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Management control systems in research and development organisations: A multiple case study in Indonesia

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Management Control Systems in Research and Development Organisations: A Multiple Case Study in Indonesia

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

DOCTOR OF PHILOSOPHY

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By

Parulian Silaen, B. Accy., SE., M. Com (Hons)

School of Accounting and Finance
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Declaration

I, Parulian Silaen, certify that this thesis has not been submitted previously as part of the requirements of another degree and that is the product of my own independent research.

Parulian Silaen,
31 October, 2006

Dedication

For my dearest,
Micke Nories, Andrew Giorgio, Michelle Flavia,
and Ashley Lavoynne Silaen

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Abstract

Research and Development organisations deal with different environments, purposes, goals, and employees' characteristics compared to non-Research and Development organisations. Research and Development (R&D) activity is a learning process that makes the R&D units deal with relatively uncertain conditions in conducting their tasks. The R&D activity is a non-repetitive task with a purpose to contribute new knowledge whether or not it has specific commercial objectives. Such a situation makes the goals relatively difficult to measure quantitatively and monetarily.

This thesis is built on the thrust of those characteristics of R&D organisations and uses a descriptive case study research strategy to conduct an investigation into how management control systems are applied in public sector R&D organisations in Indonesia and why such practices are chosen. This thesis develops a framework that consists of four core elements of management control systems that need to be considered in setting the control function. The framework is used to explain how and why such practice was implemented. This thesis also involves the historical background of Indonesia from its colonial past to the present. The study has no intention to generalise its finding, rather it hopes to make a contribution to the body of knowledge and practice, with its consideration of the four core elements involved in setting management control systems.

The four core control elements are Desired Ends, Actors, Control Implementation, and Control Tools. The Desired Ends consists of two sub-elements namely Yardstick and Direction. The Actors consists of five sub-elements; Behavioural, Motivational, Domination, Power, and Decision Space. The Control Implementation contains two sub-elements; Control Types and Timing, in which the Control Types consists of Formal and Informal types, and Timing of implementation contains three stages as Input, Process and Output.

The practice of management control systems in Indonesia was found to be an archaic and centralised system. Centralisation of control was found to be placed in the central government offices in Jakarta. Such practice may be influenced by several factors including historical, political, and cultural as well as the nature of the R&D activities. In addition, the management control systems applied were found to be both formal and informal during the input, process and output stages. The control tools practiced by the controller were found to be directional, bureaucratic, and mostly emphasised the financial dimension. The use of the scientific dimension was only found to be used during a seminar presentation.

This thesis contributes to the body of knowledge particularly in the area of management control systems by showing how and why such practices of management control system exist in the government sector in Indonesia. The conclusion of this thesis is that there is a need to consider the core control elements simultaneously in designing a management control systems particularly for a research and development organisation.

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Glossary

Anggaran Pembangunan	Development Budget
Anggaran Rutin	Routine Budget
APBN	National Budget
Bakun	The National Accounting Bureau
Bappeda	The Regional Development Planning Agency
Bappenas	The National Development Plan Agency
Batan	The National Atomic Energy Agency
Bendaharawan	Treasurer
BEPEKA	The Supreme Financial Audit
BKU	General Cash Ledge
BPKP	The Financial and Development Supervisory Agency
BPPI	The Agency of Research and Development in Industry
BPP-Teknologi	The Agency of Assessment and Application of
DIK (Daftar Isian Kegiatan)	Routine Budget
DIP (Daftar Isian Proyek)	Approved Development Budget
Direktorat Pembinaan Anggaran I	Directorate for Budget Sustainability I
Direktorat Pembinaan Anggaran II	Directorate for Budget Sustainability II
DJA	The Directorate General of Budget
DPR	Lower House
DRN	The National Research Commitee
DUP	List of Proposed Projects
GBHN	The General Direction for National Development
Inspektorat Jenderal (It-Jen)	Internal Auditor
Jabatan Fungsional	Functional Career Path
Jabatan Struktural	Structural Career Path
KPKN	Government Treasury Office
LIPI	The Indonesian Institute of Science
LK (Lembaran Kerja)	Working Paper
Loknas-Ristek	National conference for Research and Technology
LPD	Departmental Institution
LPND	Non-Departmental Institution
MIBRS	Multi Institutions Based Research Scheme
MPR	The Upper Hourse
Pimpro	The Project's Leader
PO (Petunjuk Operasional)	Operational Guidence
PPILM	The R&D Project in Metal and Machinery Industry.
Proyek Penelitian Sumber Daya Hayati	The R&D project for Biological Resources
Punas-Ristek	The National Direction for Research and Technology.
Puslitbang-Biologi	The R&D Centre for Biology
Repelita	The Five Year National Development Plan
Repeta	The Annual National Development Plan
Ristek	The Ministry of State for Research and Technology
RUT	The Integrated Excellent Research Scheme

Satuan Dua	Budget Ceiling
Sesdalopbang	the Secretary of Local Government
SIBRS	The Single Institution Based Research Scheme
TOR	Terms of Reference
UYHD	Advance Received
Wanpro	Project's Treasurer

CHAPTER ONE

Overview of the Thesis

Introduction

The purpose of research and development (R&D) activities is to contribute new knowledge whether or not these activities have specific commercial objectives (Place, 1977, p. 19). This may include creating new or improved devices, products, process systems, and concepts (Nason, 1981, p. 27). Since the purpose of the R&D function is to develop new knowledge, the expected output should not be the same as that which had been previously produced. In turn, as its purpose is to produce new knowledge, the task may be characterised by non-repetitive tasks in which causal relationships may be poorly understood in advance. Therefore, this type of organisation may experience an uncertain environment (Duncan, 1972; Lorsch & Morse, 1974; Simons, 1987). These characteristics would differentiate the R&D organisation from the non-R&D organisation in making a choice of the quality of its organisational functions such as goal setting, planning systems and management control systems.

Some studies indicate that there is a significant impact by environmental uncertainty on organisational goal setting (Lindblom, 1959; March, 1978; Cooper et al., 1981; Georgiou, 1973). This environmental uncertainty may require goals with different qualities from those described in the management literature, and are characterised by complexities that often require a longer time for achievement. These situations may also influence the choice of the planning systems (McCaskey, 1974; Kukalis, 1991).

Since goals and planning have a close relationship with the control function, (Euske, 1984; McCaskey, 1974), the different characteristics of goals and planning (McCaskey, 1974; and Davila, 2000) may influence the choice of control systems (Chenhall, 2003;

Davila, 2000; Abernethy & Brownell, 1997; and Hartmann, 2000). Therefore, to study the control system alone is insufficient. It should be done by considering other organisational functions in their actual context (Hopwood, 1983; Kaplan, 1983; Merchant, 1985; Chenhall, 2003).

Indonesia has unique circumstances. The country is an archipelago that comprises 17,508 islands with a huge population that consists of about 500 major ethnic groups. At least four countries have influenced Indonesia during the colonial era, Portugal, the Netherlands, Britain, and Japan. Considering this situation, the historical, political and cultural background of Indonesia may also influence the practice of management control systems in the government sector.

This study investigates the system of management control systems in three government institutions that are involved in research and development (R&D), and three other units that are involved in controlling R&D projects in Indonesia. The study includes a review of the literature on the history of Indonesia as well as a discussion of environmental uncertainty and its impact on organisational goal setting, planning, and control.

A review will also be made of existing concepts of management control systems. By so doing, the weaknesses of the existing control theory, when it is applied to R&D organisations will be then identified. The study will then propose an alternative approach to management control systems and examine the dynamics of the control system in order to contribute to the development of control theory in respect of R&D organisations.

This chapter presents an overview of the study and consists of eight parts. Part two is background of the study that contains review of literature which lead the study to developed the research questions presented in part three. Part four presents the objective of the study, followed by part five that presents the justification of the study. Part six presents the research method, sample sites and data collection techniques used by the study. Part seven presents the limitation of the study, and finally part eight will close the chapter with the organisation of the study.

Background to the study

Accounting information has been found to play an important role in providing managers with information for control purposes (Hopwood, 1983; Simons, 1987). Some studies however, indicate that accounting data should be used with caution for control purposes. Hopwood (1972) indicated that in the short term, the Budget Constrained Style might lead to dysfunctional behaviour, and bring undesired consequences for the organisation. He also found that the Profit Conscious Style might have higher efficiency than the Budget Constrained Style, whereas the Non-accounting Style seems to create less tension compared to the other two styles.

Otley (1978) investigated the use of accounting data for performance evaluation of profit centres that were substantially independent of each other. He found a contrary result from Hopwood's (1972) study. Therefore, Otley (1978, p. 146) suggested that there was a need for further study of the use of accounting data for performance evaluation in different organisational types, environments, norms and values.

Brownell (1982) conducted a study of 48 managers to reconcile the results of Hopwood (1972) and Otley (1978). He found that budget participation reduced the impact of the evaluation style on performance. However, a further study taken by Brownell & Dunk (1991) indicated that the role of budgetary participation in moderating the impact of evaluation styles on performance was only confirmed when the task uncertainty was low.

A study by Hirst (1983) recognised that the relative completeness of accounting measurement would decline when task uncertainty increased. Hirst (1983) indicated that the incidence of dysfunctional behaviour, as in Hopwood's (1972) study was not only caused by different uses of accounting performance measures, but was also caused by task uncertainty. These studies then attracted attention to the impact of organisational environment on the choice of organisational functions.

According to Thompson (1967), different environmental characteristics may have a significant influence on organisational functions. Traditionally, environmental characteristics were viewed as constant and certain (Miles, et al, 1974). The challenge to this view however, indicates other types of environmental characteristic as uncertain (Dill, 1958; Burns & Stalker, 1961; Thompson, 1967; Lawrence & Lorsch, 1967; Duncan, 1972), where many of the organisational functions including control systems become problematic.

More supportive results were found by some other studies (Govindarajan, 1984; and Gordon & Narayanan, 1984). Govindarajan (1984,p.132) found that managers who perceived themselves as dealing with higher environmental uncertainty used criteria other than accounting data for performance evaluation. This condition was more pronounced in the more effective units. He suggested (Govindarajan, 1984, p. 133) that there is a need to conduct further studies by examining the impact of environmental uncertainty in different organisational settings.

Gordon & Narayanan (1984) investigated the relationships between perceived environmental uncertainty (PEU) and the organisation's structure and information system. The study indicated that there is a significant correlation between higher or lower PEU with the adoption of an organic or mechanistic structure, and the quantity of information used. However, the relationship between the structure and quantity of information used was found to be insignificant. More importantly, the higher the perceived environmental uncertainty, the higher the need for external, non-financial and ex-ante information (Gordon & Narayanan, 1984, p. 43).

According to Miles, et al., (1974, p. 248), many authors have only used rapid changes and heterogeneity as sources of uncertainty, without including the degree of predictability of future events and/or consequences. Miles et al., (1974, pp. 248-249) argued that, in a situation where an organisation deals with a rapidly changing environment but where changes are relatively predictable, the organisation does not confront uncertainty. This argument implicitly stated predictability as element that creates different types of uncertainty where goals and tasks were poorly understood and subject to multiple interpretations (Simons, 1987).

Abernethy & Stoelwinder (1991) took a stand to investigate the impact of uncertainty on control systems in professional and non-for-profit organisations by polling 203 sub-unit managers in four large NFP (Non-For-Profit) teaching hospitals in Australia. The basic notion of their study was that management control was seen to be problematical in organisations where professionals dominate the operation (Abernethy & Stoelwinder, 1991, p.106). Two reasons were put as basic arguments in that study. Firstly, professionals behave differently to people who work under a system of administrative rationale. The differences in behaviour may be influenced by differences in education and socialisation processes. Moreover, they have considerable power and influence because they control the production process (Abernethy & Stoelwinder, 1991, p. 106). Secondly, professionally rational behaviour, however, is directed towards the achievement or maintenance of autonomy, which is contrary to rational/legal bureaucracy (Abernethy & Stoelwinder, 1991, pp. 107-109). They suggested that budgeting could be effectively used as a control device in a programmed task instead of in an un-programmed task, where ambiguity about tasks and goals exists (Abernethy & Stoelwinder, 1991, pp. 106-107). Abernethy & Stoelwinder (1991) indicated that budgeting, task uncertainty, and system goal orientations have significant influence on performance. The use of budgets improves performance when task uncertainty is low. However, when task uncertainty is high, system goal orientation improves performance, and budgeting may need to be supplemented by other informal controls (Abernethy & Stoelwinder, 1991, pp. 113-114).

All the above studies indicate that the central problem of the control concept relates to environmental uncertainty. However, those studies seem to investigate the direct influence of environmental uncertainty on the use of control systems, and pay less attention to the role of organisational goals and planning. The control function also has a very close relationship with the goals and planning. This relationship can be found in the process of control which has been defined by many authorities as encompassing ways to guide the action or to influence the behaviour of people in the organisation to attain desired ends (Flamholtz, 1983; Birnberg and Snodgrass, 1988; Anthony, et al., 1989), through monitoring and comparison of performance with a reliable and valid precondition (Ouchi, 1977).

Unfortunately, the concept of organisational goals is not without its problems. March (1978) for example, argued that the conventional wisdom that stated goals came first and action comes later was misleading. It is believed that human choice behaviour is a process of discovering goals (March, 1978). Other authorities comprehend that organisational goals are often vague, and contradictory or multiple (Georgiou, 1973; Otley & Berry, 1980), and may lead to a situation where the goals and tasks are poorly understood, and this in turn creates problems of performance measurement.

Regarding organisational planning, conventional wisdom describes the planning process as beginning with objectives, and then defining strategies, policies and detailed plans to achieve the objectives (McCaskey, 1974). However, when it is too early to set precise goals as in the early stages of a new company, or when the environment is unstable and uncertain, and/or when it is difficult to define agreement toward a common goal, this planning concept seems to be problematical (McCaskey, 1974).

The study by Kukalis (1991) provided supportive results by indicating that environmental complexity reduced the ability of members of firms to make a relatively accurate prediction over a longer period, and increased the frequency of plan revision and shortened the plan period. Therefore, a more flexible planning system is likely to be found in organisations dealing with uncertainty.

Considering the interaction among organisational functions such as goals setting, planning and control, and their problems with environmental uncertainty, it is plausible to adopt the view that environmental uncertainty may not directly influence the effectiveness of control systems alone. Environmental uncertainty may influence the suitability of goal setting, and further, the goal setting characteristic influences the appropriateness of the planning and control systems. Therefore, the joint contribution of the characteristics of the goals and the planning systems may contribute to the problem of the control systems.

An R&D centre may deal with an uncertain environment during its lifetime. Uncertainty may be a natural characteristic of the environment that is confronted by an R&D organisation as a consequence of the domain chosen. It is appropriate to quote a suggestion from Bourgeois (1985, p. 570) who mentioned that, "...uncertainty should be confronted rather than avoided, if the environmental volatility level warrants it." Therefore, there is a need to develop goal setting, and planning and control systems in this condition (Lindblom, 1959; Georgiou, 1973; Cooper et al., 1981; McCaskey, 1974; Kukalis, 1991, Hofstede, 1978; Flamholtz, 1983; Birnberg, 1983; Merchant, 1985).

The tasks in R&D organisations are not repetitive as in most manufacturing companies, and their objective is to contribute new knowledge. Once new knowledge is found in a particular cycle of activities, the next cycle begins with an expectation of finding further new knowledge. The process of R&D normally has clear goals at the abstract level but the translation of that into operational goals may not be self-evident. Such operational goals may need frequent modification in the light of new knowledge, and the cause and effect relationships are normally less well defined in key dimensions than most other human endeavours. Repetition of tasks increases the ability to predict future events and/or consequences, and decreases uncertainty (Thompson, 1967, p. 16), to which the traditional model of rational choice can be applied. However, in the situation where operational goals are often ill defined and/or discretionary, this model would probably be inappropriate (Cooper et al., 1981, p. 179). As the objectives of the R&D units are to produce new knowledge, it could be said therefore that R&D organisations deal with a specific type of environmental uncertainty that is characterised by non-repetitive tasks, ambiguous goals, uncertain technology and is dominated by highly specialised and creative personnel.

The behavioural aspect is important in the control context (Ouchi, 1977; Flamholtz, 1983). The behaviour of personnel within an organisation should follow, or presumably will strive for or will be influenced by, control systems following a set of behaviour patterns that had been defined as being appropriate. This type of presumption is similar to that in administrative control, which set a standard before the action and uses it as a yardstick to be compared to performance.

However, the behaviour of creative people, which dominate R&D organisations, has been found to be different from those of people who deal with administrative functions (Gibson, 1981; Root-Bernstein, 1989; Abernethy & Stoelwinder, 1991). These creative people are often impatient with routine, disdainful of regulations, unresponsive to the requirement for meeting attendance and making reports (Gibson, 1981), hate bureaucracies and abhor administrators (Root-Bernstein, 1989). Therefore, the behavioural factors inserted in the control systems are required to be different from those currently presumed by administrative control.

In summary, the foregoing situation was a background that formulated the study undertaken. Environmental uncertainty may create different type of goals within an organisation, which finally requires a different setting of organisational functions. R&D organisations were found to have non-repetitive tasks, ambiguous goals, uncertain technology and were dominated by highly specialised and creative personnel. Therefore, this type of organisation may need a different type of management control system setting.

Research Questions

Despite the historical background of Indonesia, this study is built on the thrust of the characteristics of R&D organisations including their environment and attempts to understand how and why management control systems are applied in R&D organisations. The study proposes a framework that consists of four control dimensions that need to be considered in the setting of management control systems. They are Desired Ends, Actors, Control Implementation, and Control Tools. It should be noted that the role of accounting information forms an integral component of varying importance in most of the framework. The study uses six sample sites involved with R&D in the government sector in Indonesia, which is different to the private sector in terms of profit and non-for profit orientation. Therefore, the central question of the study is how and why the management control systems practiced by the sites in Indonesia comply with the framework developed by the study.

Objective of the Study

Previous studies have indicated some weaknesses in the existing concept of management control systems applied to organisations that dealt with an uncertain environment (Govindarajan, 1984; Hopwood, 1972; Brownell, 1982; Simons, 1987; Williams, 1990; Abernethy & Stoelwinder, 1991 Jaworski & Young, 1992). In addition, the R&D organisations have been found to experience uncertainty that may result from the domain chosen (Thompson, 1967). The operation of R&D organisations may be characterised by some factors that make them different to non-R&D organisations. The differences may include non-repetitive tasks, ambiguous goals, less knowledge of the transformation process, domination by scientists rather than managers (Twiss, 1992; Jain & Triandis, 1990), and provision of a longer time to return the investment (Ravenscraft & Scherer, 1982). These characteristics may require different control systems to those that are used in non-R&D organisations.

A study by Abernethy & Stoelwinder indicated different goal orientations between organisations that were and were not dominated by professionals. Other studies (Duncan, 1972; Lorsch & Morse, 1974) indicated that R&D organisations have more uncertain and rapid changing environments compared to manufacturing firms, and therefore required more flexible planning and control systems. Differences in profit and non-for profit orientation as in the government and the private sector may also create different goal orientations. Various studies in accounting literature also indicated ineffectiveness of financial data to control organisation that dealt with an uncertain environment (Govindarajan, 1984; Hopwood, 1972; Brownell, 1982; Simons, 1987;

Williams, 1990; Abernethy & Stoelwinder, 1991 Jaworski & Young, 1992). However, those studies investigated the direct influence of environmental uncertainty on the control systems alone, and contained less consideration of the impact of environmental uncertainty on organisational goals, planning and control simultaneously in their actual context (Otley & Berry, 1980; Hopwood, 1983; Flamholtz, 1983; Simons, 1987; 1990; Dent, 1990; Kaplan, 1983; Merchant, 1985).

Therefore, the objective of this study is to provide a contribution on practical and theoretical grounds to the discussion of management control systems. The contribution on practical grounds is related to the needs of the management control system used by organisations that deal with environmental uncertainty particularly R&D organisations.

The contribution on theoretical grounds is related to the development of a theoretical framework for control in R&D organisations by taking multiple cases in Indonesia, with particular reference to the sub-role of financial data. The empirical case studies are designed to raise issues and to supplement the literature base on which the theoretical model is developed.

Justification of the study

In recent years research and development activities has attracted many studies to investigate the effective way of management control system for the R&D activities (Rockness & Shields, 1984; Bisbe and Otley, 2004; Tatikonda and Rosenthal, 2000; Ditillo, 2004). The environment dealt with by an R&D organisation is different from that implemented by a non-R&D organisation. Clarke (2002, p. 9) pointed out four unique features of an R&D environment as follows;

1. The uncertainty associated with R&D activities.
2. The difficulty of assessing the contribution or impact of the research result on the firm or on the advancement of science/technology in general.
3. The rapid changes in science and technology that result in an ongoing battle to stave off technological obsolescence in both people and equipment.

4. The values, expectations and attitudes of research scientists and engineers are in many aspects different from those of other professionals.

Since the situation dealt with by R&D organisation is uncertain, it may affect the goal setting (Chenhall, 2003), planning system (McCaskey, 1974), and control systems (Govindarajan, 1984; Hopwood, 1972; Brownell, 1982; Simons, 1987; Williams, 1990; Abernethy & Stoelwinder, 1991 Jaworski & Young, 1992, Chenhall, 2003, Bisbe and Otley, 2004; Tatikonda and Rosenthal, 2000; Ditillo, 2004, Davilla, 2000). Some authorities suggest that there is a need to develop a management control systems framework suitable for organisations in ambiguous situations (Cooper et. al., 1981), and professionally dominated organisations (Abernethy & Stoelwinder, 1991).

Cooper et al (1981) investigated the use of accounting systems in organisations that deal with ambiguous situations. The ambiguous situations refer to such conditions as poorly specified goals and a poor understanding of technology for goal attainment. Two functions of accounting systems used in this type of organisation were suggested in their study (Cooper, et al, 1981, p.188). Firstly, accounting systems represent an ex post rationalisation of action rather than an ex ante statement of organisational goals. Secondly, accounting systems provide a basis for justifying an action rather than as an input for future decisions. Nevertheless, they suggested that further studies are needed to investigate the role of accounting systems in organisations that deal with ambiguous situations.

Abernethy & Stoelwinder (1991) investigated the use of budgeting for performance measurement on four non-for profits teaching hospitals that were dominated by professionals. They argued that this type of organisation has different characteristics to non-professionally dominated organisations in two areas: task uncertainty and system goal orientation. Their study indicated that budgeting, task uncertainty, and system goal orientation has significant influences on performance. In a situation of high uncertainty where the use of budgeting for control purposes is problematical, the system goals orientation improves performance. The system goals orientation refers to the use of other informal control mechanisms to neutralise the inadequacy of financial data as a control device (Abernethy & Stoelwinder, 1991, p.114). Furthermore, they suggested that there is a need for developing a broader, more dynamic and integrated control system framework that would match the situation dealt with by professional organisations.

Various studies on management control systems in R&D organisations are also available. Rockness & Shields (1984) conducted a study of R&D organisations to examine the presumptions regarding the task characteristics required by the three organisational control frameworks developed by Ouchi (1977). These were input control, behaviour control and output control. Their study found that, in R&D organisations, input control is important when knowledge of the transformation process is limited. However, when knowledge of the transformation process is sufficient, behaviour control plays an important role within the control systems. As the output of the R&D function was difficult to measure on a short-term basis, their study could not find any support for the importance of output control in R&D organisations (Rockness & Shields, 1984). Finally, Rockness & Shields (1984, p. 175) suggested a need for future studies to investigate the combination of various organisational elements and to define an integrative and more complete control framework, other than accounting control, which is used by non-manufacturing organisations, and by R&D organisations in particular.

The use of management control systems were also investigated by some studies. Bisbe and Otley (2004) investigated the effect of the interactive use of formal management control systems on product innovation of Spanish firms. The study found that the relationship between interactive formal control systems and innovation were variable across the level of innovation. The use of interactive formal control only stimulated creativity and product innovation in low-innovating firms, whereas in high-innovating firms the effect was in the opposite direction. Furthermore, the study also found that the more interactive the use of a formal control system the greater the effect of product innovation on performance (Bisbe and Otley, 2004, p.21). Finally, the study also suggested further research on management control systems to balance different control styles to enhance understanding on broader framework of control packages (Bisbe & Otley, 2004, p.22).

Tatikonda and Rosenthal (2000) examined the effect of project execution method on the project execution success of 120 R&D projects. The study particularly investigated the effect of project execution method in terms of firmness and flexibility influence the success of product development project and the influence of R&D output on the relationship between project execution method and project execution success. The study found that the most appropriate way for project execution was by balancing firmness and flexibility and this had a positive association with project success. They suggested that the use of firmness and flexibility in the project execution method should be considered in managing a R&D project.

A study by Ditillo (2004) investigated the role of management control systems as knowledge integration mechanisms in knowledge-intensive firms, considering the uncertainty dealt with by the firms. The study found that to be effective, the management control systems should be capable of coordinating individuals and support knowledge integration. The study suggested further research on management control systems to investigate and describe implications of combination of controls, as well as to enlarge variables that affect both management control systems choices and their effectiveness in knowledge intensive firms (Ditillo, 2004, p.417).

