technology development, and its application thereof. The central innovation process starts off with concept development and through the processes of proof of concept, laboratory and industrial prototyping, as well as production of the final product, translates research ideas into products, processes, services, systems and applications that promise to improve the nation's competitive positioning in the K-based economy. The NIS also effectively complements and enhances the Industrial Master Plan II, to encompass areas outside the domain of manufacturing. The NIS is especially instrumental in enhancing the depth and breadth of the manufacturing sector in its efforts to move out of the heavy concentration on assembly and testing activities, and the inclusion of a higher component of knowledge in the traditional areas of economic activities.

The innovation system for Malaysia therefore aims to aid the innovator community through successful R&D and commercialization efforts. It holds as its ultimate aim the creation of more innovators and innovative activities and practices that will enhance Malaysia's competitive ability. On both the national and firm levels, five areas are of prime importance: Strategy; Process; Resources; Organization; and learning.

The success of the NIS rests to a large extent on an effective and comprehensive support mechanism ranging from an adequate and innovative financing system, to the role of monitoring agencies and information disseminators. The importance of the other agencies notwithstanding, a strong and responsive funding mechanism is of great significance. The enhancement of R&D grants, i.e. IRPA, IGS, MTDC, MGS, and the proposed establishment of the Malaysian Technology Guarantee Corporation (MATEG) are steps towards improving funding capability for innovation in Malaysia.

The support players in the innovation process consists of the government mechanism i.e. inclusive of the Prime Minister's Department, MOSTI and MIDA, the custodian of grants schemes, technology parks and incubators among others. These set the stage for the direct players, the inventors, universities, research institutions and business entrepreneurs to push the innovation agenda for Malaysia. The various components of the NIS are well established in Malaysia. As a result of the robust implementation of past policies, Malaysia has successfully developed a sound and comprehensive technology management system comprising various agencies and institutions. They hold the common objective of realizing the effective translation of bodies of knowledge and technological know-how into successful commercial endeavors.

1.4.3 Research on R&D-Innovation in Malaysia

During the Ninth Plan Period, R&D was given due priority as reflected by the increase in national gross expenditure on R&D (GERD) from RM1.7 billion in 2000 to RM4.3 billion in 2005, at an average annual rate of 20.8 per cent. The ratio of GERD to GDP, a measure of research intensity, increase from 0.5 per cent in 2000 to 0.9 per cent in 2005.

From an economic perspective, overall R&D efforts were concentrated in manufacturing, information and communications technology (ICT) services, plant production and primary products, followed by energy resources. For the public sector, there was a shift in focus of R&D activities from agricultural sciences towards ICT. Meanwhile, the private sector, continued to focus on the manufacturing industries, particularly in electronic equipment and components, transport equipment as well as petroleum products and refining. It should also be noted that during the Ninth Plan period, besides manufacturing sectors, the agriculture sector will be revitalized to become the third engine of growth. The emphasis will be on large-scale commercial farming, the wider application of modern technology, production of high quality and value-added products, unlocking the potential in biotechnology, increased convergence with information and communication technology (ICT), and participation of entrepreneurial farmers and skilled workforce. Agricultural research and development (R&D) continued to be emphasized to further improve competitiveness of the sector. During the Plan period, of the total 535 R&D projects undertaken by the agricultural research agencies, 90 were commercialized while another 30 were ready to be commercialized.

Much technological innovation is taking place in the Malaysian industry. This is demonstrated by the products being produced, their high quality and market acceptance. There has been a number of useful innovation surveys carried out locally by various agencies and interest groups, especially the Ministry of Science, Technology and the Innovation (MOSTI) and the Ministry of International Trade and Industry (MITI).

The first National Survey of innovation activity was conducted in 1994-1996 by Malaysian Science & Technology Information Centre (MASTIC). The definitions and methods of survey were based on the internationally agreed guidelines as put forward by the Organization of Economic Co-Operation and Development (OECD) to measure innovative activities and attitudes within Malaysian Industry. The report is intended to provide a benchmark for future surveys of industrial innovation, and a base on which more detailed industry studies on the invention and adoption of technology by Malaysian industry can be grounded.