Since goals in an R&D organisation cannot be stated in advance quantitatively (Twiss, 1992; Jain & Triandis, 1990; Roussel, et al., 1991; Clarke, 2002), the use of a comparison process by the control system (Ouchi, 1977) cannot be granted, and therefore would require a type of control system that does not place emphasis on the comparison process. To define a typical control system that suits the situation of uncertainty as dealt with by an R&D organisation, there is a need to identify the possible dimensions contained in the management control system. The identification of the control dimensions would provide a rich understanding about the characteristics of each dimension, and therefore can be used to develop a more comprehensive control framework.

Research method, sample sites, and data collection

Case study research is one of alternative way of doing social science research as pointed out by Yin (2003, pp.1-2) who said its role was "… to contribute to our knowledge of individual, group, organisational, social, political, and related phenomena." This study uses case study research through a multiple case study of three government's R&D units and three government units that are involved in controlling R&D activities in Indonesia.

Indonesia is an archipelago that consists of 17,508 islands widespread between the Indian Ocean and the Pacific Ocean. As a tropical country, Indonesia is rich with natural resources and needs R&D activities to help develop the country. Therefore, the concern of the country with the importance of R&D calls for a study of management control systems in R&D organisations that brings a practical contribution to research and development organisations, particularly in the Indonesian context.

The study uses a multiple case study approach to investigate the practice of management control systems in three R&D units in Indonesia. In order to be able to investigate more thoroughly how and why the control systems used operated, the study uses two groups of research sites: the first is a group, which executes the control function, and the other is the group being controlled. In the first group, the units that execute different degrees of control, consists of three units: the Directorate of Culture, Science and Technology; the Agency for Research and Development in Industry; and the Directorate of Budget. The second group consists of units that perform R&D activities. They are the R&D Centre for the Textile Industry; the R&D Centre for the Metal, Machinery, and Electronic Industry; and the R&D Centre for Biology.

Prior to the field visit, the study conducted a literature review to understand the existing concept of management control systems and other related factors, and to identify the inquiry for the development of the concept of management control systems. From the literature review, the study developed a framework of management control systems and proposes four dimensions to be considered in designing the system. They are Desired ends, Actors, Control Implementation and Control Tools. Data was gathered using primary sources from field visits, through observation, interviews, and documentation, as well as telephone interviews.

Contribution and limitation of the study

This study contributes an understanding of how the management control systems practiced in R&D organisations, particularly, in the context of the government sector in Indonesia. This study also makes a contribution to knowledge by introducing the control dimensions in their actual context to answer the inquiry from many authorities (Otley & Berry, 1980; Dent, 1990; Kaplan, 1983; Merchant, 1985; Govindarajan, 1984; Hopwood, 1972 and 1983; Brownell, 1982; Simons, 1987; Williams, 1990; Abernethy

& Stoelwinder, 1991 Jaworski & Young, 1992, Chenhall, 2003, Bisbe and Otley, 2004; Tatikonda and Rosenthal, 2000; Ditillo, 2004, Davilla, 2000). The study brings a contribution to practitioners by way of introducing the control dimension in different organisational settings. In addition, the study will add to the existing stock of knowledge in the list of case studies regarding management control systems, particularly for R&D organisations.

This study uses the case study research method to investigate the social phenomena particularly in the management control systems in the government sector in Indonesia. Several limitations of the study can be expected. Firstly, the study is limited to the practice of management control systems in government R&D projects in Indonesia. The characteristics of the government sector generally may differ from the private sector in terms of profit motives, proprietary versus political interests, users and resource allocation processes (Williams, et al., 1990). Secondly, the study uses three sample sites where two sites run applied research and one site runs basic research. Therefore, the limitation of the study lay upon the number of sites investigated as well as the context of R&D in the public sector in Indonesia. In addition, there is no intention of the study to generalize the result, which may be viewed as another limitation of the study.

Organisation of the study

This study consists of five parts, Introduction, Review of Literature, the Research, the Analysis, and the Conclusion. **Part One** consists of this chapter.

Part Two of the thesis presents a discussion of the relevant literature on Organisational Environment, Research and Development Organisations, and on Management Control Systems. Therefore, this part consists of three chapters as follows:

Chapter Two: The Organisational Environment

This chapter consists of review of the literature on the characteristics of the organisational environment, with an emphasis on the typical types of environmental uncertainty. The notions of organisational environment that are found from the review are used to redefine the existing concept of organisational environment. The implication of typical environmental settings will be linked to goals and planning. Finally, the relationship among those elements will be described to develop pairs of goals settings and planning systems for a particular type of organisations, which deal with environmental uncertainty.

Chapter Three: Research and Development Organisation

This chapter consists of a review of literature on research and development organisations. The characteristics of R&D organisations presented in this chapter include organisational environment, personal characteristics of scientists and the process of research and development activities. Moreover, to provide a more comprehensive understanding of the nature and characteristics of R&D organisations, this chapter will accommodate various published studies that have been done in the context of R&D organisations.

Chapter Four: Concepts of Management Control Systems

This chapter presents a review of literature on Management Control Systems. A review of existing control definitions and empirical studies is used to enrich the understanding of the control concepts. This chapter also presents a conceptual basis for management control systems to be developed and proposed by the study. The Four dimensions of Management Control Systems that need to be considered in designing the system are desired ends, Actors, Control Implementation and Control Tools. The implications of environmental settings, organisational goals and planning for the management control systems are used to define the characteristics of each dimension of the proposed concept of management control systems.

Part Three of the thesis provides a discussion of the research method used by this study. This part contains one chapter, which is chapter five.

Chapter Five: Research Methodology

The chapter provides a discussion on the use of case study research as well as the process and the method of data collection in conducting the study. The process to decide the sample sites chosen is also discussed in this chapter.

Part Four of the thesis presents the background of Indonesia, describes the management control systems practiced in the government sector in Indonesia, and specifically exposes in detail the implementation of the control system in the R&D units being studied. This part consists of three chapters from chapter six to chapter eight.

Chapter Six: Background of Indonesia

This chapter presents the background of Indonesia as well as its brief history from colonialism until the present. The impact of colonialism on the practice of government administration particularly concerning management control system is described in this chapter.

Chapter Seven: Management Control System Outlook in Indonesia

This chapter presents the data collected from sites of the units that perform the control function. A description of different types of government institutions, R&D projects in Indonesia, as well the budgeting process in the government sector and the accounting system practiced during the era of the New Order in Indonesia are presented in this chapter. A detailed description, roles and function of the three government units in conducting the control function on R&D project in relation to the framework proposed by the study are also discussed in this chapter.

Chapter Eight: The Management Control System in R&D units

This chapter presents the data collected from sites of three units that perform R&D activities. Brief descriptions of the units are presented in this chapter as well as the practice of management control systems from the perspective of the scientists in the R&D units. Throughout the chapter, control system practice is discussed with attention to the four control dimensions of Desired ends, Actors, Control implementation, and Control tools. Furthermore, the accountability systems in operation during the project's duration and performance measurement of each example are also discussed.

Part Five of the thesis consists of one chapter, chapter nine regarding the analysis done by the study.

Chapter Nine: Analysis

Based on the data collected from the fieldwork, the chapter presents an analysis of the control systems that applied in the R&D units observed. The use of the dimensions of the management control systems are discussed in this section including the importance of the actor in control systems as well as how the control types and control tools were applied to input, process and output control. The historical contexts are also put as a component in describing the existing administrative system particularly in relation to the management control system.

Finally**,** the last part of the thesis is **Part Six** and comprises only one chapter, which is the conclusion.

Chapter Ten: Conclusion

The chapter provides summary and conclusion of the study in relation to the finding particularly on the use of the four control dimensions, and suggestion for further research.

The next chapter will discuss a review of literature on the organisational environment and its implication on the choice of organisational function.

CHAPTER TWO

Organisational Environment

Introduction:

The environment, in which an organisation operates, influences the effectiveness of its functions. The view that environmental characteristics were traditionally considered to be constant and certain has been challenged by a description of other sets of environmental characteristics that are uncertain. Under environmental uncertainty various organisational functions such as goal setting, and planning and control systems become problematical (Thompson, 1967; Burns & Stalker, 1961; Miles, et al., 1974; Kukalis, 1991; Govindarajan, 1984; Gordon & Narayanan, 1984; Hirst, 1981, 1983; Abernethy & Stoelwinder, 1991; Bourgeois, 1985; Chenhall, 2003).

Some authors proposed elements of environmental uncertainty (Dill, 1958; Lawrence & Lorsch, 1967; Thompson, 1967; Duncan, 1972), and used them to examine its impact on the choice of organisational structure (Burns & Stalker, 1961; Gordon & Narayanan, 1984), organisational planning (Kukalis, 1991; McCaskey, 1974; Lindsay & Rue, 1980); goal setting (Bourgeois, 1985; Cohen, 1972; Georgiou, 1973; Lindblom, 1959), accounting systems (Rayburn & Rayburn, 1991; Hayes, 1977), and control systems (Hirst, 1981, 1983; Simon, 1990; Abernethy & Stoelwinder, 1991; Govindarajan, 1984; Abernethy & Brownell, 1997).

Central to their findings is that environmental uncertainty influences the effectiveness of organisational functions. However, they are inconclusive because different studies used different types of uncertainty and examined its impact on different organisational functions. Also when examining the impact on a certain organisational function, other functions were assumed to be constant and therefore ignored (Chenhall, 2003). Two primary limitations of those studies can be suggested. Firstly, the use of different internal and/or external organisational elements as sources of uncertainty that create different impacts, and secondly, those studies tended to focus on the direct impact of environmental uncertainty, and ignore the impacts of internal elements of goals and planning that may mediate the effect.

There is a very close relationship between organisational goal setting, planning systems and control systems. Environmental uncertainty may influence the effectiveness of goal setting and planning and control systems simultaneously. However, the impact of environmental uncertainty on control systems cannot be viewed in isolation (Chenhall, 2003; Hartmann, 2000). Goal ambiguity at the organisational level as caused by environmental uncertainty may create difficulties in setting clear and certain operational goals as well as planning.

The problem with operational goals and the planning system may contribute to the effectiveness of the control systems chosen. Therefore, to study the impact of environmental uncertainty on the control systems alone is insufficient. It should be done by considering the other interrelated organisational functions (Hopwood, 1983; Kaplan, 1983; Merchant, 1985; Chenhall, 2003).

This chapter reviews literature on organisational environment. Various definitions of environmental uncertainty, sources of uncertainty and their impact on goals setting, planning and control are discussed.

Organisational Environment

Various studies have been done to refine the concept of the environment as well as to identify the characteristics and dimensions of the environment (Dill, 1958; Thompson, 1967; Lawrence & Lorsch, 1967; Burns & Stalker, 1961; Duncan, 1972; Downey, et. al, 1975; Miles et al., 1974; Tosi et al, 1973; Karagozoglu, 1993).

Dill (1958) called that part of the total environment which is potentially relevant to goal setting and goal attainment as *task environment* and used it to investigate the direct influence(s) of environmental dimensions on organisational goal setting and goal attainment. Two Norwegian companies named Alpha and Beta were used by Dill (1958), and he measured the environmental dimensions of degree of homogeneity and degree of stability. The degree of homogeneity refers to the degree of similarity of environment faced by a decision maker from time to time as indicated by similar customers, a similar time of selling from year to year, and selling similar products. The degree of stability refers to significant changes in the environment by changes in customer demands and technology. The study indicated four major elements of the task environment that had the greatest impact on goal attainment: 1) customers (both distributors and users), 2) suppliers (of materials, labour, equipment, capital, and workspace), 3) competitors (for both markets and resources), and 4) regulatory groups (government agencies, unions, and inter-firm associations) (Dill, 1958, p. 424).

Burns & Stalker (1961) examined the impact of task environment on the choice of organisation structure by using the dimensions of environment that they termed stable and dynamic and which referred to the degree of change in the environment including external elements; customers, competitors, suppliers, regulatory groups, and the internal element of technological change. Two types of organisational structure were used, mechanistic and organic. The mechanistic structure was described as placing more reliance on formal rules and procedures, a narrower span of control and decisions being reached at a higher management level. Whereas the organic structure paid less attention to formal rules and procedures, decisions were reached more at the middle management level, and there were wider spans of control. The study found that effective organisations in stable industries tended to be mechanistic, and effective organisations in the more dynamic industries tended to be more organic.

Thompson (1967) refined the concept of organisational environment and enlarged the analysis by introducing four internal organisational elements that influenced the task environment: *Domain*, *Structure*, *Technologies*, and *Goals*. *Domain* refers to the choice of areas or type of activities or products to be produced by an organisation, or the area in which a unit of an organisation focuses its activities (Thompson, 1967, p. 26). *Structure* refers to the internal differentiation and patterning of relationships within an organisation. *Goals* referred to some imagined state of affairs which may conceivably be attained or approached (if finite) at some future time, and therefore were considered by those in the dominant coalition as the intended future domains (Thompson, 1967, pp. 127-128). *Technology* refers to the organisation's technical functions, and can be categorised into three types (Thompson, 1967, pp. 15-18): *Long-linked technology, Mediating technology and Intensive technology.*

Long-linked technology refers to a series of activities where each activity depends on the completion of a previous activity. This type of technology can be found in a mass production assembly line. *Mediating technology* refers to an activity that links clients and customers, such as commercial banks, which link depositors and borrowers. *Intensive technology* refers to varieties of techniques that are drawn up to achieve a change in some specific object; but the selection, combination, and order of application are determined by feedback from the object itself. This type of technology, for example, can be found in a general hospital that consists of various organisational elements that work together to cure the patients including: dietary, x-ray, laboratory, pharmacists, medical specialists and so forth.

Thompson (1967) examined the source of uncertainty by using Dill's (1958) task environment as external environmental elements, and the domain, structure, technologies and goals as internal elements. Thompson (1967, p. 159) suggested that the sources of uncertainty may come from the external environment and consists of two elements, a) being generalised uncertainty, or b) lack of cause and effect understanding outcomes determined by specific actions. The uncertainty from the internal environmental element may come from interdependence among components within an organisation.

Lawrence & Lorsch (1967) argued that rapid change in technological or scientific developments and pressures from changing market demands may cause uncertainty, and the degree of uncertainty may differ among the units. Lawrence & Lorsch (1967) conducted an investigation on types of uncertainty faced by research and development (R&D), production, and marketing units in six plastic industry firms. They found (Lawrence & Lorsch, 1967, p. 28) that R&D units dealt with a more uncertain environment compared to production and marketing on three components of uncertainty: (a) the lack of clarity of information, (b) long time span of definitive feedback, and (c) the general uncertainty of causal relationships. In addition, Lawrence & Lorsch (1969) also examined the influence of environmental uncertainty on four factors:

1) orientation toward particular goals,
2) time orientation of definitive feedback,
3) interpersonal orientation, and
4) formality of structure.

Regarding, goal orientation, they found that sales personnel were more concerned with marketing goals which were customer problems and competitive activities (Lawrence & Lorsch, 1969, p. 37). The production personnel were found to be more concerned with techno-economic factors they were cost reduction and process efficiency. The research laboratories' personnel however did not primarily focus on the development of new knowledge; they were concerned more with techno-economic factors. Though the R&D personnel were concerned with the development of new knowledge, the essential goal was to improve production processes and product modifications to obtain a better economic performance.

Concerning the time orientations of feedback on a decision, they found that marketing and production units dealt with a short time period which was often less than one month, whereas the R&D units dealt with a longer time span which was often several years (Lawrence and Lorsch, 1969, p.35). About the interpersonal orientation, they found that sales department personnel were the most relationship-oriented compared to production and R&D units (Lawrence and Lorsch, 1969, pp. 33-34). While the production personnel were found to have a task-orientation rather than being relationship-oriented, the R&D personnel were in between the production and sales department personnel.

Tosi, et al. (1973) duplicated the study of Lawrence & Lorsch (1967) using the same questionnaire, and used industry volatility from New York Stock Exchange firms to calculate the uncertainty. Tosi, et al. (1973, p. 31) found that the correlation was low and inconsistent to the study of Lawrence and Lorsch (1969).

The contradictory results however, may have been caused by two factors that were used differently by the two studies (Tosi, et al. 1973, pp. 33-35) they were the level of managers being used, and the type of uncertainty measured. With regard to the management level, Lawrence & Lorsch (1967) used only top executives in their sample, while Tosi, et al. (1973) used the middle and top management level. The managers in large firms may not be as sensitive to uncertainty as are functional managers. With regard to the type of uncertainty measured, Lawrence & Lorsch (1967) measured the uncertainty in terms of the perception of the samples, while Tosi, et al. (1973) used volatility measured in terms of volatility or fluctuation in technology, income, and sales. Nevertheless, Tosi, et al. (1973) concluded that Lawrence & Lorsch (1967) measured internal volatility, while Tosi, et al. (1973) measured external volatility. In addition, Tosi, et al. (1973, p. 33) suggested that when internal uncertainty is a function of external uncertainty, both those types of uncertainty may influence the organisational functions differently.

Based on these conflicting results, Downey & Slocum (1975) suggested that the basic nature of environmental uncertainty can be of two types: perceptional and structural. Lawrence & Lorsch (1967) used perceptional. Tosi et al. (1973), in contrast, used a structural approach. Downey & Slocum (1975) suggested a basic model for uncertainty perception. They argued that the environment may provide basic inputs into the individual's mapping process. Through the mapping process, which is subject to accuracy of interpretation, the perceived uncertainty may be constructed, depending on the stock of information possessed by individuals. Therefore, it may be suggested that, the less the information possessed by the individuals, the higher the perceived uncertainty (Galbraith, 1973). In addition, it can be can be said therefore, if the perception of uncertainty is only personal trait, what may seem highly uncertain to one individual may seem minor to another who has previously experienced much more uncertain conditions. The solution for this type of uncertainty is collecting more information (Bourgeois, 1985; Simons, 1987).

The study of Duncan (1972) attempted to identify the elements of internal and external environment. He examined the impact of different environmental characteristics on the decision-making process and defined the environment as "…the totality of physical and social factors that are taken directly into consideration in the decision-making behaviour of individuals in the organisation" (Duncan, 1972, p. 314). The study of Duncan (1972) did not only consider the external physical and social factors, but also factors internal to the organisation.

Three levels of internal environment were introduced by Duncan (1972). Firstly, the *organisational personnel component* refers to the individual level regarding the quality, quantity and behaviour of the individuals within an organisation. Secondly, the *organisational functional and staff unit components* which refer to the functional unit level in terms of the technology used and the interaction of and interdependency with the functional units within an organisation. Thirdly, the *organisational level components* which refer to the organisational objectives and goals, the integration process to achieve the goals and the nature of the organisation's products. As regards the external environmental element, Duncan (1972) specified external components as: customers, suppliers, competitors, socio-political, and technological components. The summary of the components is presented in table 2.1.

Duncan (1972) conceptualised the environment's dimensions as Simple-Complex and Static-Dynamic, and operated these dimensions in his study on research and development and non-research and development organisations. The Simple-Complex dimension referred to a number of factors that should be considered by a unit within an organisation in making decisions. The Static-Dynamic dimension referred to stability or instability over time of the factors that should be considered in making decisions. Duncan (1972, pp. 322-324) indicated that non-research and development organisations dealt with simpler and more static environments (a relatively lower level of uncertainty), while research and development organisations tended to deal with more complex and dynamic environments (a relatively higher level of uncertainty). Thus, Duncan (1972, p. 318) conceptualised three uncertainty components as:

> …(1) the lack of information regarding the environmental factors associated with a given decision making situation, (2) not knowing the outcome of a specific decision in terms of how much the organisation would lose if the decision were incorrect, and (3) inability to assign probabilities with any degree of confidence with regard to how environmental factors are going to affect the success or failure of the decision unit in performing its function.

Table 2.1: Organisation Environmental Components

Please see print copy for Table 2.1

Miles et al, (1974) agreed that to survive and to act effectively, an organisation needs to define a boundary between what belongs to the organisation, and what belongs to its environment (Miles, et al, 1974, p.248). The environment may change over time, and as an open social system the organisation's boundary will fluctuate, as will the elements that belong to the organisation. They suggested a series of decision points that could be useful to identify the organisational boundaries (Miles, et al., 1974, pp. 246-247);

1. The decisions by which the organisation selects a portion of the total environment as its particular arena of activity (i.e. its domain) and chooses a basic strategy for managing the domain;
2. The decisions by which the organisation establishes an appropriate technology for implementing its basic operating strategy;
3. The decisions by which the organisation creates a structure of roles and relationships to control and coordinate technology and strategy; and
4. The decisions made to assure organisational continuity-the capacity to survive, adjust, and grow.

Miles, et al. (1974) indicated that the existing literature in organisational environment has treated environmental change (stable-dynamic) and heterogeneity (simple-complex) as important components of the environmental dimension. They argued that there is a need to distinguish between the rate of environmental change and the degree of predictability of change as a measurement of uncertainty. However, they preferred the latter.

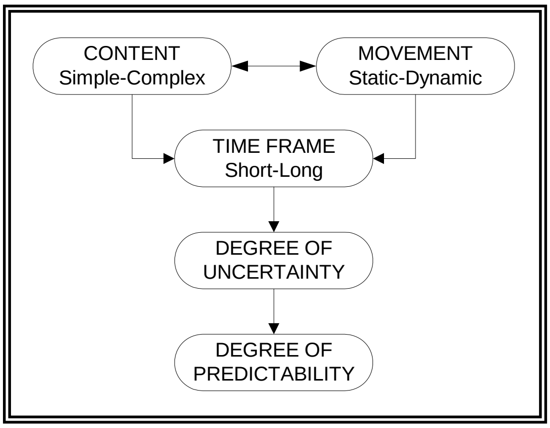
Lorsch & Morse (1974) conducted a study of four manufacturing plants and six research laboratories to identify the difference in the perceived environmental uncertainty of individuals in manufacturing plants and research laboratories. The study indicated that the four manufacturing plants dealt with a certain environment in terms of rapid and short time spans of feedback for performance, unambiguous tasks and programmable tasks. Moreover, the continuous-feed production line required relatively high intra-unit coordination. In contrast, the six research laboratories dealt with a more uncertain environment in terms of relatively long-term performance feedback, ambiguous tasks and relatively un-programmable tasks. The research laboratories were primarily concerned with innovation in developing new knowledge that could be applied in developing new or improved products. Those types of tasks made them more independent, and placed less emphasis on intra-unit coordination.

This finding led them to conclude that research laboratories would deal with a more uncertain environment than would manufacturing plants (Lorsch & Morse, 1974, p.30). Through the study of Lorsch & Morse (1974) another environmental dimension was consistently found (Lawrence & Lorsch, 1969) that is a long time-span of feedback may contribute to an individual's perceived uncertainty.

Dimensions of Organisational Environment

Three environmental dimensions at least have been recognised from the review of the literature: *Movement*, *Contents*, *Time Frame of Feedback Information* which may affect the degree of *Uncertainty* and hence also *Predictability*. *Movement* refers to the degree of change of internal and/or external environmental elements that are often characterized by stable /or static, and dynamic. *Contents* refer to the number of factors of internal and/or external environmental elements that need to be considered in making decisions which characterized by homogeneity and heterogeneity. *Time Frame of Feedback Information* refers to a period of time required to receive information regarding an action. *Uncertainty* refers to inadequate stock of knowledge perceived to be possessed with regard to the action taken by internal and/or external parties in response to those three environmental dimensions. Finally, *Predictability* refers the ability to make relatively accurate guesses of future events or consequences, so that the required action can be taken in advance. The interaction among these environmental dimensions is presented in figure 2.1.

Figure 2.1: Interaction among Environmental Attributes



A diagram developed to portray the construction of Environmental uncertainty

The interaction between the movement and time frame dimensions may be explained in various ways. For example, an organisation may have a long time frame of feedback information and a relatively static environmental movement. However, when the movements of environmental factors become dynamic, the time frame of feedback information will be shortened whenever it is possible, so that the movement can be monitored and the anticipation can occur. On the other hand, the time frame may also take effect on the type of environmental movement. The longer the time frame of feedback information received, the more dynamic the environmental movement.

The interaction of the time frame and the content of the environment may be described in a similar way. When the content dimension becomes more complex the time frame will be shortened whenever it is possible, so that the complexities can be maintained at a level that is perceived to be enough for making a decision. In turn, the longer the time frame dealt with by the organisation, the more complex the content that should be considered in making a decision. Similarly, the simple number of factors that should be considered in making a decision under static environmental changes may become complex when the movement becomes dynamic or visa versa.

The interaction among these dimensions forms an environment that deals with the organisation and consists of the four environmental dimensions. The environment that consists of a combination of these four dimensions may provide different types of environmental characteristics that creates the degree of uncertainty and finally will influence the ability of the organisation to make an accurate prediction about future events and consequences. This predictability dimension will be relevant to form an environment that is characterised by a certain or an uncertain situation. Though there is no intention in this study to make a further investigation of these four dimensions, it is plausible to suggest that in studying the influence of environmental uncertainty on organisational effectiveness, these four dimensions should not be treated in isolation. Rather, they should be viewed as a set of environmental dimensions that contribute to environmental uncertainty. However, it should be kept in mind that the contribution and impact on each dimension of environmental uncertainty may differ as to the organisational functions. Furthermore, perceived sources of uncertainty may vary among members of an organisation, depending on the organisational level at which a member is responsible, and with whom and to what they most frequently interact. Therefore an understanding of the dominant dimensions and their major impact is important to facilitate the designing of effective organisational functions.

The problem of environmental uncertainty may not be solved solely by reducing only a particular source of uncertainty. The uncertainty may be fabricated by a combination of environmental dimensions. The organisation cannot substantially change the environment, because it is created by various external and internal environmental factors, and the organisation would never have enough capacity to do that. As mentioned by Bourgeois (1985, p.570) “Uncertainty should not be reduced if it is, in fact, an accurate manifestation of the objective situation”. The environment is there somewhere inside and outside organisations complete with its characteristics. The organisation may only recognise its influences on the organisation’s functions. Moreover, different environmental dimensions or combinations of dimensions may create different types or combinations of types of uncertainty. In turn, the difference in types of uncertainty or combinations of uncertainty may influence the effectiveness of different organisational functions. Therefore, the organisation needs to identify the dominant types of uncertainty as well as the source of uncertainty, so that effective anticipatory action can be taken.

Perrow (1967, 1970) defined task uncertainty as being based on an activity to process input into output, which is characterised by the interaction between a number of exceptional cases found in the work, and the degree of analysability of the work that should be performed. Van de Ven & Delbecq (1974) adopted Perrow's (1967) perspective, and proposed task uncertainty based on working groups in an organisation rather then individuals. They suggested task uncertainty as a contribution of a combination of task difficulty and task variability. Van de Ven & Delbecq (1974, p. 183) referred task difficulty as to "…the analyzability of the work itself and the extent to which there is a known procedure that specifies the sequence of steps to be followed in performing the task", which is similar to Perrow's (1967) task analysability. Task variability relates to "...the number of exceptional cases encountered in the work requiring different methods or procedures for doing the work", which is similar to Perrow's (1967) exceptional cases encountered in performing the work.

The above concept of task uncertainty seems to be limited within the planning system by defining the methods or procedures for doing the task, and ignoring the linkages between the task and the goals' characteristics. It is plausible however, to suggest that if the essence of the goals has been understood by the individuals within the organisation, there will be other possible ways to achieve the goals. By linking the characteristics of the task and the goals, it will allow the individuals to be more creative. Therefore the scope of task uncertainty should be enlarged from the methods or procedures to do the task, to an understanding about the goals themselves (Latham & Yukl, 1975).

As the focus of the study is on the control system, other organisational functions that have a close relationship with the control function would also be considered.

However, this study limits the discussion to three organisational functions: organisational goals, planning and control systems.

Organisational environment and goals

Organisational goals have a close relationship with control systems, as mentioned by Chenhall (2003, p. 135) that;

> Distinguishing official and operative goals would seem an essential aspect of MCS [*Management Control Systems*] research that includes consideration of goals, mainly as it flags that the issue of organisational goals is far from unproblematic.

Thompson (1967, p. 127) referred to goals as "...some imagined state of affairs which may conceivably be attained or approached (if not finite) at some future time." In a similar vein, Latham & Yukl (1975, p. 824) used a simple definition of goals, being "...what the individual is consciously trying to do." If goals are defined as a psychological trait, then it would be related to the environmental characteristics perceived by individuals and the goal setting process.

Daft (1983, pp. 84-88) classified goals into two types: official goals and operative goals. Official goals reflect a general purpose, describe a value system for the organisation, and therefore are abstract, vague, unspecific and immeasurable. Having those qualities, official goals deal with the external members who have an interest in the organisation, and are less appropriate to guide actions and to measure the performance within an organisation (Daft, 1983). Operative goals reflect the actual and desired operational activities from which the organisational planning and control system are derived. These goals are more concrete, specific and measurable than official goals, and therefore would be more appropriate to be used for criteria of performance and to guide actions. Although in many organisations the operative goals are often found to be inconsistent with the official goals, the operative goals are expected to be set parallel with the official goals (Daft, 1983, p. 85).

According to Daft (1983, pp. 86-87) five operative goals are commonly found in organisations: environmental goals, output goals, system goals, product goals and sub-unit goals. Environmental goals refer to an intention to satisfy people and organisations in the external environment. These types of goals are concerned with the feelings, attitudes and perceptions held by the external members towards the organisation. Output goals refer to the purpose or type of product or products, which should be produced and emphasised. System goals refer to the desired condition of the organisation, such as its size, form, growth, employees' satisfaction and internal climate. Product goals are the goals that relate to the required product level and characteristics, such as quantity, quality, variety, design and uniqueness. Sub-unit goals relate to the goals of each work unit within the organisation.

Four possible purposes of the goals are mentioned by Daft (1983, pp. 82-84) they are; (a) to legitimate the organisation's existence, (b) to provide direction and decision guidelines, (c) to formulate criteria for performance appraisal, and (d) to reduce uncertainty. Apparently these four purposes may be found with different emphases among organisations. The first purpose is legitimating organisational existence. For this purpose, the official goals seem to be very relevant to the requirement of the external environment where the organisation deals with the external members or bodies. The rest of the purposes, such as direction, criteria for performance, and minimising ambiguity, would be considered to be relevant to the requirement of the internal environment. Nevertheless, to be able to be used, these three purposes of operative goals are preferred to be clear, concrete, rational and understandable.

In contrast, Weick (1969, p. 37) argued that;

> …the view common to most organisation theories attributes to goals more stability than they seemingly have. It is probable that goals are tied more closely to actual activities than has been realized, and that they are better understood as summaries of previous actions. Much of the organisation's work does not seem to be directed toward goal attainment. Instead, it can be understood more readily as actions with a primitive orderliness, this orderliness being enhanced retrospectively when members review what has come to pass as a result of the actions.

Similarly, March (cited in Cooper et al, 1981, p. 181) suggested,

> ...it seems to me perfectly obvious that a description that assumes goals come first and action comes later is frequently radically wrong. Human choice behaviour is at least as much a process for discovering goals as for acting on them.

Bourgeois (1985) investigated the relationship between environmental uncertainty, goal setting and economic performance of 20 firms. He believed that goal setting was a product of perception about the environment. He also believed that there was a relationship between structural and perceptional environmental uncertainty. When the structural environmental uncertainty was accurately perceived by the organisational members, then the appropriate goals and strategy could be set, and finally a high economic performance could on average, be obtained.

Bourgeois (1985) argued that to adapt to environmental volatility the organisation must continually modify its goals. During the process of goal change, the new goals are added to the old goals until the new goals entirely replace the old ones. Using this argument, Bourgeois (1985) proposed that there was a relationship between the number of goals and environmental characteristics. A successful firm in an uncertain environment would have a large number of goals, and a successful firm in a stable environment would have a small number of goals.

The study by Bourgeois (1985) indicated that the more the perceptional uncertainty matches the structural uncertainty, the better the economic performance of the firm. Although the study indicated that both the perceived environmental uncertainty and goal diversity increased or decreased together, they moved in the opposite direction to divergence between perceptual and structural environmental uncertainty.

This finding led him to suggest that when perceptual uncertainty misinterpreted structural uncertainty, the managers tended to agree among themselves about the perceived uncertainty and increase consensus on goals. In addition, this misperception would lead the firm to poor economic performance. With regard to the number of goals, Bourgeois (1985) only found a weak positive relationship between perceived environmental uncertainty and the number of goals. Nevertheless, the study by Bourgeois (1985) provides empirical evidence that the goal setting process would relate to perceptional rather than structural dimensions, and the notion of the number of goals warrants further examination.

Number of goals could mean the number of expected future domains (Thompson, 1967) that establish directions for future achievement and which are followed by specific activities to achieve them. The greater the number of goals could be associated with the greater amount of funds needed to finance the activities to attain those goals. Apart from the influence of perceived environmental uncertainty, it is plausible to suggest that the decision to increase the number of goals may also relate to the degree of risk associated with the intended goals. In addition, it also increases the availability of internal organisational elements including the availability of financial support and skills. These aspects however were ignored by Bourgeois (1985). Organisational goals potentially change over time (Chenhall, 2003), depending on the priorities of the internal and external environmental characteristics, which are dealt with by the organisation. It is possible that, at any point in time, an organisation may have various announced goals, but may only focus on a particular goal because of limitations created by internal and external environment.

Georgiou (1973) traced the evolution of organisational goals and indicated that the classical goal definition was inadequate. The problem with the classical version is that organisation was viewed “as an instrument, a deliberate and rational means for attaining known goals” (Georgiou, 1973, p. 292). Furthermore Georgiou (1973, pp. 292-293) mentioned that "…the stated goals of the organisation have often been found to be vague, contradictory or multiple, with no clear indication of their respective priorities".

Multiplicity of organisational goals may create a cloud to hide the direction of action, and this may create a great problem if it occurs at a lower level such as departmental or sub-unit level. The goals at this level are preferred to be clear, concrete, rational, and understandable qualities, so that they can be used as a reference for individual role prescription.

Latham & Yukl (1975) reviewed 27 published and unpublished reports of field research to investigate the applicability of Locke's theory of goal setting. The focus of their study was on three main areas: a) the effect of specific and generalised goals or no goals on organisational effectiveness, b) the effect of goal difficulty on performance, and c) goals as mediators of performance feedback, monetary incentives, and time limits. In relation to first area, they found that ten out of eleven studies in this area indicated that setting specific goals will improve organisational effectiveness. Regarding the second area, they found that six out of the seven studies indicated that difficult goals lead to greater performance than easy goals on the condition that the goals are accepted by the member of the organisation. It may be caused by goal acceptance that may moderate the goal's difficulty as long as the goal is reasonable. Individual who has a high degree of self-assurance, and has previously experienced more successes than failures may perceive the hard goal as a challenge (Latham and Yukl, 1975, p. 835). Regarding the third area, they reviewed three studies on the effect of feedback on performance and one study on the effects of feedback in conjunction with goal setting. However, those studies were indicated to be less relevant in defining a conclusive result of the role of goals in mediating the effects of performance feedback. With regard to the role of goals in mediating monetary incentives their study (Latham and Yukl, 1975) could not find any relevant studies that could be used to investigate the issue.

The study of Latham & Yukl (1975) however, did not attempt to consider the influence of environmental aspects on the goal setting process. They reviewed field studies that mostly involved routine tasks on production, marketing, telephone operators, and focused on operative goals at individual levels of output quantity and quality. It could be said that the task difficulty used by their study referred to technical difficulties or internal procedure. Nevertheless, the study by Latham & Yukl (1975) concludes that specific and clear goals would be preferred by most organisations. However, in an uncertain environment the members of the organisation may be unable to set specific operative goals which would further make the task difficult. In this situation the goals' acceptance and understanding is important to allow the individual to be creative and improve his or her performance (Jaworski & Young, 1992).

The magnitudes of organisational goals have a potential to change over time depending on the influence of perceived environmental characteristics (Perrow, 1970; Daft, 1983; Warner & Havens, 1967-68, Chenhall, 2003). According to Chenhall (2003, pp.135-136) there were at least six situations that may make the goals change;

1) the influence of new powerful players internally or externally,
2) changes toward a more effective goal direction,

3) change toward different goal characteristics from measurable toward un-measurable quantitatively,
4) changes on the standard or benchmarks for performance,
5) the need to satisfy multiple and potentially competing goals, and
6) aligning operative goals with official goals.

Warner & Havens (1967-68, pp. 540-541) proposed that the goal changes may take place in two basic forms. Firstly, the goal change occurs when the former goal has been achieved, and is replaced by another goal. Secondly, the goal change occurs even when the former goal has not been achieved. It is replaced by other goals that are perceived to be more appropriate. The later is characterised by two types of replacements: a) goal diversion and b) goal displacement. Goal diversion refers to the situation where the original goals are supplanted by alternative goals. Goal displacement refers to "…means-ends inversion, the neglect of the claimed goals in favor of the means as ends in themselves" (Warner & Havens, 1967-68, p. 541). Goal displacement occurs in community organisations which deal with such goals pointed out by Warner & Havens (1967-68, pp. 541-542) as:

> ...helping people become better citizens, developing greater community integration or stronger community spirit, developing attitudes and skills of cooperation, helping people help themselves to solve their problems, educating people and changing their attitudes, developing human resources, increasing the dignity of human life, improving society, improving the well-being of people, and so on…

In these types of organisations, to attain such goals a means-ends chain of sub-goals must be developed to bridge those goals and individual role prescriptions. The goal displacement will occur in these sub-goal phases, in which the reason for displacement basically is the preferences for tangible goals (Warner & Haven, 1967-68). The organisation must act and it can only do so in a concrete way. Therefore the organisation needs tangible goals that can be used for coordination and control. The intangibility of goals will create uncertainty, anxiety, insecurity, frustration, and risk.

All of these results will create pressure in the organisation for a more tangible goal. However, when an organisation deals with intangible goals as the consequence of the domain chosen, it should accept this condition as the nature of the organisation.

The interaction between the organisation and its environment should be treated as an open system to allow direct and/or indirect influences of the environment on the organisation, or vice versa (Daft, 1983; Thompson, 1967; Simon, 1964-1965; Dill, 1958). The acceptance of this condition would enforce the members of the organisation to learn, during its lifetime, to anticipate the impact of uncertainty that may be created by the intangible goal (Thompson, 1967, Bourgeois, 1985).

Some authorities proposed a different approach than economic rationality to deal with environmental uncertainty in goal setting (Cohen, et al, 1972; Cooper et al, 1981; March & Simon, 1958; March, 1978; Lindblom, 1959). Cohen et al. (1972) characterised intangible goals as organised anarchies where problematic preferences, unclear technology, and fluid participation exist. For this type of organisation the choice behaviour in setting the goals is different to those organisations under environmental certainty. March & Simon (1958) suggested a bounded rationality model to replace economic rationality; March (1978) proposed the technology of foolishness as the basis for action; Lindblom (1959) proposed the science of muddling through, Gouldner (1959, cited in Georgiou, 1973, p. 293) proposed a natural system model, where the organisation was viewed as an organism, in which its primary concern is to survive. Those alternative views direct the choice to a position, which emphasises learning and adaptive behaviour. In order to adapt to a situation, an organisation needs to learn.

During the learning process, the announced goals may be used as a tentative guide for the organisation to act. Furthermore, during the process of the action, the organisation may find some desired practical directions to be followed. The choice of the directions may be based on their priorities in relation to the announced goals and is bounded by the constraints dealt with by the organisation. The new directions chosen would be followed by the action that is characterised by the learning process. However, once the directions are perceived to be inappropriate during the process of the action, then other desired directions may be chosen to replace the old direction. This is a continual process of action during the organisation’s life.

Organisational environment and Planning

Goals and planning have a very close relationship in the organisational process. This relationship is clearly stated in the definition of planning. For example Steiner (1969, cited in McCaskey, 1974, p. 282), defined planning as;

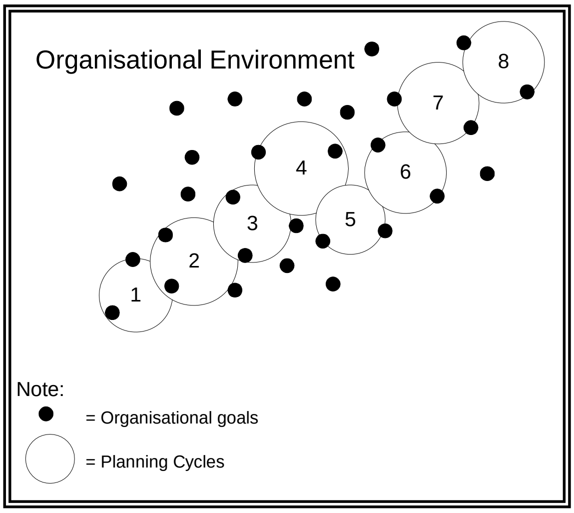
> ...a process that begins with objectives; defines strategies, policies, and detailed plans to achieve them; which establishes an organisation to implement decisions; and includes a review of performance and feedback to introduce a new planning cycle.

However, the planning system, which presumes goals come first and action comes later, may only work in a relatively certain environment. Under environmental uncertainty, however, the existing planning system is still controversial. Kukalis (1991, p. 144) stated that “…collectively the conceptual empirical work to date leads one to conclude that the impact of firm and environmental characteristics on strategic planning processes is still not clearly understood.”

However, Kukalis (1991, p.145) still believed that under a complex environment, companies tended to employ a more flexible planning system than companies under a less complex environment. The complexities of the environment will limit the ability of the company to forecast, and to anticipate any future crisis (Kukalis, 1991, p.155).

An alternative view was suggested by McCaskey (1974) in his *directional planning* model as depicted in figure 2.2. It starts with identifying the domain and pattern that lead in a certain direction. The planning undergoes several cycles of acting along the path of direction, and objects which lie along this path may become goals, but other objects found across the cycle may easily replace the current goals.

Figure 2.2: A diagram developed to portray the concept of Directional Planning



For example, the organisation may start with planning cycle 1 in figure 2.2. In planning cycle 1, the action may find preferred goals that would be stated as the organisational goals. At the same time, the action performed in planning cycle 1 may find other preferred directions that are located outside the boundary of planning cycle 1. When the dominant members of the organisation choose new directions, then the planning cycle would be shifted into planning cycle 2. However, it should be kept in mind that the current organisational goals are those that are produced by the action in the planning cycle 1. Furthermore, the action during the cycle 2 may result in other new goals, and at the same time may also find other new directions. The goals defined by the action in planning cycle 2 may replace the current goals, depending on the expected benefit promised by those goals and the constraints dealt with by the organisation. In addition, if new directions are desired by the dominant members of the organisation, again the action will be shifted into planning cycle 3 and so forth. The advantage of this planning system is its flexibility, adaptive and learning ability, and its dynamic response to an uncertain environment.

The study of Kukalis (1991) seems to support the directional planning characteristics to be used in an uncertain environment. He found that more flexible planning systems are likely to be found in organisations with uncertain environments (Kukalis, 1991, p.155) where flexibilities were indicated by more frequent review of the planning and a tendency to shorten the planning time horizon.

Karagozoglu (1993) conducted a study of seventy-five manufacturing firms to explore the effects of environmental uncertainty and planning processes on the firm's competitive advantage obtained through technological innovations.

The study found that,

> …sophisticated planning processes played a relatively minor role in mediating the effect of environmental uncertainty. This implies that managers tend to translate environmental uncertainty into organisational action via informal approaches and episodic knowledge rather than formal, sophisticated planning process (Karagozoglu, 1993, p.340).

Davila (2000, p. 404) described how a R&D project manager used contingency planning when he went on to state that the

> ...actual planning of a product development process is not well understood. Project manager A planned uncertainty. He tried to remove it as soon as possible except in the case of customer-related uncertainty. He kept this uncertainty intentionally unresolved until the appropriate time in the development effort: ambiguity was planned.

As the environmental uncertainty may influence the choice toward ambiguous goals, the classical planning may also be affected. Therefore, different types of planning may also affect the choice of control systems.

Organisational environment and control

Environmental uncertainty has been seen to require different control systems (Chenhall, 2003; Davila, 2000: Abernethy & Brownell, 1997: Hartmann, 2000). Many studies had been done to investigate this matter (Amigoni, 1978; Ouchi, 1977; Govindarajan, 1984; Macintosh and Daft, 1987; Davila, 2000) and will be reviewed.

Amigoni (1978) conducted a literature review on management control systems and suggested that effective control systems should match appropriate combinations among three important elements: *independent variables, distinctive features of the management control systems*, and *control tools*. The *independent variables* were divided into two parts: a) *degree of complexity*, which was considered to be internal environment; and b) *degree of discontinuity,* which was considered to be external environment. The degree of complexity consists of two factors: the number and the degree of inter-dependence, and the number and type of organisational units. The degree of discontinuity contained three types of environmental characteristics: stable, dynamic, and complex environments.

The distinctive features of the control system refer to the features of the control system implemented and consist of eight types: 1) degree of detail, 2) degree of relevance, 3) degree of selectivity, 4) degree of formal responsibility, 5) degree of procedural rigidity, 6) style of control, 7) quickness, and 8) orientation. The control tools refer to facilities used to perform the control function such as financial accounting, ratio analysis, cost accounting, responsibility accounting, operational budgeting, and investment budgeting.

Amigoni (1978) discerned that the independent variables may influence the need for information as well as the control systems. Under a stable environment a great number of business units would cause more frequent contact among the members of the organisation and require a rather complex organisation structure. The increase of interaction among the members would produce more information, and further would encourage the control system to require more detailed information. As the organisation structure becomes more complex, the control system would be more selective in using the information in terms of its relevance for making decisions, and would encourage the control system to increase the degree of formal responsibility and procedural rigidity. Finally, this situation will tighten the control style. In addition, the complexities of organisation's structure would cause the existing control tools to be incomplete and would require additional control tools to capture the complexity.

The turbulent environment may also influence the choice of distinctive features of the control system, and the choice of control tools. A high degree of environmental discontinuity would encourage the organisation to be more future-oriented and shorten the period of feedback information. In addition, the increase in environmental discontinuity would cause the current control tools to be less effective and would be likely to be replaced by other combinations of control tools. However, when the environmental discontinuity is low, the procedural rigidity would decrease and the style of control would change from a tight to a loose control style.

The changes of the control features may also influence the choice of control tools or visa versa. For example, when the degree of detail is needed to be increased, ratio analysis may be required to provide a detailed analysis on each item in the accounting system. When procedural rigidity is needed to be increased, the operational budget would be more rigid than flexible. In a similar case, the control style would also play an important role in determining whether the operational budget should be rigid or flexible. Moreover, when selectivity and relevant features are increased, the emphasis on the cost accounting system will increase.

The study by Amigoni (1978) attempted to tie the direct influence of environmental characteristics to the choice of control systems, and ignored the qualities of goals and planning that would probably have had more effect on the choice of control systems. The choice of control tools could not be connected directly to environmental characteristics. The control systems are a function of goals and planning systems.

Control systems are mostly used as devices to ensure that the direction to goals attainment is followed, and that the planning function plots the path in that direction. However, a study, which investigates the relationship between environmental uncertainty, goal setting, planning systems and control systems together, is rarely found. The influence of environmental characteristics on the choice of control systems would plausibly be reflected by the relationship of the control systems with organisational structure (Gordon & Narayanan, 1984), interdependency (Macintosh and Daft, 1988) and management styles (Govindarajan, 1984). Though these studies did not involve organisational goals and planning system in their examinations, they provided empirical evidence that environmental uncertainty influences the choice of control systems, and at the same time examined some of Amigoni's (1978) propositions.

Gordon & Narayanan (1984) examined the relationship between management accounting systems, perceived environmental uncertainty and organisational structure by using questionnaires from 34 senior managers of 40 profit-oriented firms in the USA. They found that the degree of perceived environmental uncertainty has a positive association with the choice of organisational structure. The perceived environmental uncertainty will influence the members of the organisation to move toward an organic form of structure which is characterised by a higher information processing capability (Gordon & Narayanan, 1984, p. 37). Moreover, as the decision-maker perceives a greater environmental uncertainty, there is a need for additional information on external, non-financial and ex-ante qualities.

Macintosh and Daft (1987) investigated the relationship between control systems and interdependence among organisations. The management control system elements used by the study were similar to those of Amigoni's (1978) control tools; standard operating procedures (SOPs), budgets, and statistical reports. The interdependency concepts used were pooled, sequential and reciprocal interdependency. Pooled interdependency refers to a low level of interdependence as little work flows among units. Sequential interdependency is characterised by serial work flows between the units. For example, output of a particular unit will be input for another unit. Reciprocal interdependency is complex and is characterised by the movement of work back and forth among units.

The study indicated that under pooled interdependency, the SOPs were more important control tools than budget and statistical reports. Budget and statistical reports were positively associated with sequential interdependency, whereas SOPs have been less used in such circumstances. Under reciprocal interdependency the SOPs and Budget were used less, while statistical reports played an important role in planning, target setting and coordination.

Govindarajan (1984) investigated the appropriateness of accounting data in performance evaluation by using environmental uncertainty as an intervening variable. The study by Govindarajan (1984) indicated that superiors in business units who perceived a higher environmental uncertainty would use more subjective performance measurements than superiors in business units who perceived a lower environmental uncertainty.

The study by Gordon & Narayanan (1984) indicated that environmental uncertainty encourages the members of an organisation to respond faster and therefore it will increase the degree of quickness of the control tools. To respond faster, the organisation may need an organic form of structure that would have more information capabilities (Gordon & Narayanan, 1984). Being uncertain, the decision makers would require more information which is future-oriented (Amigoni, 1978), and this was supported by Gordon & Narayanan (1984) who found that the organisation requires external, non-financial and ex-ante information to improve its ability to make a prediction.

In the case of interdependency, Macintosh & Daft (1987) indicated that the higher the interdependency the less the use of SOPs and operational budgets and the more the use of statistical reports. This finding may be interpreted as supporting the statement that organisational structure as a determinant of interdependency could be a source of uncertainty. Being uncertain, the organisation needs more detailed information, a shorter time frame, and non-financial data as characterised by statistical reports (Macintosh & Daft, 1984). The SOPs that provide monthly information about progress toward budget targets, and operational budgets that consist of prescriptions to handle the operation may reflect a rigid feature of control systems. The shift from SOPs and operational budgets to statistical reports took place when uncertainty increased (Macintosh & Daft, 1987), then may be interpreted as a shift from the rigid and tight control type to a more subjective or less tight feature, and to less emphasis on financial data (Govindarajan, 1984).