The National Survey of Innovation 2000-2001(NSI-3), which is the third survey on innovation in the manufacturing sector was carried out by Malaysian Science and Technology Information Centre (MASTIC). The Fourth National Survey of Innovation (NSI-4) use the reference period of three-year between 2002-2004 which is longer than the NSI-3. In the Third Outline Perspective Plan of Malaysia (OPP3), the manufacturing sector continues to be targeted as one of the main engine for economic growth in the country. In

line with the new knowledge-based economy, the manufacturing sector is also expected to move out of “low-technology” production into “high technology” production in order to remain competitive. Without innovation in today’s complex, knowledge-intensive, globalized environment, the products produced by the manufacturing sector in Malaysia can be easily replaced by cheaper and better product from other countries, not only in the home market but also in the export market. Thus, innovation becomes the key for the future of the manufacturing sector in this country. Table 1.1 shows the summary of the main findings of the NSI-4 survey.

Table 1.1. Characteristics of Innovation in Malaysian Industry

Innovation Characteristic	Description
Innovation by Industry Sector	The distribution of innovating firms across the manufacturing sector is fairy even (an average of 4.5% of innovation). Example of industries: Radio, tv and communication equipment and apparatus; food products and beverages; and chemicals and chemical products.
Innovation by Company Size (employment size), Age (establishment) and Annual Turnover	Size: 50% (50-247 employees), 17% (250 and more employees) and 33% (less than 50 employees). Age: 68% (between 1990 and 1999), 15% (between 1980 and 1989, 2.6% (before 1997). Majority of the innovating firms were established about 5-15 years ago. Annual Turnover: 54% (RM <5 million), 17% (RM5 million-RM10 million) and 28% (>RM10 million)
Innovation by Ownership	83% are wholly locally owned, 3% are wholly foreign owned, 7% are majority locally owned, and 4% are majority foreign owned.
Types of innovation	Product and process innovation (77%), product innovation (11%), process innovation (0.06%).
Location of Innovative Companies in Malaysia	Innovative companies were mostly located in the states of Selangor, Pulau Pinang, Johor and Kedah.

Source: MASTIC National Survey of Innovation 2002-2004

1.4.4 International Comparison of R&D Expenditures

A country's R&D expenditure per capita is a measurement of a country's GERD over its total population. There is also ageneralized relationship between a country's R&D expenditure per capita and its GDP per capita. The general trend is that the higher a country's R&D expenditure, the higher its GDP per capita. Table 1.2 shows that the EU15, the United States, Japan, Australia, Singapore, Korea, and Taiwan surpass many other countries in terms of GDP per capita. Chile's GDP per capita surpasses Malaysia by about RM4, 266.1, while Singapore's GDPper capita is higher than Malaysia by RM75, 657.6. Malaysia's GDP per capita at RM17, 549.1 is somewhat the same as that of South Africa and Turkey, but higher than Argentina, Brazil, Thailand, China, Indonesia, Jordan and India.

Table 1.2. International Comparison on GDP per Capita and R&D Expenditure per Capita

Country	GDP per Capita (RM)	Expenditure per Capita (RM)
EU 15	1,951,994.2	29,414.3
United States	1,46,031.6	3,617.9
Japan	135,268.3	3,604.5
Australia	113,512.3	1,154.0
Singapore	93,206.7	1,737.9
Korea	52,188.5	1,235.8
Taiwan	49,798.3	1,145.2
Mexico	23,735.5	90.3
Chile	21,815.2	118.4
Malaysia (2004)	17,549.1	111.1
South Africa	16,923.8	72.5
Turkey	15,503.0	65.1
Argentina	14,182.1	38.9
Brazil	12,321.0	135.1
Thailand	9,283.3	21.5
Jordan	7,744.1	23.7
China	4,695.3	53.3
Indonesia	4,406.7	1.1
India	2,138.6	13.3