Tentatively, it can be concluded that, when the environment becomes more uncertain, some of the features of the control system will change. The increase of environmental uncertainty caused by discontinuity suggests the performance measurement would change from formula based to non-formula based evaluation systems. In addition, being uncertain and to react immediately to the changes in the environment, the organisation needs more detailed information for monitoring purposes, and the information would not rely solely on financial data (Chenhall, 2003).

Goals or Objectives and Control

The organisational goals or objectives are not always clear and measurable quantitatively, as stated by Euske (1984, p.7) that;

> …the goals and objectives of the organisation are given to the management control system, which addresses how best they can be accomplished. The specificity of the goals and objectives affects the success of a management control system. Poorly specified goals and objectives will create difficulty because of the resulting uncertainty and ambiguity.

However, when goals are ambiguous and technologies uncertain by nature, the applicability of the control concepts, which pretend that goals come before action, will be problematical. This matter has been long identified by Otley and Berry (1980, p.241) who said,

> …firstly, organisational objectives are often vague, ambiguous and change with time. They are often set by ill-defined processes, and are multiple and partially conflicting. In addition, they are congruent to only a varying extent with the objectives of various interest groups associated with the organisation. Secondly, in this situation, measures of achievement are possible only in correspondingly vague and often subjective terms. Thirdly, predictive models of organisational behaviour are partial and unreliable, and furthermore different models may be held by different participants. Finally, the ability to act is highly constrained for most groups of participants, including the so-called 'controllers,' by virtue of the limited range of possible actions open to them.

Similarly, Chenhall (2003, pp. 137-138) concluded that;

> …from these illustrations it can be seen that a consistent stream of research over the past 20 years has confirmed that uncertainty has been associated with a need for more open, externally focused, non financial styles of MCS. However, hostile and turbulent conditions appear, in the main, to be best served by a reliance on formal controls and an emphasis on budgets. The question may be posed, what is the appropriate MCS for organisations operating in conditions of uncertainty, turbulence and hostility?

Although studies that explicitly examine the relationship between goals and control are rarely found in literature, some studies glance over this relationship and will be reviewed.

Ouchi (1977, p. 97) believed that controlling the work of people and technology is "...basically a process of monitoring something, comparing it with some standard, and then providing selective rewards and adjustments." In this view two control variables are essential, the behaviour of people who do the job, and the output produced by the operation. Ouchi (1977, p.78) draws implications of goal characteristics on the knowledge of the transformation process in conducting tasks and the availability of output measures which constructed 4 situations;

(a) situation 1: perfect knowledge and availability of output measure is high;
(b) situation 2: imperfect knowledge but availability of output measure is high;
(c) situation 3: perfect knowledge but availability of output measure is low and
(d) situation 4: imperfect knowledge and availability of output measure is low.

Further, Ouchi (1977) examined the appropriateness of two types of control: *behaviour control* and *output control* under those four situations in 78 retail department store companies in the USA. *Behaviour control* refers to control of behaviour of subordinates by watching and guiding their behaviour toward the expected behaviour preferred by the supervisors. Ouchi (1977) found that behaviour control could only be effectively applied if the supervisors had a perfect knowledge of the transformation process. *Output control* refers to the measurement of output in which knowledge of the transformation process is not compulsory. This type of control would only need a valid measurement of desired output (Ouchi, 1977).

Throughout the study Ouchi (1977) indicated that better knowledge of the transformation processes is associated with less emphasis on output control, except for sales person groups. For this group it was indicated that output control was predominantly used. These findings led him to conclude that the availability of an output measure would influence the emphasis on output control. In addition, the incompleteness of either one of these two factors may contribute to a certain level of goal ambiguity.

The measurability of output is considered to be the ability to determine the value of output with regard to the value of input being used. In the case of a research and development organisation that produces new knowledge, it is plausible to suggest that the organisation may have difficulty on measurability of the output. For this type of organisation the expected benefit resulting from the expected output is difficult to predetermine, and hence would cause goal ambiguity. Furthermore, one aspect that causes a low degree of knowledge of the transformation process is the inability of the organisation to define a relatively clear expected output in the first place. Therefore this condition would also be considered as creating goal ambiguity.

When some operative goals are highly measurable and have a clear means-ends relationship as in situation 1, the goal will be clear. For instance these types of goals are mostly found in production units of manufacturing organisations that utilise either manual processing systems or high technology arrangements. To these types of goals either behaviour or output control can be applied. Some units may have ambiguous goals that are characterised by a high measurability of output, but imperfect knowledge of the transformation process, as in situation 2, or low in output measurability but high in knowledge of the transformation process as in situation 3. For situation 2, the only option that can be applied is output control, and for the case in situation 3 behaviour control can be applied. The case in situation 4 is characterised by highly ambiguous goals, and to this situation neither behaviour nor output control could be effectively applied (Ouchi, 1977, p. 99). The only way to handle this situation is by being ritual rather than rational. Though the organisation will attempt to employ a rational control system by using either behaviour or output control, Ouchi (1977, p.99) suggested that in some situations organisations should accept ritual or ceremonial control as part of their control systems.

An organisation possesses multiple goals, and each goal may contain different degrees of ambiguity, which may partly be influenced by the incompleteness of either the degree of the knowledge of the transformation process or the measurability of output. When an organisation has variety of goals, it may employ control systems that place a different degree of emphasis on each type of control tool (Khandawala, 1972; Amigoni, 1978; Merchant, 1985; Rockness & Shields, 1984).

Some studies that investigated the behavioural aspect of control systems indicated that the failure to match appropriate control systems with goal characteristics may cause undesirable results for the organisation (Hopwood, 1972; Birnberg, et al., 1983; Williams, et al. 1990; Jaworski & Young, 1992).

As found by Hopwood (1972) the cost centre heads who were evaluated under the budget constraint style had the highest job-related tension, poorer relations between peers and subordinates, and greater chance for dysfunctional behaviour compared to those who were evaluated under the other styles. The cost centre heads who were evaluated by the profit conscious style also had high levels of cost and job-related tension, even though the levels were not as high as those of the centre heads who were evaluated under the budget constraint style. Moreover, the non-accounting style was shown as causing lowest tensions compared to the other two styles.

Since the use of financial data was found to create tensions, this financial dimension would be less appropriate in controlling organisations which dealt with uncertainty, particularly research and development organisations. In research and development organisations the creativity of the individual member plays an important part during the organisation's life (Gibson, 1981), and the tension and/or pressure resulting from the control system may reduce creativity and innovation (Abbey, 1982; Gerstenfeld, 1970). Other reasons to disregard the emphasis on the financial dimension for the organisations that dealt with uncertainty is based on its inability to adequately reflect performance, difficulties in defining means-ends relationships, and difficulties to predetermine the expected outcomes (Govindarajan, 1984). The undesirable condition resulting from the emphasis of the financial dimension on control systems would shift the system to a need for other non-financial dimensions (Govindarajan, 1984). The advantage of the use of non-accounting performance was found to cause fewest tensions (Hopwood, 1972), and therefore the use of this style seems to be relevant to organisations which deal with environmental uncertainty.

Hirst (1981) used situational factors to analyse the use of accounting data for performance evaluation. The study attempted to identify the factors that cause pressure or tension that lead to dysfunctional behaviour. He believed that financial measurement is an internal measure which is incomplete and fails to reflect such factors as the environment and interdependency. Hirst (1981) developed an evaluation classification system based on the combination of two factors: *degree of reliance on accounting performance measures* and *task uncertainty*. Each factor is classified into three levels as high, medium and low. The combination of these three factors then forms six different evaluation situations.

Using theoretical analysis, Hirst (1981) argued that the incidence of dysfunctional behaviour, as in Hopwood's (1972) study, was not only caused by different uses of the performance evaluation style, but was also caused by task uncertainty. Moreover, Hirst (1981) suggested that the appropriateness of accounting measurement would increase when task uncertainty decreased. In his later study, Hirst (1983) investigated the influence of task uncertainty on the relationship between job-related tension and budget emphasis. He found that in low task uncertainty situations budget emphasis had a negative relationship to job related tension, and visa versa.

Task uncertainty is likely to occur in jobs that have a less specified structure, and less measurable output. For this particular circumstance, Hirst & Yetton (1984) investigated the influence of accounting data on role ambiguity and job structure between production and non-production jobs. His study was done with 111 managers who were classified into production and non-production categories. It was found that the relationship between the reliance on accounting data for measuring performance and role ambiguity was insignificant for non-production tasks. In contrast, for production tasks this relationship was strongly supported. It was concluded that increased reliance on accounting data to measure performance would reduce the role ambiguity for individuals who were involved with production jobs. Therefore, the use of accounting data for performance evaluation is more sensitive for production jobs than for non-production jobs, and accounting data is a more complete measure for production than non-production jobs.

In proposing the relationship between task characteristics and control, Birnberg et al., (1983) reviewed three models of relationships developed by Thompson & Tuden (1959); Perrow (1970); and Ouchi (1979). The Thompson-Tuden model reflects the interconnection between belief about goals and the process of achieving goals within a decision-making situation. The model used two variables: belief about causation and preferences about possible outcomes, and formed four decision situations. Perrow's model proposed organisational responses to planning and control. The model used two variables as degrees of the analysability of tasks, and task homogeneity. The two variables will create four types of organisational responses to planning and control.

Birnberg, et al. (1983) finally combined these two models and linked them to the control function. The combination model indicates that, when actors believe they understand the task and design the process to execute the task, and if the goals are known, then the planning system would be based on computation, and the control function would be based on comparison process between actual performances to standard. When the task becomes more prone to exceptions or less analysable, which is characterised by the less known goals, then the control function becomes more difficult and tends to focus on aspects that are believed to be important. In relation to the situation where analysability is high, the administrative control of Hopwood (1972) or output control of Ouchi (1979) would be used heavily. In the situation where analyzability is low, the self and social control of Hopwood (1972) or behaviour and clan control of Ouchi (1979) would be significant.

According to Birnberg, et al. (1983) when the choice is of control systems which are developed under the assumption of the perfect world do not match real conditions, managers will manipulate the information through some efforts which were labeled as *smoothing*, *biasing*, *focusing*, *gaming*, *filtering*, and *illegal acts*.

Birnberg et al (1983) examined the possible occurrence of the information-manipulating behaviours under four situations. The four situations are constructed from the combination of two variables: belief in analysability, and belief in measurability and verifiability of data. It was indicated that data manipulation behaviours are very unlikely to occur under a situation of high belief in measurability and data verifiability and high belief in analysabilty. However, data manipulation behaviours are likely to occur under the situation of low belief in measurability and data verifiability and low belief in analysabilty. The implications of their study indicated that the characteristics of the information presented to reflect the action would influence the possibility of the occurrence of the dysfunctional behaviours.

Jaworski & Young (1992) conducted a study on 500 marketing executives to investigate the causal relationship among three contextual variables: goal congruence, perceived peer dysfunctional behaviour, and information asymmetry to create dysfunctional behaviour among managers. In their study, marketing managers were used as subordinates and the peers were the directors of the firms. The model examined by their study is presented in figure 2.3.

Figure 2.3: Dysfunctional Behaviour among Managers.

Please see print copy for Figure 2.3

Dysfunctional behaviour was defined as any action that violates the existing control system rules and procedures. The person-role conflict refers to a condition where the role expectations are incongruent with the orientation or values of the role occupant. Perceived peer dysfunctional behaviour refers to the behaviour of peers which are perceived by the subordinates to be inadequate with regard to the existing rules and procedures. Information asymmetry refers to the excess information possessed by an individual over that possessed by peers.

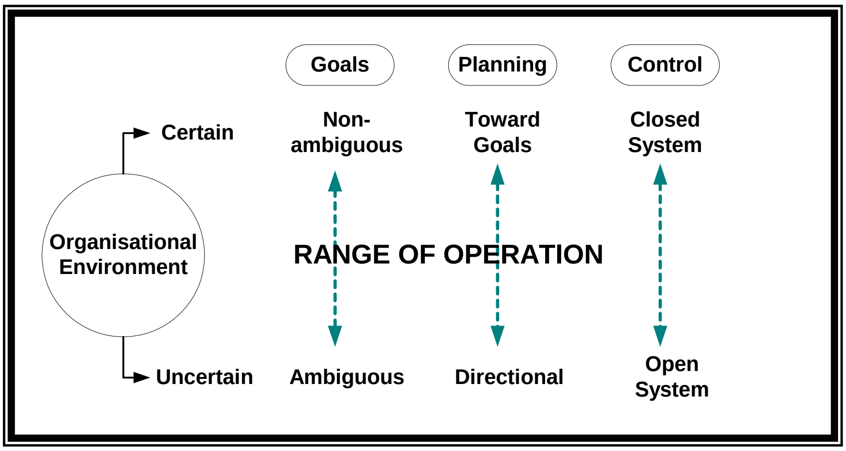
The implication of their study indicated that the effects of the three variables on dysfunctional behaviour were mediated by person-role conflict and job tension, and that perceived peer dysfunctional behaviour had a direct influence on individual dysfunctional behaviour. More importantly, goal congruence was found to play an important role in reducing dysfunctional behaviour. When the goal was internalised by members of the organisation, their behaviour would be likely to correspond with the activities that were required by the organisation, and therefore would decrease dysfunctional behaviour.

Summary

Two types of environmental measurements are found from a review of the literature: structural and perceptional environmental uncertainty. However, the appropriateness between the two in examining the impact of environmental uncertainty on organisational functions is still inconclusive. Most of the studies presented in this review indicated that organisational environment may be distinguished into internal and external dimensions. Using this prescription, then, the structural features may be characterised by the external environment, whereas the perceptional may be on the internal side. These two dimensions may interact with one another, and construct environmental uncertainty.

Environmental uncertainty is found to have impacts on the organisational functions. However, most of the reviewed studies seem to ignore the role of goals and planning to mediate the influence of environmental uncertainty on the choice of management control systems. The organisation may not be able to influence entirely the external environment; rather it has to suit its strategy which consists of designing the organisational functions including goals, planning and control systems to adapt to the situation required by the external systems as presented in figure 2-4. Therefore a further study which using more contextual variables simultaneously is needed (Chenhall, 2003).

Figure 2.4: The Choice of Organisational Setting in relation to Environmental Conditions



The next chapter of the thesis will present a review of the literature on Research and Development (R&D) organisations and discuss their characteristics.

CHAPTER THREE

Research and Development Organisations

Introduction

Research and Development (R&D) organisations experience different environmental conditions compared to non-research organisations. The tasks in a R&D organisation are not repetitive as in most manufacturing companies. R&D activities are expected to contribute new knowledge whether or not they have specific commercial objectives such as to create new or improved devices, products, process systems, and concepts. Since the purpose of R&D is to develop new knowledge, it is suggested that R&D units would deal with uncertain and rapid change situations. The nature of R&D units as mentioned above would require employees such as scientists and researchers who are used to deal with the unknown, as well as organisational climates and structures, goal setting, and planning systems suited to the research environment. Also required would be a different type, or emphasis, in the choice of organisational functions including control systems.

This chapter consists of a review of R&D organisations in seven parts. The first part is a discussion about the nature of the R&D organisation. The second part is about the process of the R&D activities, followed by R&D goal setting in part three, and organisational planning systems in part four. Part five presents a discussion of management control systems in R&D organisation. Part six presents a discussion of the personal characteristics of scientists. Finally, the chapter will close with summary.

The nature of R&D organisations

R&D activities can be seen from different perspectives. Roussel, et al. (1991), for example, put R&D operations into known and unknown areas by placing the quality of expected technology output as the boundary of the two distinct areas as presented in figure 3.1. The R&D operation may be undertaken within known and/or unknown science and engineering areas. These two areas are separated by a line called State of Art (Technological Quality) that represents the boundary between the known and unknown knowledge.

Figure 3.1: Relationship between degree of uncertainty and technology quality

Please see print copy for Figure 3.1

Since the R&D function operates in unknown areas such as at point A, this type of operation was called by Roussel, et al., (1991) fundamental R&D. In this type of R&D operation, uncertainty is high and confidence of probability of success is impossible to calculate (Roussel, et al., 1991, p. 81). Moreover, this situation at best refers to decision under uncertainty rather than risk. When the R&D function operates at point B, which is situated close to the State of Art line, the uncertainty is less compared to point A. Although the technical risks are still significant, it may be possible to calculate the confidence of probability of success (Roussel, et al., 1991, p. 81). For this particular situation, the R&D operation may be where research can be applied to possible product development. The output of the operation can be seen as patent and/or patent application. In addition, the operation in this area of the diagram may involve a large investment compared to point A. This investment is for research as well as for development activities. The operation of the R&D function at point C deals with more certainty regarding the output, less technical risk and higher probability of success compare to operation at point A and B.

The relationships among those three R&D functions may also be explained through Figure 3.1. The effort that is done at point A to discover the unknown technology would result in enabling the organisation to possess the knowledge as situated at point A1. The knowledge obtained from activity A would give direction for R&D activity as depicted at point B. The result obtained from activity would give knowledge to the organisation as located at point B1. Since the knowledge at point B1 is already in hand, the company may conduct subsequent R&D operations that are represented by point C, and would position the company at point C1. Another explanation that arises from the diagram in Figure 3.1 is that, the closer the organisation is situated to the bottom line indicates that the technology possessed is obsolete and would have little value in respect to competitive advantage. In contrast, where the organisation is located far from the bottom line, the higher the technology quality possessed by the organisation, the better the value in respect to competitive advantage. However, it should be kept in mind that the purpose of this diagram is to simplify the situation held by a R&D organisation. It does not ignore other R&D operations that may be positioned at points other than those three points.

Three types of R&D operations may exist in the known and unknown science and engineering areas (Roussel, et al., 1991, pp. 16-17). First, incremental R&D, which refers to small advances in technology, but big in development, such as improvements in the manufacturing process to reduce manufacturing costs. Second, radical R&D, is related to a large enhancement of the scientific foundation as well as translation into practical matters. Third, fundamental R&D, which refers to large research and no development.

The US National Science Foundation (NSF) used a different and more formal approach and defined the R&D task as falling into three categories (Rockness & Shields, 1984, p. 169):

> Basic research: Original investigation for the advancement of scientific knowledge not having specific commercial objectives, although such investigations may be in fields of present or potential interest to the reporting organisation.
>
> Applied research: Investigations directed to the discovery of new scientific knowledge having specific commercial objectives with respect to products or processes.
>
> Development: Technical activities of a non-routine nature concerned with translating research findings or other scientific knowledge into products or processes.

Accordingly, Nason, et al., (1978, cited in Nason, 1981, p. 23) found that only 35 from 179 respondents actually used the NSF definition. This finding led Nason (1981) to question the appropriateness of the NSF definition. Nason (1981, p.23) suggested that the classifications of the R&D functions were tailored to the individual organisational structure and function.

Place (1977) used a different view by looking at R&D activities from the point of view of the purpose of each R&D activity. The product of successful research and development is knowledge designed to create societal change. The aim of basic research is not to create societal changes but to improve understanding in a particular area of scientific knowledge that the scientist is examining. Therefore, the output of basic research is knowledge that is usually published and from that, technical effort to create societal changes may arise. The aim of applied research is similar to basic research in that its aim is to create new scientific knowledge, but applied research is more concerned with the utility of the new knowledge to fuel societal changes. Therefore, the output of applied research is not evidenced by scientific publications, but is more likely to be patent applications or new products and processes. Applied research is complex, in that the researcher must be motivated by science as well as the utility to the society. Society requires consideration of the impact of various non-technical factors such as the environmental, political, regulatory and economic factors (Place, 1977).

As the output of R&D activities is knowledge, it involves a learning process to gain the knowledge. According to Place (1977, pp., 19-20) there are two types of learning process resulting from the R&D activities; type I and type II learning. Type I learning is the extension of present areas of knowledge, it is more certain and predictable. The program of Type I learning can be scheduled and budgeted for even if it requires a longer time and larger investment. This learning may be found in applied research but more likely is in product development that uses a variety of inputs to support the operation (Place, 1977).

Type II learning requires an intuitive leap away from the present areas of knowledge, that is brand new knowledge. It cannot be kept on schedule and budget. The program is exciting and rapid, and demands a relatively small investment. Though it is difficult to place a clear boundary between basic and applied research (Nason, 1981), the type II learning process is likely to occur during the basic research function up to applied research. As the task of basic research is to contribute to the development of the science, the investigation for example, may be done on the behaviour of a particular chemical substance or a particular insect by applying a trial and error mechanism in the laboratory. Those tasks can be done at the laboratory level and need small investment, they would be difficult to keep within schedule and budget (Place, 1977).

Regarding applied research, as its objective is to fuel societal change by the creation of new scientific knowledge as well as the utility of that knowledge to the society, then it would possess those two types of learning (Place, 1977). However, the emphasis of the effort of applied research may vary along the way from basic research to product development. When the applied research effort is closest to basic research, the emphasis would be on type II learning, whereas if the effort were closest to product development, the emphasis would be on type I learning. It could be said therefore, that type II learning will occur within the process of developing the ideas in which the new ideas produced would be used as a direction for the project, whereas the type I learning would predominantly occur during the project life cycle.

The R&D operation is clearly a learning process to transform the unknown to the known. Smart management is needed to turn the advanced knowledge into a viable business project. Type II learning occurs mostly in the R&D operation within the unknown areas, while Type I learning mostly occurs in the known areas. However, any R&D activity starts with an idea. The idea is then developed to become concrete proposals, which may be stated as hypotheses. Then the proposals are chosen for execution. In the execution process, it is a matter for the experimental program to confirm or modify the hypotheses. In the stage of developing an idea, it needs innovative scientists who have a clear understanding of the goals of the organisation. The idea may then become a sub-goal of a particular project. During the project execution, the hypotheses are tested and modified and finally produce knowledge. The utilization of this new knowledge needs innovative scientists and management to interpret the expertise and translate it into viable business projects. In any of those situations described above, it seems that to be successful a R&D unit needs its employees to have innovative behaviour. Innovation in this case is not limited to the development of the existing product, but also a breakthrough in new knowledge to benefit the entire business. The behaviour may be different from those assumed by administrative behaviour that tends to be bounded by rigid rules and procedures. The scientists might require a fair degree of autonomy (Abernethy & Stoelwinder, 1991) to give them a space for innovation. As the scientists are the most important assets of R&D units (Twiss, 1992; Jain & Triandis, 1990), more understanding of their behaviour is needed to be able to manage the task in the R&D organisation.

The Research and Development process

According to Roussel, et al. (1991, p. 67);

> R&D produces one product only - knowledge. True, it is knowledge with a purpose, but it is still just knowledge. R&D does not produce sales, earning, or cost reduction. It does not produce physical product for sale or an operating process. It does not produce a new business. Nor does it produce quality. However, R&D does produce the know-how at the foundation of all of these other results.

The product of R&D will benefit the business unit, only if the management in the business is able to interpret it and turn it to the objective of the business. According to Tiedemann (1982) there are three types of R&D process implemented in industry; the pipeline model, the systemic model and a combination between the two. The Pipeline model (figure 3.2) describes the process, by linking different activities.

Figure 3.2: The Pipeline Model

Please see print copy for Figure 3.2

The Systemic model as presented in figure 3.3 describes the process as a system that consists of various sub-systems as different activities that interact one to another and focus more on the interaction among activities rather than the R&D process itself.

Figure 3.3: Systemic Model

Please see print copy for Figure 3.3

In the combination model, the activities in the pipeline model are considered sub-systems, which interact with preceding and subsequent activities by input/output interfaces. Though Tiedemann (1982) did not describe the combination model in a more detailed manner, this study proposes the model as depicted in figure 3.4, as will be used for the discussion of the process of innovation.

Figure 3.4: The Combination Model

Please see print copy for Figure 3.4

The aim of using this model is to simplify the complex activities of R&D, but it does not mean to ignore the preceding and subsequent interface with other units within the organisation, rather to use units that seem closest to the R&D function. For example, the product that will be developed must be related to forecast market demand. The information about a particular product that is demanded by customers can be collected from the marketing unit. Therefore, the interaction between these two units is very important; otherwise poor relationships may cause a project to fail. Similarly, the product of R&D functions should be transferred to the production unit and should be able to be produced within cost constraints. As indicated by Baker et al (1986, p. 33) there are four situations, which may make the R&D project more likely to succeed:

- A relevant business need, problem, or opportunity has been clearly identified.
- An appropriate scientific or technical approach has been matched with the need, problem, or opportunity.
- The project results can be transferred to an internal user.
- The internal user can produce, market, distribute, and sell the resulting product.

In a similar vein, Dumbleton (1986, p. 7) pointed out that,

> …the problem of innovativeness deals with the processes within R&D and with the interaction of R&D with the external environment of the company. The other problems deal with the interface between R&D and the marketing, manufacturing and other groups.

It can be said that the success of R & D activities relies upon two major factors, external factors and internal factors, and suitability of internal factors to fit the demands of external factors. External factors refer to how well the R&D units identify the outputs demanded by the society and incorporate them as constraints or objectives for the R&D project. These constraints encompass the impact of environmental, political, regulatory and economic outcomes. Internal factors refer to how well the R & D sub-unit is being managed which may focus on setting the system that encourages an innovative environment.

According to Gambino & Gartenberg, (1979, p. 44) there are 14 sources of ideas for a research project:

> (1) the R&D department, (2) the corporate planning department, (3) president of the corporation, (4) competitors' activities, (5) marketing functions, (6) salesman, (7) outside consultant, (8) outsider selling an idea, (9) engineering department, (10) bench scientist working on a project, (11) quality control department, (12) plant management, (13) the government, or (14) employee suggestion boxes.

It could be said that the success of R&D activities transferred to business activities rely on the ability of the scientist to interpret the results of basic research, applied research and product development. The scientist must be able to interpret and transform the result of basic research into applied research by considering its utility to meet the society's need as well as science. Then, the success of product development activity also needs the ability of the scientists or engineers to interpret and translate the result of applied research into a technical application. Even if the output can be interpreted and translated into a technical application, it will also take time for other phases such as production, and selling of which to translate the new product into benefits for the organisation.

R&D Goal Setting

Since basic and applied research involve type II learning (Place, 1977) then it would be difficult to define clear and measurable goals in advance. The only thing that can be stated in advance is the direction of the activities. Along with the direction, various sub-goals can be tentatively defined, and from that, the commercial function can be started.

The R&D operation begins with ideas, and then the ideas are set out in proposals. The proposals are selected by the management team who will define the proposals that are qualified to be set as a project that would be financed. Before the ideas become the sub-unit goals, the ideas are selected that fit with the organisational system goals that are commonly vague (Georgiou, 1973; Otley, 1980; Daft, 1983). The ideas are commonly not measurable accurately in financial terms. Therefore, the process of selection may involve subjective judgment, and rely heavily on the ability of the selector to interpret the value of the new ideas to the future of the organisation. Pinto & Slevin (1989, p. 33) described four stages of the R&D project life cycle as:

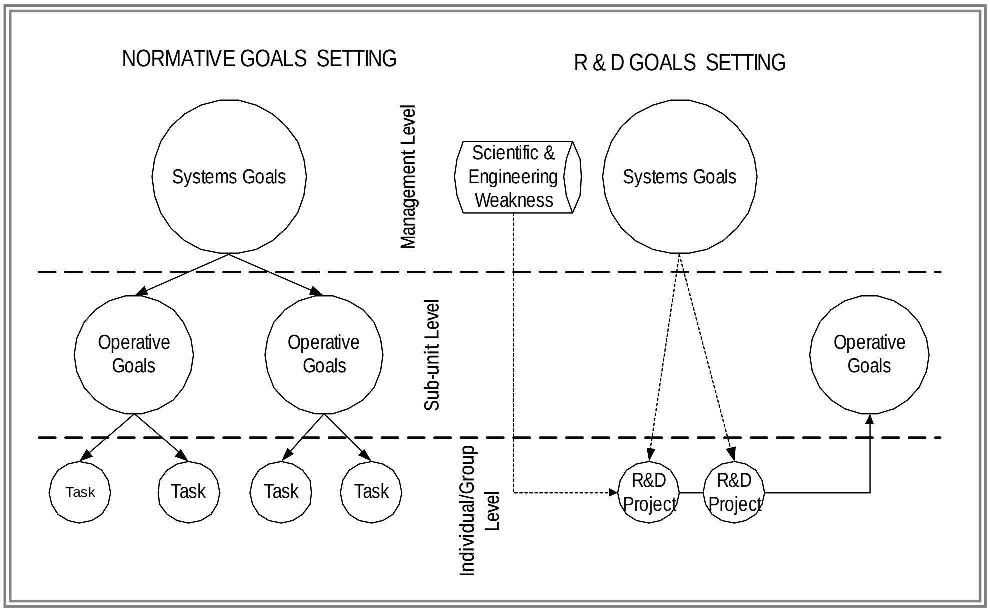
> Stage I-The conceptual stage involves the initial determination of a need for a project. Preliminary goals and alternatives are specified as well as the possible means of accomplishing the goals.

> Stage II-Once goals have been agreed upon, a more formal set of plans is developed in order to accomplish these goals. These activities often involve the definition and allocation of specific tasks and resources.
>
> Stage III-The actual 'work' of the project is performed during the execution stage. Materials or resources are procured, the system or project is produced, and performance capabilities are verified.
>
> Stage IV-Once the project is completed; several final activities must be performed, including the release of resources and transfer of the project to the clients, as well as the reassignment of project personnel. There is often some form of project review and evaluation to assess relative successes and failures, their likely causes, and possible corrective actions in case they occur again.

The implication of the nature of R&D organisation is that the goal setting for sub-unit goals of this particular organisation is different from non-R&D organisations such as production units. The goals are primarily developed from innovative scientists suggesting novel programs for the consideration of strategy making groups or in response to broad goals of the strategy making groups (Gambino & Gartenberg, 1979). It should be kept in mind that the information from other units may be used as direction for the R&D function, and then the scientists in the R&D unit propose the research project in the light of the organisation’s desired direction.

The goal setting process of R&D and non-R&D organisations is at best illustrated in figure 3.5. The proposal consists of a hypothesis to be tested (Place, 1977) that focuses more on the system goals rather than other sub-unit goals such as the marketing and production unit. During the project execution the hypothesis is tested and modified, where applicable as found by Davila (2000, p. 388). In this stage, the action is a process of action that would at best be referred to as a process of searching for the goals rather than goals' attainment (Cooper, et al., 1981) particularly at the stage of basic and applied research. The quality of goals presented in the proposal is only a direction of action rather than a concrete product that should be attained which is characterised by high uncertainty as to what should be achieved. Again either basic, applied research or product development and whether it operates in known or unknown technological areas, the output is information, and it will be used as a direction for other functions such as product design, and production to develop their sub-unit goals.

Figure 3.5: Normative and R&D Goal Setting Process



The action in searching for goals may circle several times in testing and modifying the hypotheses until a particular level of knowledge is achieved. This action reflects a process of rapidly changing goals in terms of directions of action (Davila, 2000). As the rapid change of goals are highly uncertain and characterised by direction quality rather than measurability then, these types of goals may require different planning and control systems.

Another problem with financial goals is the time lag for the return of the investment in the R&D function. It may also place a boundary to limit predictability, as was found by Ravenscraft & Scherer (1982) to be on average from four to six years. The difficulty of defining the output of R&D operations in the first place and the long time to receiving the benefit from R&D operations requires goals that may only be used as a cloudy direction of action rather than as concrete goals that can be used to assess the achievement that is assumed by normative theory.

Organisational Planning System

The R&D organisation may have a difficulty in employing planning systems that are designed to achieve clear and measurable monetary goals that have been set up in advance as in normative planning systems. Because of the nature of basic research projects, the goal characteristics cannot be defined precisely in relation to financial measurement. Its goals would be dominated by the directional feature dimension rather than the quantitative measure. Further, the objects found along the planning cycle of basic research projects may be used as new directions for other basic or applied research projects. Suppose the subsequent project is on an applied research project that would also be dominated by directional features then the planning cycle will also be searching for a new direction for product development projects rather than a precise description of the desired output and its financial values to benefit the organizations. Similarly, product development planning is to achieve know-how to implement the scientific achievement into a product or process.

Since the output of applied research is taken as a direction of the product development function, a new planning cycle would take place. The execution of the product development function may involve various stages before the outputs can be shifted into production including laboratory testing, product design, and product testing (Gibson, 1981; Tiedemann, 1982). At the earlier stage of this process, such as in the laboratory-testing phase, the desired output is still unclear and difficult to be measured by monetary measurement (Davila, 2000). For this situation, the planning toward direction as described by McCaskey (1974) may still be appropriate, and the control function would still emphasise on input and behaviour control. However, since the laboratory testing is done continuously, a more clear set of outputs would be found.

When the characteristic of the desired outputs has been found, the product design phase can be started and will be followed by product testing. During the phase of product design and testing, the description of desired output is clearer as well as the potential financial benefit. Therefore, though the planning system would still employ directional planning, the use of the financial measure by the control system would be considered to be significant. The financial measure in this case may be used to analyse the approximate cost of a desired product to compete with the competitor’s products and price in the market. However, in relation to the implementation of output control to facilitate performance measurement in this stage, the balance between financial and non-financial measurement should also be considered to be important. Since the output of product development has been transferred to the production function, the goals may be capable of being clearly defined and planning with goals can be applied. For this situation, the financial dimension may be considered to play an important part in the control system.

Studies by some authorities are indicated to support this situation. For example, a study by Karagozoglu (1993) based on seventy-five samples indicated that the managers of the companies rely on intuitive informal strategic plans rather than a formal and sophisticated plan. Davila (2000) found that managers in a R&D project employed contingency planning. The actual planning was not well understood, and the manager kept the uncertainty until the time development effort achieved a certain degree, rather than replace the plan with a more formal plan.

Management Control systems

The characteristics of R&D activities are different from those assumed by the traditional control concept. The long period demanded from means to achieve ends may cause that feedback information for corrective action to be useless. Furthermore as a learning process, that is expected to produce knowledge, the R&D goals are characterised by a qualitative feature and can only be used as a direction of action. Moreover, as a learning process (Place, 1977), it deals with uncertainty and rapid changing of direction of the field being studied (Twiss, 1992), and may take a long period before the resulting benefit can be enjoyed by the entire organisation (Ravenscraft & Scherer, 1982). These characteristics then may be insufficient for developing a standard of assessment. Using these arguments therefore, the practice of a control system in a R&D organisation may be unlike those that usually found in management and accounting literature.

First stage control

The control process in a R&D organisation may have taken place prior to the execution of the project. However, the construction of the control function needs to provide encouragement for creativity and would be more tangible since the ideas have been presented in a project proposal. The first tangible control process that can be seen in a R&D project cycle is the selection of the proposals. Gambino & Gartenberg (1979) proposed a form of research proposal as depicted in figure 3.6.

Figure 3.6: Research Assignment Form

Please see print copy for Figure 3.6

According to Dumbleton (1986), the proposal should be accompanied by an *activity list* that provides a detailed program of the steps that will be undertaken by the project proposed. He suggested that the activity list can be presented by one of the following techniques; a Flow diagram, a Gantt chart, or a PERT diagram (Dumbleton, 1986, p. 251). The activity list is expected to reflect the logical steps that will be used by the project team, and the degree of understanding of the researcher of the field being studied.

Once the project proposals have been lodged, the next process is to choose the required project. According to Gibson (1981, pp. 291-295) there are five groups of project selection methods: Ranking, Scoring or Rating, Economic Rating, Formal Optimization, Risk Analysis and Decision Analysis method.

The Ranking method was described by Gibson (1981, p. 291) as,

> a ranking procedure can be as simple and intuitive as the reading and ordering of the decision packages by an experienced manager with no explicit explanation of the criteria or weightings used. ...It is also possible to develop more elaborate ranking schemes such as ‘Q-sort’, ‘dollar metric’, ‘standard gamble’, and the like. The central principle of all ranking methods is a pair wise comparison.

The Scoring or Rating method procedure places a score or weight on each criterion depending on its level of importance. Every proposal will be assessed with regard to the highest level of the total score. The Economic Rating method is an extension of the scoring or rating method, but in this method consideration is much more involved with financial criteria such as Net Present Value, and Internal Rate of Return. The Formal Optimization method is a package of computer programs that involves various optimization techniques such as linear and non-linear programming, dynamic programming and so on which was rarely used in a practical situation (Gibson, 1981, p.295). The Risk and Decision Analysis method is a model of the logical thought decision-making process. The management thought process is put into a series of decision steps, and then possible outcomes would be calculated. Although these methods are of academic interest, in practice they are also rarely used (Gibson, 1981, p. 295).

According to Gambino and Gartenberg (1979, p. 49) there are two types of degree of success that should be considered, technological and economic success. However, it should be noted that, technical success only is important for research activity and it is not so significant for development activity (Gambino and Gartenberg, 1979, p. 49).

According to Mansfield (1981, p. 100) the economic success is a function of three separate factors;

> (1) The probability of technical success, (2) the probability of commercialization (given technical success), and (3) the probability of economic success (given commercialization).

It seems that those selection methods should be used with caution particularly when the existence of a R&D project is attempted to be connected to economic criteria as reflected by the Economic Rating method. The stage in which the R&D operation is located may be used to indicate the appropriate criteria that should be used. For example, when the stage of the R&D operation is dealing with the achievement of technical success, the use of economic criteria would be less appropriate. However, since technical success has been obtained, the effort moves toward the achievement of commercialisation, and the use of economic criteria starts to be significant.

At the organisational level, economic success relies heavily on the budget rationality, which is described as follows:

> From the rational view, budgets can be understood as a master plan for action in ensuing periods of time. Explicit in such a model of budgeting is the notion of the budget as a quantitative expression of organisational goals. In its implementation, the standards and targets embodied in the budget are utilized as control devices to channel and co-ordinate action to lead (ideally) to the realization of the budgetary goals in terms of some financial representation of organisational fitness (Cooper, et al., 1981, p. 180).

However, it could be argued that budget rationality is not the only alternative in making decisions. Prior to economic success, the project should have achieved technical success, and then through another exercise the probability of economic success will be predicted. Apparently evidence provided by the study of Twiss (1992, p. 166) of seven major Japanese companies indicated that none of those companies was found to use a financial estimation method as a basis for a project selection decision. Unfortunately, in his study (Twiss, 1992) did not describe the type of R&D functions where the samples operated.

Though the provision of a budget to finance the R&D function must suit the financial policy and condition of the organisation, however, to rely heavily on an economic rating method in selecting the proposal may not capture long-term privilege of the organisation. Nevertheless, there are five budget-setting models for a R&D organisation mentioned by Dumbleton (1986): *Competitive Comparison, Fixed Relationship to Sales*, *Fixed Relationship to Profit*, *Reference to Previous Levels of Spending*, and *With Reference to Projects*.

The *Competitive Comparison* method uses the competitor's budget as a comparison in approving its budget. This information can be taken from the PIMS database that consists of R&D expenditure data and ROI (Return on Investment) information from over 200 companies (Dumbleton, 1986, p. 212). The *Fixed Relationship to Sales and Profit method* uses the proportion of the budget, which is tied to the level of sales and profit. With the *Reference to Previous Levels of Spending* model the budget is set to pay some degree of attention to the last year's spending, and *With Reference to Projects model*, the budget is set in relation to the list of the projects agreed to be funded.

As in economic rating, the projects are selected with regard to particular economic criteria such as, NPV (Net Present Value), IRR (Internal Rate of Return), Payback Period and so forth. Some evidences can be found for the use of financial techniques in selecting a R&D project (Liberatore & Titus, 1983; Mansfield, et al., 1971). The study by Liberatore and Titus (1983) of 29 major US firms and their product development activities indicated that all of the respondents used only a few of those financial analyses for the screening and evaluation of R&D projects. Mansfield, et al., (1971) conducted a survey of nineteen laboratories in chemical petroleum firms and indicated that the Rate of Return was the most likely technique. However, it was noted by Mansfield, et al. (1971, p. 48) that,

> to prevent misunderstanding, it is important to note that the laboratories where these techniques are used do not rely entirely on them to select projects. On the contrary, intuition and 'gut reaction' seem to continue to play a very important role. Moreover, these techniques are much more often employed in the connection with development than with research. Where these quantitative techniques are used, it is difficult to tell how significant they are in the decision-making process.

Another study conducted by Breadsley & Mansfield (1978) provides evidence that the use of financial techniques to forecast the expected profit from the R&D function should be made with caution. Breadsley & Mansfield (1978) conducted an empirical study of the accuracy of profit forecasts from a R&D project in one large firm from 1960 to 1964. The typical functions of the R&D operation examined were distinguished into two types, new product and new process.

They indicated that the accuracy of forecasting profit from the initial plan only achieved 25% in 1961 for new product development. The initial forecast of total discounted profits from new processes was only accurate to 40% below the actual figure. The inaccuracy of the forecasting was considered to be influenced by the inherent uncertainty involved in estimating the profitability of an innovation (Breadsley & Mansfield, 1978, p. 133). The implication of the study indicated that the use of financial forecasting for the R&D function could be worse than better. As it is noted by Breadsley & Mansfield (1978, p. 133) that "...the initial forecasts of the profitability of a new product or a new process are no more reliable than forecasts of development cost and time."

For the purpose of selecting a R&D project it seems that the use of costs and benefit analysis would be less appropriate particularly at the basic and applied research phase as mentioned by Dumbleton (1986, p. 224) that,

> …estimates made at the beginning of the project are apt to be highly inaccurate. Estimates improve as the project progresses, as the technical problems become more apparent, as the product becomes better defined so that manufacturing data as to cost and sales performance become clearer and because economic factors can be better assessed.

Since the above evidence indicated the decision makers were not relying heavily on the financial forecasting, other criteria to evaluate and select the project proposal are needed. The study by Gambino & Gartenberg (1979) found that there were two major approaches that were commonly used in selecting a R&D project; the qualitative and quantitative approaches. Alternatively, political consideration may also be used in selecting a research project particularly in government sector. The qualitative approach is based on individual judgment that is influenced by prior experience and committee decisions or both. This approach is commonly used in basic and applied research. For example, Henriksen and Traynor (1999) found the use of qualitative approaches in basic laboratory research. Since the expected output is clearer on development than basic and applied research project, the quantitative approach may be used. The quantitative approach uses various mathematical equations that consist of predictions and presumptions about particular factors as found by many authors such as, Hsu et al. (2003) in Taiwan, Lawson et al. (2006) for small to medium enterprises in UK, and Chiesa and Masella (1996) in Italy.

Twiss (1992, p. 131) proposed five groups of the most important criteria other than the use of cost-benefit analysis in selecting the project:

1. Corporate objectives, strategy, policies and values
2. Marketing
3. Research and Development
4. Financial
5. Production.

The *corporate objectives, strategy, policies and values* refer to four sub-criteria such as corporate image, risk aversion, attitude to innovation, and time gearing. The corporate image is related to the strategic objectives of the organisation to define the position of the organisation to be perceived by the customers. The organisation may choose for example a position as a producer of high quality and/or high technology products. This image would be consistent with the choice of the effort of the R&D operation. Risk aversion is related to the attitude of the top management toward risk. Similarly, the attitude to innovation is related to the desire of the top management to operate the R&D function. Time gearing is related to short or long-term orientation used by the organisation of its operational goals.

The *marketing* criterion consists of ten sub-criteria (Twiss, 1992, pp. 132-141) as follows:

1. Customers' needs
2. Estimated sales volume
3. Product life period
4. Probability of commercial success
5. Time scale in launching the product and its relationship to market plan
6. Effects upon current products
7. Pricing
8. Competition
9. Distribution channels
10. Launching costs.

The *research and development strategy* criteria is related to the total activity that would be performed by the R&D units that consists of seven sub-criteria: Consistency with the R&D Strategy, Probability of technical success, Development cost and time, Patent position, Availability of R&D resources, Future development, and Environmental effects.

The *financial* criterion is related to the availability of the funds that should be provided by the organisation if the project is executed. This criterion was divided into two sub-criteria such as Cash Flow and the Effect of the proposed project financially upon other projects that requiring finance.

The *production* criterion refers to the condition that would be dealt with by the production unit if the output of the product development is achieved such as manufacturing capability, cost of manufacture, and value added in production.

Batty (1988) provided evidence from an international group company that may be used to indicate the contrast in the usage of cost-benefit consideration in selecting the project under the fundamental research and product development. The company being studied by Batty (1988) was primarily a producer of electrical and domestic products. The R&D activities consisted of three specific areas such as: Fundamental research, Multi-use components and Components or materials development e g. integrated circuit or semiconductor development. The project selection criteria for fundamental research were related to areas of work and the negotiation process (Batty, 1988, p.221). The area of work was used to select whether the topic proposed was within the areas of interest of the organisation in which it is categorised into materials or components' area of study. The negotiation process required the ability of the researcher to convince the decision maker of several aspects including: (a) relevance and need for the project; (b) commitment required; (c) methods of tackling the problem; (d) an approximate time scale for results, usually on a stage-by stage process. It could be said that, under this type of research financial criteria are less involved, if any; they would be used merely as a financial constraint. This was mentioned by Batty (1988, pp. 221-222) that monitoring took place when

> …the progress reports are called for and stage scheduling encouraged to identify those phases with greater problems. Probable outcomes are not evaluated, nor are benefits, either directly related to projects or spin-off.

However, under the other two activities as in multi-use component and component or material development, the selection criteria involve the market possibilities that are related to economic criteria (Batty, 1988, p.222). The selection of the project under multi-use components is determined by market intelligence, consumer use and the desire to improve technological performance. The project under product development is selected based on a full analysis from market research, production or modification of specifications, and from market intelligence of competitor's products.

Salasin & Bregman (1983) conducted a survey of the management practices in the US Federal research program. They found planning in basic research was less intensive in employing cost benefit analysis (Salasin & Bregman, 1983, p.160), which means that since the relatively accurate prediction of the financial benefit cannot be reached the involvement of cost benefit analysis would be less appropriate.

Rockness and Shields (1984) investigated the organisational control framework in R&D units by using Ouchi's control framework of input control, behavioural control and output control. Input control refers to personnel selection and training process, and expenditure budget. Behavioural control refers to bureaucratic control such as standard operating procedures and technical scheduling control such as PERT and CPM. Output control refers to internal markets such as transfer pricing. They indicated that the importance of the control framework varies with knowledge of the transformation process. It was found that input controls appeared to be most important when there was little knowledge of the transformation process, whereas behaviour controls such as rules, procedures, PERT and CPM, were most important when there was a high level of knowledge of the transformation process. Furthermore, they found a limited support for the association between the importance of output control and measurability of the output.

From the discussion above, it could be said that the application of first stage control as occurs in the project evaluation and selection phase plays an important role in the total control system of a R&D organisation. However, when the control process is a matter of comparing something with something else (Ouchi, 1977), and the process of action contains unclear characteristics of the desired output and less knowledge of the transformation process, the control process is crucial.

Being highly uncertain, financial aspects such as budget setting may be an ex post justification rather than an information input (Cooper, 1981), and the budget may be a supporting device rather than a yardstick. However, when the expected output becomes clearer and relatively measurable, the cost benefit relationship can be better assessed. In this situation, the role of the budget may reflect the situation as viewed in the rational model. This analogy may be transplanted to the situation of a R&D operation that varies along the continuum from basic research to product development. It is suggested that there is a different degree of association of the project objectives and the organisational financial objectives between a basic and an applied research project compared with a product development project. The differences may be caused by the different distance of each R&D function to the expected benefit that may result.

As the purpose of basic research is to produce a scientific finding rather than a financial benefit, the association between the project objective and the financial objectives may be a difficult link. The purpose of the applied research is to strive toward the achievement of scientific finding as well as the possibility of financial benefit. However, there are several long steps that involve high degrees of uncertainty and risk that need to be passed before the financial benefit is attained. These steps include product development, technical design, production and sales. Though the connection between the project's objectives and the financial objectives in applied research is clearer than basic research, the degree of predictability of the expected benefit may be far from accurate. This circumstance may make high reliance on the use of models that emphasise financial measurement in selecting the proposal seem less appropriate. In the product development, the characteristics of the required output may have been clear. This phase may deal with high risk rather than high uncertainty. Under the product development phase, the cost-benefit relationship is more predictable; therefore, the cost-benefit consideration in evaluating and selecting the proposal may be more appropriate for this stage.

Second stage control

During the project duration, it is necessary to ensure periodically that the project remains within the desired boundaries. Since the R&D activities deal with task uncertainty, technical problems may occur along the process, and may modify the assumption stated at the beginning of the project. Consequently, the project plans, the time span, and the resource needs may have to be reassessed. Therefore, during the project duration the second stage of control systems may exist.

The control function in this stage may be facilitated by feedback information that produces regular reports about 'what has been done' and 'how far the project has gone'. During the project’s operation, the financial data and the activity list may be used to monitor how the work is doing by comparing the actual performance with the initial planning. During this time, the control system would execute behaviour control that treats significant variances as an occasion for making a corrective veer with a view to decide whether to terminate, postpone or continue a project, rather than to use the initial plan as a rigid standard with which the project should comply.

The study of Gambino and Gartenberg (1979) indicated that periodic reporting is essential to a good management accounting system. From one of the firms they interviewed, they found a relatively complete cycle of internal financial reporting that seem to emphasise the reports of actual and budgeted hours and dollars. The project hours report as depicted in figure 3.7, stated the budgeted and actual hours for each division. The hours column indicated the hours budgeted for all the projects under each division, the next column showed the hours for approved projects, and the Balance column indicated the hours available for future research.

Figure 3.7: Reports of R&D Project Hours

Please see print copy for Figure 3.7

The expense report contains monthly actual and budgeted dollars and hours. This report is issued by several levels as individual location, all locations, and the section. The all location report would accumulate and combine all the individual location reports into one report, and the section report would combine a number of projects under one manager or group leader. Then, these reports will be accumulated into a divisional summary as depicted in figure 3.8 that presents the cumulative actual hours, labour burden and outside services for all the projects under the division.

Figure 3.8: Research Project Expense Report: Divisional Summary

Please see print copy for Figure 3.8

The activity report contains the research project expense summary with hours and dollars as depicted in figure 3.9 and 3.10, and the performance report contains a comparison between actual and budgeted expenses (figure 3.11).