Source: IMD World Competitiveness Yearbook

1.5 Research Problem

Nowadays, 80% of companies with more than 100 employees use a team based approach (Cohen & Bailey, 1997; Kratzer et al., 2004) to support innovation activities. The same hold when solely looking at companies executing new product development (NPD). Teams are also more diverse in terms of their purpose, structure and function. One example of a variation in team structure is the cross-functional new product development team. Cross-functional team is a small group of key players from each affected functional area who have been carefully chosen for complementary skills and who are committed to a common goal and are mutually accountable for the team's success. Many researchers have found consensus that effective implementation of cross-functional teams is critical to new product development success (e.g., Ancona & Caldwell, 1992a, b; Boyle, Uma & Vinod, 2006; Cooper & Kleinschmidt, 1995b; Jassawalla & Sashittal, 2000; Keller, 2001; Larson & Gobeli, 1989; Sethi 2000a, b; Sethi et al., 2001; Valle & Avella, 2003). The effective use of cross-functional NPD teams, however, require that they be supported by various organizational groups, including senior managers, functional managers, and team members. Organizational support in this study is captured by the extent that top management support exists for cross-functional NPD team.

Despite the large literature on the functioning of teams, knowledge on the functioning of NPD teams' remains relatively limited, also knowledge about the conditions that enhance or hinder NPD teams' performance is scant. The findings from traditional group research may not be very helpful in

enhancing the effectiveness of cross-functional teams because these studies are mainly applicable to groups that have members from common backgrounds. The multifunctional nature of these product development teams creates unique barriers to their effectiveness. There exist some firm-level research on the determinants of product performance (e.g., Clark & Fujimoto, 1991; Menon, Jaworski, and Kohli, 1997; Morgan & Piercy, 1998; Song, Souder, and Dyer, 1997). However, these studies have mainly concentrated on the effects of macro-or firm-level variables, such as structural and cultural factors rather than on the influence of micro-or team-level factors such as team characteristics and dynamics on new product performance. Scant attention has been directed toward team-level innovation (Burningham & West, 1995; Scott & Bruce, 1994).

Research often suggests that formal NPD processes increase the success rate of NPD projects in a firm. However, even though the effectiveness of product development processes has been well-proven, many firms still do not use a formal NPD process (e.g., Rundquist & Chibba, 2004). The same hold when looking at NPD programmes in Malaysia. Suhaiza, Premkumar, Junaimah and Nabsiah (2007) found that more than one-third of all firms investigated in their study still use no formal process for managing NPD. It was also found that the best-practice firms that use more multifunctional teams were more likely to measure NPD processes and outcomes. Given the significance of new product development in innovation, the need to intensify NPD efforts especially for a developing country such as Malaysia is crucial. Diez and Kiese (2006) in their survey of 1600

manufacturing firms in Singapore, Malaysia (Penang) and Bangkok showed that the breadth and efficiency of innovative activities still lag considerably behind those found in 11 European regions.

This study undertakes to explore how project team characteristics and dynamics (team level factors) affect new product development performance? And to see the impact of team immediate context, top management support and recognition on project team characteristics and dynamics in relation to new product development performance. The study focuses on cross-functional new product development teams within manufacturing companies across industries in Malaysia that have certain level of new product development activities taking place in their organizations.

1.6 Research Objectives

There are several research objectives that this study attempts to achieve, which are to:

i) examine how project team characteristics namely, functional diversity, superordinate identity, and social cohesion affect the performance of new product development.

ii) investigate how project team dynamics namely, trust, communication, coordination, and transformational leadership style affect the performance of new product development.

iii) analyze the moderating effect of top management support and recognition on the relationship between project team characteristics, dynamics and new product development performance.

1.7 Research Questions

In achieving the above objectives, this research addresses the following questions:

i) Is the performance of new product development affected by project team characteristics namely, functional diversity, superordinate identity and cohesion?

ii) Is the performance of new product development affected by project team dynamics namely, trust, communication, coordination, and transformational leadership style?

iii) Does top management support and recognition moderate the relations between project team characteristics and dynamics on new product development performance?