Figure 3.9: Research Project Expense Summary-Actual Hours

Please see print copy for Figure 3.9

Figure 3.10: Research Project Expense Summary-Actual Dollars

Please see print copy for Figure 3.10

Figure 3.11: Performance Report

Please see print copy for Figure 3.11

Though it was found that the variances were not used to determine the inefficiencies as in a production unit, it seems that to some degree the financial control was relevant to the control of the R&D project. The budget control was used simultaneously with the time schedule, which was provided by the activity list.

The survey by Pinto and Slevin (1989) of 159 R&D projects indicated project schedule or plans and monitoring or feedback to be critical for the success of project implementation. Lindsay (1971, p.63) provided evidence of the usage of accounting information for the R&D project in Owens-Corning Fiberglass Technical Centre, which maintained the following series of monthly reports:

1. General Ledger Account Expenses
2. Project Allocations
3. Project Cross-charges
4. Summary Research and Development Costs
5. Projected Annual Research and Development Costs

General Ledger Account Expenses would present current monthly expenses and year-to-date expenses. This report would be used to develop a monthly budget for each cost centre and to determine the significant variances that occurred between the budget and actual expenses. However, Lindsay mentioned (1971, p. 63) that "...it is more important to be able to explain and know the significance of any variance from the budget than it is to be exactly on the monthly budget."

The Project Allocations reports showed the allocation of actual cost to the approved projects. The Project Cross-charges presented the following information (Lindsay, 1971, p. 64):

> …current month and year-to-date costs for each project and all tasks within each project. It also shows the total program costs by month and year-to-date and compares these totals with the program budgets giving the sponsoring group manager a quick picture of the financial status of his program.

The Projected Annual R&D costs was given as (Lindsay, 1971, p. 65),

> ...it analyzes the year-to-date costs, current month cost, projected year-end costs, budget and variance by cost center and by allocation to the corporate and operating division accounts. Projected costs are calculated by a formula which changes slightly from month to month and is based on an evaluation of historical research and development cost trends.

Croft and Finlay (1987) conducted a study of the control model in R&D organisations. The study used ten respondents from AICRO (Association of Independent Contract Research Organisations) members. One of the findings indicated that (Croft and Finlay, 1987, p. 266),

> ...all of the members of AICRO that contributed to the survey have some form of project cost recording system, either computerized or a manual job card system. This forms the basis for what is seen as the most important control, which is the monitoring of the actual costs of a research project compared with the contract value, and the regular comparison of residual funding with the cost of work required to complete a project.

Further, Croft and Finlay (1987, p.267) also found that all the companies surveyed have also less formal controls associated with the behaviour of individuals and groups. More evidence indicated the existence of financial control in the R&D organisation. Faust and Ackerman (1974, p.40) pointed out that one of the important key-planning documents on program or project management in Hoffman-La Roche is the financial report. They said that,

> …research expenditures are monitored quarterly through a series of theme numbers to which man-power effort, equipment, grant funds, and other related expenses are assigned.

The monitoring system in this case is related to behaviour control, in which budget control was used simultaneously with PERT. Further, they said that,

> …an analysis of research expenditures provides specific data on the cost of programs/projects, thus giving research management quantitative and comparative information on areas of research emphasis (Faust and Ackerman, 1974, p. 39).

Although, Salasin and Bregman (1983, p. 160) found that the approach to program planning basing the program on applications received, and using PERT or other critical path techniques were not characteristic of most programs, but the usage of CPM was more characterised as explanatory of applied than basic research. Basic research is more characterised as basing the program on applications received than other types of research. However, the explanation of this result was suggested by Salasin and Bregman (1983, p. 167) when they said that,

> …basic research programs are operationally defined by the planning and project selection mechanisms employed. They are driven by the interests of the research community, a characteristic expressed by funding projects based on the unsolicited proposals received"

Contrarily, in the industrial sector, Allen (1970) found that PERT/CPM was used by 60% of the respondents, whereas Dean (1968) found one third of the respondents used a Gantt chart in the evaluation, selection and control of research projects (Liberatore and Titus, 1983, p. 963).

In a similar vein, Liberatore and Titus (1983, p.970) also found a more selective use of the PERT/CPM scheduling methods in controlling the project. Although, they found that some of the respondents were not completely satisfied with the existing techniques for monitoring, scheduling and controlling the project, but this situation may be caused by the perceived uncertainty of data that led them to tend to use simple (user-friendly) interactive systems (Liberatore and Titus, 1983, p.971).

The evidence above indicates that the information about the actual and budgeted cost and the time schedule seems to be important information for second stage control. The variances that occur tend to be used to indicate a need for corrective action (Lindsay, 1971) or to indicate the cost required to complete a project with residual funding, for contractual research agencies (Croft and Finlay, 1987) rather than to determine the ineffectiveness (Gambino and Gartenberg, 1979).

As to monitoring the project's performance, the second stage of the control function may compare the actual performance with certain criteria. The criteria may be developed from information provided during the project selection and evaluation process. Therefore, the criteria are developed for each project, rather than standardised to all projects. Moreover, the information may contain financial data and technical information as found in the activity list. This information can then be used as a package program to monitor and evaluate the plan in terms of time and procedures simultaneously. The role of financial information for control purposes in this stage may reflect the tolerance in funding the project. Examples that are more precise can be taken from the use of economic rating criteria in the project evaluation and selection phase. Such measure as ROI, NPV, IRR, and Payback period would need the financial data that shows actual resources consumed by the project.

The information, which is accumulated by the accounting reporting system, would be used to indicate whether the project was still within the financial boundaries such as within a desired ROI, IRR and Payback period. Moreover, the actual cost information can be used to indicate how the project has consumed the budget. Although it is difficult to define reliable figures of cost, benefit and time scales, the actual expenditure could indicate critical points at which the project should be reviewed, postponed, discontinued or continued with some adjustment. However, some evidence indicated the financial tolerance on the uncertainty dealt with by the R&D operation. For example, the development of the Olympus aero engine for Concorde had been escalated from £150 million in November 1962 to £1,065 million in June 1973 (Twiss, 1992). A study by Devriese and Young (cited in Twiss, 1980, p. 126) indicated that a 140% increase in cost over the initial estimate caused by three main unpredictable conditions,

1. Error in estimating the manufacturing costs of the prototype bench and test engines that required an escalation of 28%,
2. Changes in the programme and design that caused a required escalation of 46%,
3. Changes in economic conditions, overheads and other accounting changes that required an increase of 66%.

The above case indicates that the changes in technical approach was tolerated as long as the project's direction selected by the scientific measure are perceived to bring future benefit, which then lead a decision to approve financial measure to cover the escalation. However, it should be borne in mind that without the agreement of the partners involved in this project, it would have been stopped whatever the numbers may reveal. Therefore, in controlling the R&D project, the financial measure should not be rigid; rather it should be flexible to follow the conditions defined by the scientific dimension. However, it should also be noted that the tolerance of the financial measure to support the R&D project would also be limited to the availability of funds possessed by the organisation.

Third stage control

The third stage control would take place at the end of a certain period along the process or at the end of the whole effort to monitor and measure what output has been achieved. Some authors continue to hold the view that the basic process of control is comparing the achievement against some standard (Ouchi, 1977) and therefore would require the measurability of input-output (Otley, 1983; Hofstede, 1978). Since one of the purposes of the third stage control is to monitor what has been achieved, it does not need the measurement and tangibility of output. The measurability of output however, is required by performance evaluation. Although these two control purposes are usually accommodated in one package of control and executed simultaneously, they are two different things that interact one to another. The following situation can be used to indicate the relationships and the boundaries between those two control purposes. Throughout the duration of a certain activity, several critical points in time are chosen to place the execution of controls to monitor what result has been achieved or produced. This is the boundary of the monitoring objective. Further, the information resulting from monitoring the task would be used for performance evaluation and corrective decisions. The purpose of performance evaluation is to define whether the activities have efficiently and/or effectively obtained the desired output or are headed in the right direction, and on this result, the corrective action and reward system can be based.

Using those arguments, the problem of measurability of R&D output therefore, would relate to performance evaluation. The application of third stage control can be based on the activity list that indicates critical points during the project duration. The third stage control would be expected to give the information about 'where we are now’, from which the evaluations of performance about 'are we efficient and or effective' and the decision of 'what should be done' can be based.

In regard to the difficulties of measuring the final output of R&D, Stahl and Steger (1977) categorised the measures of innovation into two types; objective and subjective measures. The objective measures include the number of publications, or patents, new or improved processes, products or techniques, manuscripts and oral presentations and requests for proposals, whereas the subjective measures included peer ratings, supervisory ratings, independent panel and independent expert ratings (Stahl and Steger, 1977, p. 36). The linkage between the first stage and the third stage of control can be seen in the work of Gambino & Gertenberg (1979) and Stahl & Steger (1977). Although it is difficult to measure the output financially, in the selection process of the first stage, the selection committee should be able to assess the possible subjective and/or objective measures of Stahl & Steger (1977).

Weinberg (1989, p. 5) proposed two categories of R&D output measurement criteria as, Internal and External criteria by saying;

> Internal criteria arose from within the science itself, and were basically criteria of efficiency-how well the proposed research would be performed. Thus one internal criterion was the competence of the performer. Another was whether the science was 'ripe for exploitation'. Internal criteria are necessary criteria for the support of any science, or indeed for any undertaking that demands limited resources. They are criteria of efficiency because, to the degree they are met, money spent on research is likely to produce results. On the other hand, where the required resources are large, internal criteria are insufficient: 'external' criteria, arising from outside the field under consideration, must be considered. External criteria are criteria of utility that is; they measure the degree to which the given research, if successful, is, in the broadest sense, useful outside the field itself.

Further, Weinberg, (1989, pp. 4-5) identified three external criteria as;

1. Technological merit to measure the advances of technology achieved by the R&D
2. Social merit to measure the contribution of the R&D toward social goals such as better health, and better schools
3. Scientific merit to measure the contribution of the R&D to scientific fields.

Schainblatt (1982) conducted a survey to ascertain the measurement of the productivity of engineers and scientists in practice. The study focused on the performance of the R&D unit or group of scientists in the research project. From one sample group, he found that the actual performance of projects is rated on a scale of 0 to 3 that indicated the following performance (Schainblatt, 1982, pp. 11, 14),

> A 'zero' rating is assigned to a project that badly missed its objectives either by not achieving its technical goals or badly overrunning the agreed-upon budget or schedule. A 'one' rating is assigned to projects that made progress but which did not meet their technical goals within their budgets or time limits. A 'two', rating is assigned to projects that fully met their objectives, and a three 'rating' to projects that significantly exceeded their objectives or accomplished them well below the budget or significantly sooner than planned.

Furthermore, Schainblatt (1982, p.14) mentioned that,

> …in assessing the project performance however, other factors were also taken into account such as, when the failure of the project was caused by uncontrollable factors; the rating can be changed to be a higher rating. By doing this, the employees would be expected to have positive responses to the system.

Another study conducted by Taylor et al (cited in Edward and McCarrey, 1973, p.39) indicated 14 main categories of scientific performance. Those were:

> ...productivity in written work, recent reports, originality of written work, professional society membership, judgment of actual work output, creativity ratings by high level supervisors, overall quality ratings by immediate supervisors, likableness as a member of the research team, visibility, recognition for organisational contributions, status seeking tendencies, current organisational status, and contract monitoring load.

It seems that the Weinberg (1989) internal and external criteria are similar to the Stahl and Steger (1977) objective and subjective measures. For further discussion, internal and external criteria would include objective and subjective measures. Since the internal criteria involve efficiency, financial measurement such as the budget would become an important aspect for performance evaluation. It seems that the appropriateness of internal and external criteria in their application depends on the time of assessing the performance and the type of the research being conducted.

Performance evaluation can be periodically executed throughout the project duration and/or when the final output has resulted. However, the characteristics of R&D output are different between basic and applied research and product development. For the basic research the resulting output is presented in a report or scientific publication, whereas for applied research the output may form either an internal report, a scientific publication or a patent application (Place, 1977). The output of product development in turn, may form a product design, or a process design that would be more feasible compared to the output from basic and applied research. Therefore, it could be said that even for product development, before the final output is reached there is no feasible output that can be used as the base to assess performance. This situation would make the internal criteria less appropriate to be used to measure the performance of an individual researcher, and therefore would need other criteria to capture the real performance of the individual effort. The contribution of the scientist or engineers to the scientific frontier through written work or oral presentation for example may be used as criteria to measure the performance of individual researchers or engineers. Therefore, in assessing the individual performance throughout the project duration, the involvement of both internal and external criteria needs to be considered. However, the fair weight between the two would depend upon the policy of each organisation. As identified by Meinhart and Pederson (1989, p. 20) through a survey on performance appraisal of R&D professionals (a sample of 114 was used), the performance appraisal of professionals should be designed with special care and should differ from executive appraisals in other functions. They concluded that the instrument should be chosen from a generic set of attributes that is relevant to the R&D organisation.

According to Wilson, et al. (1994) performance measurement of professionals should be developed to serve not only the purposes of the organisation but also the lifelong career needs of the individual professional. Wilson, et al. (1994, p. 52) used the definition of professional as an individual who has

> "…mastery in one's field of expertise and inner-directedness such as having internalised standards or performance, reward, and status so that the professional cannot be outwardly controlled or manipulated."

Personal characteristics of scientists

The most important element of a R&D organisation is the scientists or researchers employed by the organisation. Improper performance measurement of an individual may bring some unbeneficial result to the organisation such as stress and dysfunctional behaviour (Hopwood, 1972; Birnberg, et al., 1983; Williams, et al. 1990; Jaworski & Young, 1992), and may encourage the scientist to leave the company (Cordero et al., 1994)

According to Gibson (1981, p. 35) the research and development organisation requires specific individual characteristics such as cooperative, openness, critical, and supportive behaviour for teammates, and this could be recognised when recruiting the employees. Furthermore, Gibson (1981, p. 31) pointed out several unique individual characteristics of a technical nature in reaction toward the changes as:

> One of the more interesting and more important performance characteristics of a technical person is his anomalous resistance to change. This seems to be fundamentally at odds with the normative behaviour of the technical person's profession and the needs of society. How can a person whose whole job is to promote technological change be against change? Yet there is no question about the fact that the American engineers resist change. The engineer knows about scientific advances but rarely proposes to revolutionize his own work by utilizing them. He expects, in the future, to be solving problems like the ones he has been solving in the past, using the same methods. He will modify his approach step by step but a major change? Never.

In the similar vein, Jain & Triandis (1990, p. 21) also mentioned that:

> The kinds of people who are most likely to succeed in a R&D organisation are those who are analytical, curious, independent, intellectual, introverted, and who enjoy scientific and mathematical activities. Such people tend to be complex, flexible, self-sufficient, task-oriented, and tolerant of ambiguity, and have high needs for autonomy and change and a low need for deference. …However, success in a R&D organisation requires joint action; people should not be loners. So, the extreme introvert may simply not fit.

Further, Gibson (1981, p. 35) pointed out the five individual characteristics that are highly sought by the managers when selecting their members as; creativity, judgment, analytic ability, communication ability and energy. Creativity means, "to create new relationships and interpretations of facts, to seek new concepts, and to question the commonly accepted conventional wisdom" (Gibson, 1981, p. 35). However, creative people may not be the ideal employees because they are:

> …often impatient with routine, disdainful of regulations, unresponsive to managerial request for meeting attendance and reporting requirements, and in general are only marginally accepted as employees in the normal hierarchal organisation (Gibson, 1981, p. 35).

In addition, Bernstein (1989, p. 36) pointed out that creative and innovative scientists and engineers *"hate bureaucracies and they abhor administrators."* These characteristics may have significant implications for the requirement of the control system. It seems that financial control alone would not be appropriate to be applied to this type of organisation. It was found by several studies that tight financial control may create pressure, which leads to dysfunctional behaviour (Hopwood, 1972, Birnberg, et al., 1983) and may reduce creativity and innovation (Abbey, 1982).

Judgment is related to the ability of the individual to measure all costs and benefits of a set of project proposals or options. In this case, the team members are expected to be concerned with the wider impact of the concept proposed. This characteristic would bring benefits to the organisation in terms of increasing the quality of the proposals. So, every team member is expected to consider the wider impact of the option proposed.

According to Gibson (1981), most of engineers are good in the area of analytic ability. Gibson (1981, p. 36) mentioned that in the engineering education system, they are focused and developed almost exclusively in terms of analytic ability. This analytical ability is shown as one of the likely behaviours required by the successful scientist in a R&D organisation (Jain & Triandis, 1990).

Gibson (1981, p. 36) also said most engineers are weak in the area of communication ability, as they are mostly authoritative persons with few intimate relationships and prefer to deal with objects and things rather than people. Furthermore, Gibson (1981, p. 36) pointed out four communication channels that are generally ignored by engineers as; upward through the management structure, downward through the structure, across specialist boundaries, and with the general public.

The last characteristic is energy, which is referred to as hard work. Croft & Finlay (1987, p. 266) mentioned, "...the capacity to undertake research work is a function of the abilities of the staff and the staff time available". The time available is constrained by limited funds. Therefore, the hard work of the researchers would also be an important factor for the success of the project.

Budgetary participation that is suggested to reduce the pressure (Brownell, 1982) it seems would be less effective in these circumstances. One of the important factors in budgetary participation is knowledge of the transformation process, which enables the managers and the subordinates to plan how the job would be done, and to estimate the length of time to be consumed as well as the funds that would be provided. However, in this type of organisation, the output is something new, and it is difficult to predict accurately by the managers, or even by the research team members themselves. Another reason is the general personal characteristics of the innovative and creative scientists who are impatient with routine, less responsive with managerial requests for meeting attendance and reporting requirements, and hate bureaucracies, which may lead to less participation in developing the budget. Lorsch & Morse (1977) provided evidence that showed less effective laboratories were subject to more tightly defined planning and control systems than high-performance laboratories. Some comments from scientists in the low performing laboratories reflected the implication of tight control as follows,

> This laboratory operates by the book on rules and controls. Everything is by the numbers, even on things like making out travel vouchers. It's bing-bing-bing all the way down the line. It was looser in manufacturing when I was working there. Tight controls mean that I fill in the same reports the same way, day in and day out. My job changes so much that the information I supply is often irrelevant, or, even worse, redundant (Lorsch & Morse, 1974, p. 92).

Other comment was found from another scientist in a low performing laboratory that said (Lorsch & Morse, 1974, p. 92):

> There's a strict rule about getting here on time. No one rewards you for staying late in the department, but you have to sign in the morning to insure you're here on time.... What you get is scientists coming in precisely at 8:00 A.M. but then leaving precisely at 4:30 no matter where they are on their project. If you want to see a guy after 4:30 around here, you'd better make an appointment or he'll be gone.

In contrast, one of the scientist in a high-performing laboratory indicated a more positive feeling by saying that

> We can't wear sandals because of safety regulations and we're not supposed to proposition secretaries on company time, but apart from that there's not much formality in the laboratory (Lorsch & Morse, 1974, p. 92).

In addition, Lorsch & Morse (1974, p. 92) indicated less rigid rules applied to high performing labs by mentioning:

> In high performing labs, it was a general norm to come and go at one's own discretion. Scientists typically came in at odd hours of the day, stayed long after 'regular' working hours, took breaks when their work allowed, and even came in on weekends.

When this matter was raised with the executive in the high-performing lab, it was pointed out that:

> Because we don't have many rules here doesn't mean we're lax. There is a thing going on in this lab that's evident the first day you're here. People discipline themselves. There's no need for rules. We're supposed to put in 39 hours a week, but I don't know one person in the lab who does - it's always more than that, and it's always based on the requirements of the project you're working on. We come and go, as our work requires. That's the way you should treat professionals (Lorsch & Morse, 1974, p.93).

From these findings, Lorsch & Morse, (1974, pp. 92-93) suggested that the external environment of the R&D sub-unit is uncertain and rapidly changing, therefore it needs a more flexible planning and control system to suit the demands of the situation.

Pelz & Andrew (1978) conducted a study of 11 laboratories in the USA, which employed 1311 scientists and engineers. The study examined the impact of personal and environmental factors on performance. The study divided the research personnel into five groups. The first group was doctoral scientists in development-oriented laboratories. The second was doctoral scientists in research-oriented laboratories. The third was non-doctoral scientists in development-oriented laboratories that were not dominated by doctoral scientists. The fourth was non-doctoral scientists in doctoral dominated laboratories (both development and research oriented) and the last group was non-doctoral scientists in research-oriented laboratories that were not dominated by doctoral scientists.

One of the findings indicated that the more effective doctoral scientists and engineers (but did not hold for assistant scientists and non-doctoral scientists) in development and research oriented laboratories sought and received more contact with colleagues. The aim of the communication it could be suggested was to exchange information, and provide a friendly relationship that allows criticism and evaluation of the job in progress. It seemed that the scientists ignored frequent formal and rigid communication channels as in a hierarchical structure. Therefore, Pelz & Andrew (1978, p.53) concluded that frequent contacts with many colleagues would be more beneficial, but not a complicated or rigid set of formal meetings.

The personal characteristics of the scientists set out in this section indicate that they hate bureaucracy, routine tasks, and formal communication. In addition, they require a more flexible planning and control system that is suited to the characteristics of the task performed by R&D units. Therefore, it seems that the R&D unit needs a specific organisational climate and autonomy in making decision to suit their specific behaviour. The study by Abbey (1982) seems to support this situation when he indicated that there is a relationship between the work climate of the R&D sub-system and technological innovation. Abbey (1982, p. 81) pointed out that,

> …such a climate should be characterized by a relatively high degree of achievement orientation and a willingness to experiment with innovative ideas; as a sense of personal involvement and a commitment to the objectives of the R&D sub-system through a decentralized decision making process and individual autonomy; and an effective reward system that is perceived by R&D personnel to recognize and reward excellent performance.

Regarding autonomy in making decisions, the finding of Pelz & Andrew (1978, p. 237) needs to be considered in which they found that in a R&D organisation, "...(a) relatively high level of individual autonomy was effective mainly in the middle range of situations - those which were neither very tightly coordinated nor loose."

According to Gerstenfeld (1970, p. 60), "...the creative individual can only be effective in a creative organisational climate." A creative climate for R&D organisations should provide the following elements (Gerstenfeld, 1970, pp. 60-61): Individual Challenge, Realistic Goal Setting, Immediate Feedback, Reward Structure and Recognition System, and Openness and Allowance of Conflict. Individual Challenge referred to the possibility of the scientists or engineers becoming a committed member from being merely a member of the organisation. Realistic Goal Setting was related to a clear and realisable goal. However, it may be argued that the clear description of desired goals may not be defined for such R&D functions as basic and applied research. It is possible to define a clear description of the desired goals for the product development function, in the mid-way of the project operation. Therefore, the clear goals in this context may at best refer to a clear direction of the research. Immediate Feedback referred to the flow of information about the output resulting from the action performed. Reward Structure and Recognition System were related to the ability of the system to compensate the achievement obtained by the scientists and engineers. This reward may contain financial remuneration as well as opportunities for publishing and attending conferences. Openness and Allowance of Conflict referred to a climate where the members of the R&D organisation were able to accept the conflict and uncertainty that usually occurs in R&D organisations such as receiving criticisms from colleagues.

Diversity of opinion usually occurs among the members in the R&D team. The different opinions about objects being studied may lead to a conflict. Different perspectives as to the objectives can be said to be one of the factors that create diversity of opinion. Obviously, conflict may be perceived as a weakness within the organisation and may create problem, but in other circumstances, conflict may also create innovative behaviour. Gerstenfeld (1970, p. 61) described the process of innovation in relation to conflict when he stated that

> …it has been shown that the inability to legitimize conflict depresses creativity. Conflict generates problems and uncertainties and diffuses ideas.

> Other things being equal, the less bureaucratized the organisation, the more conflict and uncertainty and the more innovation.

Another factor that may motivate the creativity of the scientists and engineers was the match between individual goals with the organisational goals. Regarding individual goals, Gerstenfeld (1970) investigated the rank of importance of ten dimensions of scientist's individual jobs as follows; 1. Challenging Work, 2. High earnings, 3. Advancement, 4. Good working conditions, 5. Job security, 6. Training opportunities, 7. Personal loyalty of supervisor, 8. Efficient department, 9. Tactful disciplining, 10. Help on personal problems.

From the ten dimensions, the study found that the top-ranked individual goal of the scientists and engineering was challenging work, and followed by high earnings and advancement (Gerstenfeld, 1970, p.85). This finding led Gerstenfeld (1970) to conclude that challenging work behaviour toward the achievement of a new knowledge should be encouraged by the organisational climate. Moreover, high earnings were found to be the second important dimension. Therefore, a proper reward should be highly considered as part of the motivational factors to support the creative climate.

Summary

Some characteristics of the R&D units that are relevant in the discussion of the control concept have been indicated. The R&D activity is a learning process that makes the R&D unit deals with relatively uncertain and rapidly changing environments. The R&D organisation requires an innovative or creative work climate and the employees are predominantly professionals, which influence their behavioural characteristics.

Given the uncertain and dynamic environment, the directional planning system would be more appropriate, in which the goals would be defined through the action process. Therefore, a relatively accurate standard for the control function cannot be developed in advance.

Considering this situation and the employees' characteristics such as impatience with routine, disdainful of regulations, dislike of bureaucracies and abhorrence of administrators, it seems that the R&D units require neither a very tightly nor a loose control model, otherwise, it may reduce employees innovative capabilities. Further, it is suggested the difficulties in defining relatively accurate standards would make the control function more effective if there is greater emphasis on the selection and evaluation of project proposals, particularly for basic and applied research. The control systems may be applied in three stages such as; during the evaluation and selection of project proposal, during the project duration, and at the end of the project’s operation.

The implementation of control function along those three stages may employ three distinctive characters they are; directional feature, scientific measure, and financial measure. The directional feature defines the direction of the project concerning the organisational objectives. The scientific measure defines the appropriateness of the area being studied and the probability of the project being successful, and the financial measure defines the financial tolerance in funding the project. However the use of those three dimensions varies along the project duration.

The application of performance measurement can be distinguished into two parts such as the performance measurement of the project, and of the individual researchers that are involved in the project. Regarding the project performance, it may be measured by several measurements such as technological merit (patent or patent application, and scientific publication), achievement of the project’s objectives, ability to operate within the budget, and ability to operate within the schedule (PERT, CPM, and Gantt chart).

The performance measurement of the individual researcher should be linked to the reward system and career development opportunities seem to be important motivator of the researchers. However, the difficulty of measuring the monetary output would make financial data incomplete measures, thus requiring additional measures such as peer rating, quantity and quality of written work within the project, professional or scientific involvement (seminar attendance, oral presentation and scientific publication), and professional membership.

The next chapter will present a literature review on management control systems and propose a framework for management control systems.

The Concept of Management Control

Introduction

The definition of management control has a number of different aspects each of which has been emphasised differently by different authors (Newman, 1951, and Brech, 1965, quoted in Giglioni & Bedeian, 1974; Ouchi, 1977; Flamholtz, 1983; Birnberg & Snodgrass, 1988; Chua, et al, 1989, Anthony, et al., 1989). According to Lowe and Machin (1983), management control is a multi-disciplinary subject. The more complex the organisational setting used in defining the concept, the more disciplines will be used to describe the phenomena. In turn, the more the dimensions are covered in developing the concept, the more complete the concept of management control systems will be.

The purpose of this chapter is to identify the dimensions of the control concept, so that they can be used to redefine the existing concept. The chapter consist of a review of the concept of management control. Four dimensions of the control concept are proposed in this chapter: *desired ends*, *actors*, *control implementation*, and *control tools*. The elements and the relationship among dimensions are discussed throughout the chapter. Finally, in this chapter, the study proposes the use of control elements to suit the conditions in which they operate.

Control Definitions

Giglioni & Bedeian (1974) reviewed the literature on the evolution of the management control concept from 1900 to 1972. Their historical study identified some definitions of management control in the early literature. Newman (1951, cited in Giglioni & Bedeian, 1974, p. 298) wrote of three control elements he described as;

standards or plans, motivation, and corrective action by mentioning that management is concerned with

> ... seeing that operating results conform as nearly as possible to the plans. This involves the establishment of standards, motivation of people to achieve these standards, comparison of actual results against the standard, and necessary corrective action when performance deviates from the plan.

The standards or plans are used as a yardstick to assess performance and also as a motivational element to encourage the members of the organisation to remain focused on the achievement of the yardstick. The corrective action then is a process to modify the decision that had been made at the beginning of the operation cycle. The purpose of corrective action is to adapt to a new situation as reflected by the existing operations. Through this action, a new plan or yardstick can be developed and be used in the next operating cycle.

Similarly, Brech (1965, pp. 13-14) defined management control systems as,

> ..checking current performance against objectives and targets in terms of predetermined standards contained in the plans, with a view to ensuring adequate progress and satisfactory performance whether physical or financial; also contributing to decisions in continuing or changing the plans, as well as 'recording' the experience gained from the working of these plans as a guide to possible future operations.

Brech (1965) employed the yardsticks or standards of objectives or targets as the criterion for performance measurement and the use of feedback information for corrective action. The definition clearly assumed that objectives and targets are measurable quantitatively and/or in monetary terms.

Ouchi (1977, pp. 96-97) also held a similar position by saying that,

> ...the control system itself consists primarily of a process for monitoring and evaluating performance, while the preconditions specify the reliability and validity with which such comparisons can be made.

Similarly, Anthony et al., (1989, p. 12) pointed out that, “...management control includes both actions to guide and motivate efforts to attain organization goals and actions to correct ineffective and inefficient performance.” The definitions of Ouchi (1977) and Anthony et al (1989) still contain the notions of the control concept defined in the earlier literature by making the standard criteria central to the function of the control mechanism.

Overall, the above views seem to presume that the environment is certain. Environmental certainty is characterised by high degree of predictability of future events and consequences in a relatively accurate manner. The objective or target is clear and is measurable quantitatively so the yardstick and planning can be developed and be used as reliable criteria for performance measurements. The above views of control seem to place an expected output as a highly important aspect in the control mechanism. However, in a highly uncertain situation faced by an organisation, the application of these control concepts would be problematical. Environmental uncertainty may be characterised by difficulty in defining a clear means and ends relationship. In the situation of uncertainty, there is a need to develop a broader concept of control that is capable of capturing and encompassing the less defined situation (Govindarajan, 1984; Hopwood, 1972, 1983; Brownell, 1982; Simons, 1987; Williams, 1990; Abernethy & Stoelwinder, 1991 Jaworski & Young, 1992).

Birnberg & Snodgrass (1988, pp. 447-448) hold the view that organisational control is a process used to modify the behaviour of performers through delimiting the decision space and defined management control system as;

> ...a mechanism designed to limit the decision space of individuals within an organization so as to affect their behaviour. ...Central to this definition …is the notion that the organization's goals are achieved by coordinating the work of individuals and units throughout the organization as they carry out their appointed tasks.

In a similar vein, Flamholtz (1983, p. 154) took different position and defined management control as, “...any actions or activities taken to influence the probability that people will behave in ways which lead to the attainment of organizational objectives." In this definition, Flamholtz (1983) viewed the control function as a behavioural modification process.

The definition of control as defined by Flamholtz (1983) and Birnberg & Snodgrass (1988) offers a broader context compared to the traditional definitions. Flamholtz (1983) and Birnberg & Snodgrass (1988) do not limit the control definition with precise criteria. Rather they move forward to a more fundamental aspect of the object being controlled, that is, the behaviour of the individuals who perform the action. This view emphasises the importance of the system goals rather than sub-unit goals. Through this concept, the performers may have a broader space for action compared with the earlier views. The performers may have a certain region for discretion or action, but they must focus on the achievement of the system goals. Otherwise, their scope for discretion or action may be reduced. Moreover, this view of control will encourage creativity in pursuing systems goals. Therefore, in this view, the function of control systems is to set rules of the game by placing a decision space for action rather than to specify an output that should be achieved by the action.

Chua et al. (1989, p.4) pointed out three meanings of control:

> ...one, as a means of steering or regulation, which is the classical cybernetic meaning: a second as a means of domination of one or more people or groups of people by other people or groups, which has more sociological and political overtones: and a third, as a process of the management of control and power.

The implementation of the first meaning in management control systems may be seen in setting policies, or planning, or standard operating procedures to direct the performers toward the desired behaviour. To be able to exercise the control function, there must be domination toward the performers. Without the ability to dominate others, the function of control may not be fully successful. The ability to dominate others may come from either a formal hierarchy within the organisation, which assign the control function to a particular unit or informally through social interactions.

Domination through informal interaction may be found in several ways. For example, a person who has more experience in a particular type of job may dominate others. The domination may be indicated by an ability to influence a decision made by another who has a higher or similar formal position, but who has less experience. This circumstance may be described as having a greater stock of information, and having more access to the collection of the information over others (Markus & Pfeffer, 1983). In addition, the role of domination will also be supplemented by the third meaning of control, which is power to dominate others in making decisions.

Core elements of Management Control Systems

In order to be able to redefine the control concept, there is a need to identify core elements of management control systems and relate them to relevant organisational components. From the review of the control definition, four broad core elements of management control systems are identified: *desired ends*, *actors*, *control implementation*, and *control tools*.

Desired ends

The element of *desired ends* refers to expected ends or the final destination of an action at the end of an operational cycle. These ends, if tangible and physically quantifiable, are used as measurement criteria where the comparison process can take place. Moreover, these ends would also be used as the final destination of a planning cycle. Up to this stage, confusion may exist. Some definitions used the measurement criteria as planning (Newman, 1951; Brech, 1965). This view seems to proclaim that the meaning of an action is to achieve the criteria as they are set out in the planning. In turn, the control function deals with the achievement of criteria that are defined by the planning systems, rather than the organisational objectives. Furthermore, this view seems to assume that the standards or criteria will be able to represent all the notions embodied in the organisational objectives in a relatively complete manner.

Other authorities stated the broader view that used the means of an action as the achievement of organisational objectives rather than the planning (Flamholtz, 1983; Birnberg & Snodgrass, 1988; Chua, 1989). Though it may be argued that those differences are only matters of different levels of where the control function is placed, the main difference is in the availability of a space for discretion. The former view requires a more certain, predictable environment, and measurable outputs, so the organisational objectives can be reasonably represented by the criteria or standards. In addition, the former view seems to assume that the availability of space for action will be limited to the standard.

In contrast, the latter view considers a situation of uncertainty and unpredictable output. So the criteria or standards are presumed to be unable to represent fully the organisational objectives. Therefore, the latter view focuses on the achievement of the organisational objectives rather than the standard. Moreover, underlying this assumption the latter view will provide a broader space for action rather than being bound by the rigid standards or criteria.

One may argue that the desired ends may be similar to those of organisational goals. However, this study prefers to use the desired ends as being able to cover comprehensively the notions that are embodied in organisational objectives, rather than goals that comprise disagreement among authorities (Lindblom, 1959; Cohen, 1972; Georgiou, 1973; Cooper et al, 1981). As mentioned by Cooper et al, (1981) that to be economically rational, the traditional concept of goals seems to be pushed toward a clearer, more understandable and quantifiable concept. Furthermore, the use of economic rationality in developing the organisational goals would characterise the goals as having solid substance, and a shorter time horizon. These goal characteristics may cause inflexibility and belated movement to adapt to the changing environment and to harmonise other organisational elements. The alternative perspective suggested an endeavour to consider the elements embodied in the desired ends.

The element of *desired ends* may have two sub-elements. The first sub-element is the *direction* of an action to describe where to go, rather than what to achieve. The second sub-element is a *yardstick* to measure the progress of an action or the result of an action. When the organisation deals with a highly certain environment, the desired ends can be translated into precise and reliable quantitative figures such as are represented by a number of units or monetary attributes. Therefore, the emphasis would be on the *yardstick*.

In a situation of environmental uncertainty however, the means-ends relationships are unclear, the prediction of future events and consequences cannot be made relatively accurate, and the *desired ends* cannot be translated reliably into quantitative features. Therefore, the *desired ends* may only contain the *direction* without being able to be described in quantitative figures. Being a *direction* only, the *desired ends* cannot be used accurately to measure the performance as in the case of quantitative measurement. Rather *desired ends* can only be used by the control systems to guide the action toward the desired direction.

Actors

The element of *actors* refers to the individuals who are involved in the control system that is relevant to a decision-making situation. Ouchi (1977, p. 97) indicated that behaviour and output were the most important elements in controlling the work of people and technologies by saying, "...there are only two phenomena which can be observed, monitored, and counted: behaviour and the outputs which result from behaviour." This statement indicated that the element of actors is very important in the context of management control. Without involving this human factor, the control concept will lose its social part, and becomes an incomplete description of social phenomena. As pointed out by Drucker (1964, cited in Lebas & Weigenstein, 1986, p. 259) "...the management control system exists within a human social situation and is a volitional system."

In the context of control, the *actor* may have two sides. One side is as a subject who exercises the control function, and the other side is as an object being controlled. However, it is argued that every individual within the organisation may be subject to formal control, but at the same time, the individual will also be an object being controlled. To some extent, the formal structure as described by the hierarchy within an organisation may be able to be distinguished by the subject-object relationship. However, an informal aspect may also occur within this formal communication. This informal aspect may twist an individual, who is supposed to be an object being controlled in the formal hierarchy, into a subject who does the controlling. This situation may occur when a scientist who is controlled by a manager in the formal control sense, has a greater knowledge of the research area than the manager, thus the scientist may exert control by influencing the decisions being made by the manager. This study will not limit the control function merely to the formal, but rather will broaden the view by also considering informal circumstances. Nevertheless, to limit this broad understanding, in this context, *actor* will refer to individuals or groups of individuals within a system as the objects being controlled. Therefore, the actor can be an individual or a group of individuals within a unit, a unit, or an organisation as a whole to which management control is applied.

As indicated by the control definitions mentioned earlier, this study proposes five aspects that are embodied on the element of *actors*, they are; *behavioural* (Flamholtz, 1983; Birnberg & Snodgrass, 1988), *domination* and *power* (Chua et al., 1989), *decision space* (Birnberg and Snodgrass, 1988) and *motivation* (Newman, 1951; Anthony, 1989). The *behavioural* aspect in this case refers to a behaviour that is preferred by the systems where the actors operate. Preferred behaviour then will relate to a set of required behaviour that is defined by individual(s) who have more power to dominate others in the systems, and which mostly conveys their pleasure. In the context of an organisation, preferred behaviour refers to the achievement of the desired ends that may or may not be objectively measurable.

However, some problems that may exist in the behavioural aspect presumed by the current control concept. When the control function is to lead the behaviour to attain objectives (Flamholtz, 1983), one may question whose objective is to be attained. If it is the organisational objectives, then the first condition assumed by this concept is that human behaviour can be generalised. If the achievement is toward individual objectives, which have more sociological and political overtones (Chua et al, 1989), then the second condition assumed by the concept is that preferred behaviour is a standard of behaviour that was defined by the subject who exercises the control and also preferred by the actor being controlled. Moreover, the view that presumes preferred behaviour is mostly concerned with the achievement of financial objectives treats the actors as a passive element and ignores their capacity to create their own environment (Chua, 1986; Laughlin, 1987). However, when the organisation deals with an uncertain situation as when the goals are unclear, the preferred behaviour is difficult to describe and goal congruence is problematic (Parker, 1976). In this situation, the choice of control systems should be made cautiously; otherwise, the control system chosen may cause dysfunctional behaviour.

Some studies found this problem. The study of Birnberg, et al. (1983) indicated that inappropriate choice of a control system might lead to actors being controlled to distort information systems. Jaworski & Young (1992) indicated that, when job tension increases, dysfunctional behaviour increases. The increase in job-related tension however would not only be influenced by the management style (Hopwood, 1972), but may also be influenced by task uncertainty (Hirst, 1981). Task uncertainty that is characterised by unclear desired ends may cause a reduction in goal congruence, and further may increase dysfunctional behaviour (Jaworski & Young, 1992). Therefore, to a situation of uncertainty, the preferred behaviour should not be constructed in a rigid form and emphasise financial achievement, rather it should be defined more flexibly to allow creativity and to tolerate the uncertainty (Ditillo, 2004; Tatikonda & Rosenthal, 2000). The financial data in this circumstance may be used as a limitation for the actor to make a decision-decision space (Binberg & Snodgrass, 1988) rather than as a criterion to which the actor should comply. For example, the provision of a budget to a particular R&D project would mean it acted as a limit where the actor can make a decision rather than as a criterion that should be met by the actor. Moreover, since the task that will be performed by the actor is difficult to connect to the financial achievement, as it is dealt with by scientists in a R&D organisation, the culture or norms that exist in their environment should be considered in setting the standard behaviour that would be applied to the scientists.

Domination refers to the ability to influence others in making decisions, and *Power* refers to the degree of strength of the influencing capacity. Though it is difficult to distinguish *domination* from *power*, this study considers them distinct. An individual within the organisation may have an ability to dominate others, however, the strength of dominating ability will relate to the degree of power the individual has in hand. In other words, the magnitude of the dominating ability is power. Though this study does not intend to measure the degree of power, it is plausible to suggest that the degree of power may be measured. Therefore, keeping these two aspects distinct will enable a more detailed analysis of the elements embodied in the concept of management control.

The source of power to influence others may arise from a formal network within the hierarchy or from an informal network through social interactions (Willer, et al, 1997). For example, in a formal hierarchy line, a manager may have the capacity to influence a decision being made by his or her subordinate. The source of power to influence others in this situation arises from the formal hierarchy. The source of power to influence others that arises from informal network may occur when an individual who is perceived to have more knowledge in the area being decided (such as the degree of seniority, level of education, scientific acknowledgment and so forth), may influence his or her superior in making a decision.

According to Markus & Pfeffer (1983, pp. 208-209) the power of a person or sub-unit within an organisation can originate from various sources. These sources may come from a position within the hierarchy or authority, an ability to acquire or provide critical resources required by the organisation, and various kinds of political skills. The political skills may include the ability to identify and build coalitions with other interests, knowledge of the distribution of power, and the ability to argue for one's position by using the information that is available selectively. What is more important is, as argued by Markus & Pfeffer (1983), that accounting and control systems are sources of power within the organisation. In a situation where the desired ends are clear and measurable financially, the accounting and control systems would be appropriate to collect and manipulate the information used in making decisions. Accounting and control can be used as a stimulus to change the performance of individuals and the outcomes of organisational processes. Furthermore, they can be used to enhance the legitimacy of individual and group activities, regardless of any substantive impacts on individual or organisational performance (Markus & Pfeffer, 1983, pp. 206-207). However, when the situation becomes uncertain as dealt with by R&D organisations where the desired ends are unclear and unmeasurable financially, the power that arises from control systems that emphasise accounting data would be less appropriate and need to be supplemented by other sources of power. Since the accounting data is less appropriate as a source of power, the enforcement to use it to influence others in making a decision may create stress on the actor in control and lead to dysfunctional behaviour (Hopwood, 1972; Birnberg, et al., 1983; Williams, et al. 1990; Jaworski & Young, 1992). However, in the case of a R&D unit, since the scientists have more stock of information regarding the project budget on hand, they may control the situation rather than being controlled.

Decision space refers to the degree of authority, which is given to an individual to enable the individual to act within the system. This element commonly exists through formal authority that is given to an individual or a sub-unit within the organisation such as job description or job specification of a position occupied by an actor, and amount of funds allocated to a particular operation that is assigned to an actor. As a formal authority, this element will deal with formal rules and procedures embodied in the control system.

Motivation is another important aspect in the element of actors. The subject that exercises the control function should be able to identify potential factors that can be used to motivate the actor to remain within a preferred behaviour. The motivational element is commonly presented by monetary reward and hierarchical promotion. For non-R&D

units where the output can be measured relatively accurately by financial data, a reward system such as a bonus, a hierarchical promotion, and a commission may be used. However, for R&D organisations where the output is difficult to measure relatively accurately by financial data, and it is difficult to distinguish the contribution of each member to project achievement, and when the actors prefer to place their reputation ahead of monetary and hierarchical promotion (Luecke, 1973), potential motivational factors other than monetary and hierarchical promotion are needed.

Control Implementation

The element of *control implementation* refers to variety of control types and control stages in implementing the control systems. There are various forms or types of control that can be found in the literature. Hopwood (1974) proposed three types of control: Administrative, Social, and Self-control. Administrative control refers to formal rules and standard procedures to regulate the behaviour of actors within the organisation. This control type would focus on the output resulting from the behaviour rather than the behaviour itself (Hopwood, 1974, p. 24). *Social control* refers to informal control that limits the actors to behave according to a particular behaviour that emerges from shared values and mutual commitment among the actors within the organisation. *Self-control* refers to the administrative and/or social control that has been internalised, so the actors would behave according to this norm.

Ouchi & Maguire (1975) proposed two types of control namely: Behavioural and Output control. Behavioural control refers to monitoring what the actors are doing through personal surveillance and direct supervision through oral communication that is made by the supervisor in giving a command to perform the task. *Output control* refers to the monitoring of the output result through written records. Ouchi & Maguire (1975) investigated the conditions that govern the use of these two modes of control on five retail department stores. Their study focused on the determinants of the behavioural and output controls, and interdependency between them. Their study found that behaviour control tended to be used when the supervisors had a greater knowledge of the task to be done by the subordinates. In addition, Output control was found to be used by the managers as an objective measure to support their claim of satisfactory performance. However, when Ouchi & Maguire (1975) divided the sample into sales and sales support group, they found that though the performance of an individual was difficult to measure in the sales support unit, output control was used more strongly in the sales support unit rather than in the sales unit. The use of output control in this situation was a tactic of the managers to claim that a satisfactory performance was achieved. Therefore, the use of output control in this situation was for self-legitimating rather than for guidance and reinforcement. The use of output control was more pronounced when the upper level of management was only vaguely able to measure the achievement, and the managers being controlled tended to use output control on their subordinates. By doing so, the managers attempted to influence their superiors for a reward for satisfactory performance.

The study by Ouchi & Maguire (1975) indicated that behavioural control would only be appropriate when the technology to perform the task is clearly understood. On the other hand, the use of output control is appropriate when the input-output relationship is clear. However, when the input-output relationship is not clear output control is less appropriate and needs to be replaced by other measures.

In another paper, Ouchi (1979) conducted a study of a parts supply division, and indicated three types of control: Market, Bureaucratic and Clan control. Market control was characterised by the interaction of external prices that compete with one another, and then move to a fair price. This type of control was indicated by Ouchi (1979, p. 835) in the purchasing unit where he describes the process as putting "... each part out for competitive bids and permitting the competitive process to define a fair price." The practice of market control seems to indicate that the organisation does not have an ability to control the supplier or contractor in making the price, and therefore, the organisation would rely on the market mechanism. Though the organisation would rely more on the price constructed by the market mechanism, the control system may use a budget limit that defines a range of areas where the price is accepted. It can be said that when the organisation cannot define the values of the output before hand precisely and accurately, the control system may anticipate inefficiency by placing budget limitation.

Bureaucratic control refers to explicit routines for monitoring and directing such as close personal surveillance and direction, and the use of rules that specify standards of output or quality. Clan control refers to the process of social interaction among members who have a deep internal commitment toward the group's objectives.

Jaworsky (1988) investigated the use of existing control types in different environmental situations and proposed two broad classes of control for a marketing unit; formal and informal controls. According to Jaworsky (1988, p. 26) the formal controls are written norms that are initiated by management to influence the probability that the workers will behave toward objectives as characterised by the usage of plans, budgets, regulations, and quotas. The formal control can be implemented in three stages; input, process and output control. Input control is exercised prior to an activity, process control is during implementation of an activity and output control is exercised in measuring the performance and evaluation of the result (Jaworsky, 1988, pp. 26-27).

In contrast, informal control is defined as unwritten norms that are initiated by the workers themselves to influence the behaviour of individuals within groups that in terms of aggregation can be classified into three as; self, social, and cultural control (Jaworsky, 1988, p. 27). Self-control refers to an establishment of personal objectives, monitoring the achievement, and adjusting behaviour regarding the result attained. Social control is characterised as an establishment of group objectives and norms and using them to confirm actual attainment. Similarly, cultural control will be considered as belonging to the entire organisation (Jaworsky, 1988, p. 27).

Abernethy & Brownell (1997) investigated the role of accounting, behaviour and personnel controls at a R&D unit belonging to a large Australian industrial company and a major US scientific organization. The study used accounting controls similar to those used by Hopwood (1972). Abernethy & Brownell, (1997, p 235) referred to behaviour controls as the usage of standard operating procedures, job codification, reporting and accountability. Furthermore, they referred to personnel control as the control that "…regulates behaviour primarily through self and peer group control process" (Abernethy & Brownell, 1997, p 235). The study indicated that personnel controls were significant and positively related to performance for the unit that dealt with non-routine and highly uncertain situations.

Pettigrew (1979, cited in Lebas & Weigenstein, 1986, p. 264) pointed out, "...culture is the system of such publicly and collectively accepted meanings operating for a given group at a given time." Culture is an amorphous concept, which will be effective for control systems, particularly in a situation where output measurement is absent and the means-ends relationship is unclear. Lebas & Weigenstein (1986, p. 265) said that:

> …culture internalizes common goals and shared expectations about roles and behaviour, thereby reducing perceptual differences among sub-units... It establishes a system of norm and informal rules which spells out how people are to behave most of the time and allows them to extrapolate in new situations and act quickly, because even if the situation is new, the values are clear. Culture is thus an especially desirable control approach where the causal model is unclear, uncertainty is high, communication is difficult with other actors, and the cycle of action and consequence is compressed.

Ouchi & Jaeger (1978) used cultural differences between Japanese and Americans to investigate the effect of culture on organisational behaviour. They indicated that national culture may influence the individual's behaviour within an organisation, and that in turn will influence the entire organisation in making a choice. Ouchi & Jaeger (1978) used seven dimensions to distinguish the characteristics of Japanese and US firms as presented in table 4.1. According to Ouchi & Jaeger (1978), these two types of organisation are suitable in their own culture. When one operates in the other culture, those seven dimensions need modification from those characteristics suiting the one culture to those of the different environment.

Table 4.1: Characteristics of Two Familiar Organizational Ideal

Please see print copy for Table 4.1

Birnberg & Snodgrass (1988, p. 447) argued by saying that "...culture under certain circumstances can provide a synergistic element to the control system and facilitate its operation". Culture is important for management control systems in two ways: "It can affect the choice of the stimuli to which the individual attends, or it can affect any value judgements about the stimuli" (Birnberg & Snodgrass, 1988, p. 449).