1.8 Scope of the Study

This study is limited to identifying those variables at the micro or project team level of analysis that may have effects on new product development performance. These include team characteristics – functional diversity, superordinate identity, and cohesion; team dynamics – trust, communication, coordination, and transformational leadership style and team immediate

context – top management support and recognition. The project team here refers to cross-functional new product development teams, particularly in the manufacturing sector across industries in Malaysia. The inclusion of selected variables mentioned above is due to special characteristics of cross-functional teams that differ from conventional teams at least in three significant ways.

Firstly, their members usually have competing social identities and loyalties. Individuals tend to identify more strongly with their function, both socially and psychologically, than with their project team. Secondly, cross-functional teams are often temporary task teams undergoing significant pressure and conflict. Thirdly, such teams often face high performance expectations, with aspirational goals of compressing development times, creating knowledge and enhancing organizational learning. These pressures create specific issues for cross-functional teams, which organization need to recognize and address. Thus, support for the inclusion of variables such as superordinate identity, functional diversity, cohesion, trust, coordination, communication and transformational leadership that might contribute to enhance the integration of diverse perspectives and performance.

1.9 Significance of the Study

Product development and innovation are central to business prosperity. An overview of the success /failure literature in new product development (NPD) reveals a long list of critical success factors that indicate what should be done to enhance new product success rates (Cooper, 1994; Cooper & Kleinschmidt, 1987, 1995b; Montoya-Weiss & Calantone, 1994; Lester, 1998;

Johne & Snelson, 1988). One of these factors is how the firm organizes for new products.

The organizational setting of the new product development activities has become increasingly important to both academics and managers. Peters (1988) notes that 75% of time slippage is due to the way projects are organized – due to siloing and sequential problem solving. The use of a cross functional team and the existence of cross-functional responsibility and interfaces between departments promotes positive new product performance (Barczak, 1995; Calantone, Droge & Vickery, 2002; Cooper, 1994; Hausman, Montgomery & Roth, 2002; Kahn, 1996; Langerak, Peelen & Commandeur, 1997; Laufer, Denker & Shenhar, 1996; Sawhney & Piper, 2002; Shapiro, 1977). Thus, cross-functional teams have become popular in the design and development of new products, but there has been little research on the specific characteristics and processes of such teams (Hitt, 1999). Clearly, more knowledge of these issues is needed. Hence, this research intends to contribute to the study of new product development performance by selecting and adding variables that rarely have been tested as independent variables (e.g. superordinate identity and trust) and moderating variable (e.g. top management support – where in most cases, top management support was treated as independent variables in NPD studies).

The findings from this research is hoped to contribute to the building of new knowledge in terms of theory and practice in new product development

and team/group study, particularly at the project team analysis. Specifically, this study is significant for several reasons.

First, this study focuses on the success factors in new product development at project team level. Due to the different unit of analysis focused in this study, the results of this study may be able to discriminate between success at the micro (project team level) and macro level (company or business unit level)

Second, majority of success/failure studies tend to treat new product performance as a single dimension- usually, financial performance. In the typical study, new product projects are either classified as “success” or failures” (or rated on a success/failure continuum), where financial results or profitability is the proxy for success and failure. We argue that this is simplistic, however indeed the measurement of new product performance has a multidimensional flavor (Ancona and Caldwell, 1992b; Barczak and Wilemon, 1992; Eisenhardt and Tabrizi, 1995; Griffin & Page, 1993; Rosenthal & Tatikonda, 1993). For example, new products can be successful in a variety of ways: they can have a major impact on the firm; they can be heralded as great “technical” successes; they can have a significant impact in the market by achieving a high market share; and even speed-to-market and the ability to reduce cycle time is being used as proxy for success/performance in some fast-paced companies (Cooper & Kleinschmidt, 1995d). Whereas many of these performance measures are no doubt interrelated, there are some important differences too: for example, it may be