Birnberg & Snodgrass (1988) distinguished the types of management control systems into two groups: explicit and implicit. The explicit management control systems refer to formal bureaucratic rules and standards. The implicit control systems, in contrast, refer to norms that are not clearly defined and readily knowable by both the subject who exercises the control and the object being controlled (Birnberg & Snodgrass, 1988, p.

448). Explicit management control systems are very familiar in management control literature, but the implicit control systems are rarely found.

The implicit control systems emphasise the cultural aspects that consist of group norms, beliefs and values (Flamholtz, 1983; Birnberg & Snodgrass, 1988). This aspect is deeply stored in the individual's mind, and will be used to filter what can and cannot be done by reference to the norm that is defined by the culture. As a set of values and beliefs then, the cultural aspect will be significant, influencing behaviour toward the organisational objectives (Flamholtz, 1983; Birnberg & Snodgrass, 1988).

Furthermore, Birnberg & Snodgrass (1988) argued that culture is a norm that is held by a particular society and will be used as a filter for perceiving the environment. The members of different culture groups may accept a particular type of control system, and reject another or vice versa. As they pointed out:

> Members of different culture groups may react differently to the same control mechanism or require different control mechanisms to achieve the same behavior. Thus, there is no reason to believe that a single MCS [*Management Control System*] is appropriate for all culture groups (Birnberg & Snodgrass, 1988, p. 449)

Birnberg & Snodgrass (1988) conducted a study of twenty-two firms in the US and Japan (consisting of eleven firms in each country) to examine the role of culture and its influence on the use of explicit and implicit management control systems. The explicit and explicit characteristics were indicated by sub-systems as monitoring, evaluation and reward systems. Birnberg & Snodgrass (1988) found that the US workers perceived the monitoring and evaluation sub-system as more explicit than the Japanese workers did. With regard to the reward sub-system, their study found that the Japanese workers perceived this sub system to be more explicit.

The overall findings indicated that the Japanese firms used more implicit management control systems than their counterpart US firms. The Japanese culture was defined as cooperative and homogeneous, and was characterised by positive behaviour and high degree of goal congruence. Using this argument, they concluded that, under a cooperative and homogeneous culture, an organisation did not need to enforce a formal control system. This may be caused by a situation where the workers already had in mind what should and should not be done.

Though the study of Ouchi & Jaeger (1978) and Birnberg & Snodgrass (1988) used culture on a country basis, it seems that this cultural aspect may also be an organisational phenomenon. Firms may have their own individual cultures resulting from individuals becoming socialised into the group. The implicit control system uses the values subsumed by the cultural ethos to exert control. Therefore, the cultural aspect used in this study would refer to organisational culture.

A review of the literature above indicates a variety of control types that are implemented in different stages. However, their positions in the control process are inconclusive and therefore need a reconstruction. For example, the administrative control of Hopwood (1974) could be included in Ouchi's (1979) bureaucratic control or the behavioural control of Ouchi & Maguire (1975), and clan control of Ouchi (1979) could be part of Hopwood's (1974) social control. In addition, they may also be partially included in Birnberg & Snodgrass's (1988) explicit and/or implicit control or the formal or informal control of Jaworsky (1988). Therefore, this study suggests a reconstruction by proposing the element of control implementation to contain two sub-elements; *control types* and *control implementation stages*.

<u>Control types</u>

Accordingly, the control types used by management control systems were found to be relevant to the effectiveness of control function (Bisbe & Otley, 2004). Therefore, in regard to the *control types* two broad types of control can be suggested: *formal* and *informal* control types. The *formal control type* refers to an explicit process that is carried out to influence actors in making a decision toward desired ends that is similar to administrative control (Hopwood, 1974) and explicit control (Birnberg & Snodgrass, 1988). The *formal* control type will be carried out with regard to written norms such as accounting reports, job description, employee appraisal system, budget, rules, standards, statistical reports, and diagrams such as PERT and CPM.

The *informal control type* refers to an implicit process that is carried out to influence actors in making decisions toward desired ends. As an implicit process, the informal control type will be implemented with regard to norms and values that are accumulated to form a belief among a group(s) of individuals within an organisation. The accumulation of norms and values may emerge from two sources that will be used to construct two types of informal control: *surveillance* and *cultural* control. *Surveillance* control may come from written norms and values that have been internalised by the actors, and applied to the actors who perform the tasks by watching and guiding them toward the proper way in performing the tasks. *Cultural* control is the accumulation of norms and values that are originated from common norms, beliefs, and shared values among the actors in a group without having any relationship with written norms. Since the accumulation of the norms and values has been internalised by the member, it may construct an informal control that will bind the individual mind to behave toward the committed behaviour namely self-control (Hopwood, 1974; Jaworsky, 1988).

Aside from the differences in their relationship with written norms, these two types of informal control may differ in their visibility. The surveillance control type may be more visible, because it is carried out through physical action, whereas the cultural control type cannot be seen physically because it is carried out through the actors' mind.

The use of informal controls has been found to be growing (Pant, 2001) and effective if they are combined properly in sales organisations (Cravens, et al, 2004) as well as in R&D organisations (Bonner, et al, 2002; Abernethy & Brownell, 1997; Heng et al, 1999; Ditillo, 2004; Tatikonda & Rosenthal, 200; Bisbe & Otley, 2004).

Control Implementation Stages

Regarding the stages of control implementation, this study proposes three stages of control implementation. The first stage may be carried out during the selection and provision of input that will be used for an operation and will be referred to as *input control* in this study. The second stage may be performed during the process of operation to monitor how tasks are performed and will be referred to as *process control*. The third stage of control may be carried out after the operation has been completed to monitor what outputs have been achieved, and this type of control phase will be referred to as *output control*.

The use of formal and informal control types may differ during these three stages. Input control may use a combination of formal and informal control types in selecting the resources that will be used for the operation. However, emphasis on the two types of control may differ depending on the characteristics of the goals and the environment where the organisation operates. When the goals are clear and the environment is relatively certain, the use of the formal control type may dominate the control function. In contrast, when the goal is unclear, and the environment is uncertain, the preferred control function may be the informal control type.

As the purpose of *process control* is to ensure that the tasks are done, the use of the combination of these formal and informal control types at this stage may also be influenced by the characteristics of the goals and the environment. When the goals and the mean-ends relationship are clear, and the environment is certain, the formal control type may be emphasised. However, when the organisation deals with the opposite situation, the use of the informal control type would be highly significant to the control function.

The purpose of *output control* is to ensure that the expected output is achieved and from that, corrective action and/or reward system can be applied. Therefore, the output control would be emphasised in a comparison between the expected output and the actual result, and would be dominated by the formal control type. The comparison process however requires a clear mean-ends relationship, and clear output characteristics. This type of control would be effective if the two conditions are met. However, if these two conditions cannot be met the output control may only be used for the justification of an action.

Control Tools

The element of *control tools* refers to instruments that are used in performing the control function. The purpose of the control function is to influence the action toward attaining the desired ends. However, the desired ends are commonly multiple and vague, and therefore they need agents which would be able to represent the value embodied in the desired ends. The fundamental role of the *control tools* is to represent both the value of the desired ends and the effort, so the control function can monitor, compare and evaluate how far the effort is performed concerning the desired ends. Moreover, the uses of *control tools* may be multiple, and may often be substituted for one another; therefore, the appropriate control tools chosen may influence the success of the control systems (Merchant, 1985; Bisbe and Otley, 2004; Tatikonda & Rosenthal, 2000).

Various *control tools* can be found in the literature (Hopwood, 1972; Brownell, 1982; Otley, 1978; Govindarajan, 1984; Khandwalla, 1972; Merchant, 1985; Macintosh & Daft, 1987; Rockness & Shields 1984). However, their existence during the control process is inconclusive, and therefore needs modification. For example, four control styles that used different control tools were found by Hopwood (1972), and have been used extensively by others (Brownell, 1982; Otley, 1978). They are Budget Constraint style, Budget Profit style, Profit Conscious style, and Non Accounting style. The Budget Constraint style uses the value of an expenditure budget to measure performance. The Budget Profit style uses profit budget as the control tool to measure performance. The Profit Conscious style uses all efforts that may increase general effectiveness as the control tools, and the Non Accounting style uses data other than accounting.

Khandwalla (1972) in his investigation on the effect of different types of competition on management control used nine types of control. However, seven of these can be categorised in this study as control tools. They are standard costs, marginal or incremental costing, flexible budgeting, internal rate of return or present value, statistical quality control, inventory control and production scheduling, bureaucratic evaluation by management and senior staff.

Otley (1999) proposed a performance measurement framework based on the use of five control components namely; Objectives, Strategies and plans, Targets, Rewards, and Feedback. He examined the use of those five components on three control techniques, Budgetary Control, EVA (Economic Value Added) and Balanced Scorecard. He found that the use of the five control components varied among the three control techniques. He suggested the framework may be used to examine management control systems in practice.

Rockness & Shields (1984), in their study on research and development organisations considered various control tools that were used during execution of input, behaviour and output control. These control tools were expenditure budget, standard operating procedures, PERT, CPM, and transfer pricing. The summary of some control tools described by various researchers is presented in table 4.2.

From the above discussion, it appears that the description of each control tool is rarely described in the literature. To understand more on the appropriate use of each control tool in different situations, there is a need to explore in more depth the characteristics of the control tools. To provide a broader perspective and to allow a more detailed analysis of the appropriateness of control tools, this study proposed two elements of control tools that need to be considered: *dimensions* that are contained in the control tool and *values* that are represented by the control tool.

Table 4.2: Summary of Control Tools

CONTROL TOOLS	AUTHORS
Expenditure Budget, Profit Budget, Cost Effectiveness, Other than accounting data	Hopwood (1972), Otley (1978), Brownell (1982)
Standard Costs, Marginal or Incremental Costing, Flexible Budgeting, Internal Rate of Return or Present Value, Statistical Quality Control, Inventory Control & Production Scheduling, Bureaucratic Evaluation by Management	Khandwalla (1972)
Standard Operating Procedures, Transfer Pricing, PERT, CPM	Rockness & Shields (1984)
Sales Growth Rate, Market Share, Operating Profits, Profit Margins, Cash Flow, Return on Investment, New Product Development, Market Development, Research & Development, Cost Reduction Programs, Personnel Development, Political Public Affairs.	Govindarajan (1984)
Net Income Targets, Expense Targets, Headcount Targets, Procedural Constraint, Directional Constraint	Merchant (1985)
Expenditure & Revenue Budget, Number of Personnel, Number of New Customer Contracts, Volume of Orders, Machinery Down Time, General Policy Guidelines, Job Description, Prescription to handle operational situations	Macintosh & Daft (1987)
New or improved processes, products or techniques; Patents and patent applications; Published technical reports/ memorandums, manuscript, and oral presentation; request for proposal; Peer ratings; Supervisory ratings; Independent panel and Independent expert ratings.	Stahl & Steger (1977)
Technological merit; Social merit; Scientific merit	Weinberg (1989)
Productivity in written work, Recent report, Originality of written work, Professional society membership, Judgment of actual work output, creativity ratings, Likeableness as a team member, Visibility, Recognition for organizational contributions, Status seeking tendencies, Current organizational status, Contract monitoring load.	Taylor et al., (cited in Edward & McCarrey, 1973)

Dimensions of Control tools

Dimension refers to the solid characteristics of the criteria that are used by the control systems regarding the result that is expected to be attained. As an instrument of the control function, control tools may contain various dimensions that can be classified into four groups: *Directional, Bureaucratic, Scientific* and *Financial*. *Directional dimension* refers to control tools that contain qualitative characteristics that represent the general directions to be followed by the action such as system goals and general policy guidelines. The *bureaucratic dimension* refers to the control tools that contain either quantitative or qualitative characteristics which represent the technical tasks, such as standard operating procedures, quality control, inventory control, and scheduling including PERT, CPM, and production scheduling. The *scientific dimension* contains the control tools that are used particularly to measure ideas and innovations such as new or improved processes, products or techniques, patents and patent applications, scientific publications, membership of professional organisations and so forth. This dimension may contain either quantitative or qualitative characteristics. The *financial dimension* refers to the control tools that contain monetary measurement. This dimension is very familiar in accounting literature and includes budgets, cost effectiveness report, standard costs, and return on investment and so forth.

Values of Representation

As an agent to mediate desired ends and actual performance, the control tools should contain *values* that ideally represent these two extreme points. Three values of representation are proposed in this study: *external values*, *internal values*, and *social values*. *External value* refers to values that are developed by an external party. For example, the use of the market mechanism to define a fair price for transfers (Ouchi, 1979; Lebas & Weigenstein, 1986) can be considered to contain external values.

Internal values refer to values that are developed by an internal party by reference to the internal condition of the organisation. An example of internal values can be seen in the bureaucratic control (Ouchi, 1979, Lebas & Weigenstein, 1986) that is commonly labelled by setting rules, standard operating procedures and policies, standard costs, and so forth. The value setting process of internal values may be done by force and be dominated by the dominant party within the organisation. This type of value setting would have a greater chance for dysfunctional behaviour if it is used in a high uncertainty and low goal congruence situation

Social values refer to values that result from social interaction among the members of a group of individuals. The existence of social values may be reflected by the organisational culture. The value setting process in this circumstance is not done by force; rather, it is accepted by the members willingly. The social values are not disturbed by clear or unclear boundaries of desired ends, because they are set by the social interactions that have a chance to change over time. Since the social values are accepted through willingness rather than enforcement, the use of social values in the control system will have less chance of significance for dysfunctional behaviour than the internal values. Though this study divided the values represented by the control tools into three types, it should be kept in mind that in exercising the control tools there would be a combination among these values embodied in the set of control tools applied.

Having defined the dimensions and the value of representation of the control tools, there is now a need to discuss the connection between the two control tool elements. The directional dimension contains directions to be followed may be set by internal members of the organisation. However, the value that is given to this dimension may be a combination of the three values: internal, external and social values. For example, in setting the system goals or general policy guidelines, the members of the organisation would be influenced by internal values that contain the desired conditions that are expected to be achieved by the organisation. However, in defining the expected conditions, the organisation also should consider the requirements of the external environment, which contain the external value. Moreover, to develop the system goals and general policies, the members of the organisation would also be influenced by their individual belief. As part of the membership of a particular social group, the individual belief will contain the social value.

The bureaucratic dimension that deals with internal affairs may be dominated by internal values. For example, the standard operating procedures and scheduling may be constructed by the members of the organisation, and these would be based on their past experience. The scientific dimension that is commonly used in an activity to produce new knowledge such as in a R&D organisation may be constructed by a combination of the three values. However, the emphasis of either one of the three values will depend on the stage where the R&D operation is performed. For example, in the basic and applied research operations, to measure the unmeasurable output such as ideas, thought and concepts, the scientific dimension may be dominated by external and social values. Some of the control tools that contain external values are as follows; patents or patent applications, scientific publications, memorandums, manuscripts, oral presentations, and independent panels and expert rating. The control tools that contain social values may include the following criteria; originality of written work, professional society membership, and creativity ratings. In the product development operation, the description of expected output will be clearer than from basic and applied research. Therefore, to some extent internal values may be used by the control tools such as peer or supervisory rating, current organisational status, and external values such as customer demands on the quality of the products.

Regarding the financial dimension, the values that are contained in this dimension, it is suggested, are developed based on the internal and/or external values. Though the control tools in this category mostly contain internal values, some of them may also consist of external values such as rate of return, transfer pricing, budgeting and so forth.

The success of the control systems may occur when each control element matches the plausible requirement of others. Therefore, it is important to understand the plausible requirement of each control element. The understanding of the requirement of each control element may be used to make a choice of dimension contained in each control element. Then a package of control systems can be developed and used to suit the environment where the organisation operates. The next section will discuss the basic requirement of each dimension by analysing the relationship among elements of the control concept.

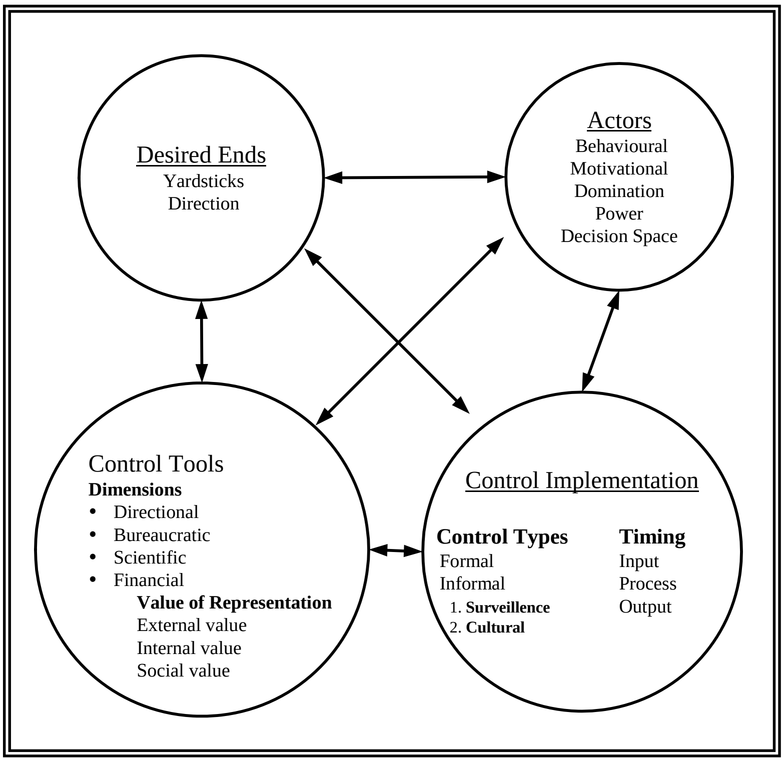
The Relationship among core elements of Management Control Systems

Though the previous studies have indicated the existence of the characteristics of the desired ends, it seems that a more comprehensive explanation of how the dimensions of desired ends are implemented, and their relationship within the social context, is necessary. The interrelationship among core elements of control may be suggested as depicted in figure 4.1.

Desired ends and Control tools

The relationship between the *desired ends* and the *control tools* occurs during the three important functions of the control systems: monitoring, evaluation, and performance measurement (Birnberg & Snodgrass, 1988). The control systems will monitor, measure, and evaluate the action by reference to the desired ends. The purpose of these control functions is to ensure that two aspects are included in the desired ends: yardstick and direction. With regard to the yardstick dimension, the control systems will function to measure and evaluate how far the expected outputs have been achieved by the action. Whereas, with respect to the directional dimension, the control systems will function to ensure that the actions are still in the correct directions for achieving the desired ends.

Figure 4.1: The Relationship among core elements of Management Control Systems



In performing those functions, the control systems need tools, and their usages are different depending on which dimension characterises the desired ends. For example, a particular organisation, which deals with a perfect environment such as concrete and measurable goals, repetitive tasks and a certain environment, may base its control system on the yardstick dimension. As it is envisaged by that perfect situation, the expected output may be relatively complete in representing the characteristics of the desired ends as well as being used to indicate direction. Therefore, by emphasising the yardstick dimension the organisation may have captured the two dimensions of the desired ends in its control system simultaneously. For this situation, the control tools may be able to represent the value of the desired ends and the action itself relatively accurately. Since the situation becomes more certain, the members of the organisation may use a predictive model in defining the description of desired output relatively accurately. The use of a predictive model in turn will encourage the control tools to use internal values which commonly involve quantitative attributes such as; standard cost, budget, financial ratios, statistical quality control, and so forth.

In contrast, under an imperfect situation such as when all the environments are uncertain, unpredictable, undergoing changes, and with goals that cannot be measured quantitatively, the organisation may focus its control system on the directional dimension. For this situation, the control tools may use either external or social values.

More precisely, when dealing with a perfect situation, the yardstick may be the core dimension of the control system and the direction would be the peripheral dimension, and vice versa for the imperfect situation. Therefore, the relationship between the dimension of the desired end and the tools is said to constitute the control system. In a perfect environment, the tools may be dominated by internal values. On the other hand, under an imperfect situation, the external and social values may play an important role as control tools (Hayes, 1977; Abernethy and Brownell, 1997; Chenhall, 2003).

Previous studies have implicitly indicated the relationship between the desired ends and the control tools. Govindarajan (1984) for example, indicated that the business unit, which perceived lower environmental uncertainty, would use a more formula-based evaluation and reward system, that is, it emphasised the yardstick dimension. Whereas higher environmental uncertainty would use a more subjective performance evaluation, that is, the directional dimension. Hayes (1977) indicated that internal variables such as productivity, cost behaviour, supportive relations, personnel utilisation, and work cohesion that use internal values were used more extensively in the unit that dealt with a certain environment. However, for the unit that dealt with a more uncertain environment, interdependency variables such as reliability, cooperation, and flexibility, that use social values, were used as the major explanatory. Though this relationship has been found by many studies (Hopwood, 1972; Hayes, 1977; Hirst, 1981, 1983; Govindarajan, 1984; Jaworski & Young, 1992; Abernethy and Brownell, 1997; Tatikonda & Rosenthal, 2000; Ditillo, 2004; Bonner, et al, 2004), a more comprehensive explanation of how the dimensions of desired ends are put into operation and their relationship within the social context is necessary.

Desired ends and Actor

The relationship between *desired ends* and *actor* essentially relies on the behavioural dimension, that is, how preferred behaviour is defined in regard to the desired ends. Traditionally, preferred behaviour is one of effort toward the achievement of the desired ends. In this case, the characteristics of the desired ends are assumed to be represented by standards, targets and rules. The actor should then behave according to those criteria, which may also limit the actor's decision space. When the actor can behave ideally, a reward will be given; otherwise, a punishment will be executed. The reward and punishment system is a manifestation of the motivational dimension, which is facilitated by the domination and power dimensions.

Studies of actors have been undertaken by some authors (Hopwood, 1972; Hirst, 1983; Jaworski & Young, 1992). However, their studies seemed to focus the analysis on bureaucratic and financial dimensions of control tools and the influence of these two dimensions on behaviour. This study, however, enlarges the understanding of actor by proposing five aspects namely behaviour, motivation, domination, power and decision space that need to be considered simultaneously in analysing the influence of control system. Moreover, the emphasis of the control system on the five elements of the actors may be different depending on the perfect and imperfect situation dealt with by an organisation.

Under a perfect situation, preferred behaviour is clear, that is, the achievement of a clear and certain desired end. The motivational element may be based on monetary and other hierarchical promotions. It should be kept in mind that the perfect situation is indicated by routine and repetitive tasks and relatively predictable and quantifiable output as in a production unit. Since the perfect situation is characterised by the above qualities, the delegation of authorities along the hierarchy will be clear and then the decision space can be defined precisely. In turn, the capacity to dominate others may come from the formal network rather than the informal. Furthermore, the degree of power to influence others in making decisions will be dominated by the formal source rather than the informal (Abernethy and Brownell, 1997; Chenhall, 2003).

A study by Dillard and Burris (1993) indicated that different management control systems should be considered by an advanced technology application firm when they said that (Dillard and Burris, 1993, p. 164),

> …in technocratic organizations, demonstrated expertise and credential certification tend to become more important than rank or position as the basis for legitimate authority. In contrast to bureaucratic authority, which is derived from seniority and promotion from within, technocratic authority rests on the allegedly neutral decision-making ability derived from expertise.

Furthermore Dillard and Burris (1993, p. 166) said that,

> …authority within an advanced technology-based manufacturing environment comes increasingly from technological knowledge. Only those who master the new technology and apply the related techniques will be in positions of influence

Therefore, in imperfect situations, where the tasks are more uncertain, unclear, and the outputs are relatively less predictable and less quantifiable such as those dealt with by a R&D organisation, the control toward those five elements of actor should be different.

The behaviour is not guided toward a precise criterion that represents the desired ends as in the case of a perfect situation. The behaviour is guided toward the organisational system goals, which are dominated, by the directional characteristic rather than the yardstick.

Motivation may not be based merely on monetary and hierarchical promotion; it should also cover individual satisfaction such as reputation and professional acknowledgment. Moreover, as it is caused by unclear and less quantifiable goals, the delegation of authority among individuals would not be clear and the decision space for every individual cannot then be defined precisely. When the decision space is unclear, the source of power may not only come from the formal network but also from the informal network, as it is the result of social interaction among the members. In turn, the domination element may not be based only on the formal hierarchy but also on informal elements including seniority and professional norms. Therefore, considering that the control system involves behavioural modification devices, the differences in the actors' elements under those two conditions should be taken into account.

Desired ends and Control implementation

The relationship between the *desired ends* and *control implementation* is related to the implementation of the predominant control type between the two dimensions of desired ends. Many studies can be found in the literatures that have examined this relationship (Hopwood, 1972; Brownell, 1982; Govindarajan, 1984; Hirst, 1983; Abernethy & Stoelwinder, 1991, Abernethy and Brownell, 1997; Tatikonda & Rosenthal, 2000; Ditillo, 2004; Bonner, et al, 2004). Most of those studies indicated that when the yardstick dimension dominates the characteristics of the desired ends, the formal type of control and the surveillance type of control may be appropriate. In contrast, when the directional dimension dominates the characteristics of the desired ends, informal control (particularly cultural control) may play an important role in the implementation of the control systems.

Actors and Control tools

The relationship between the *actors* and *control tools* traditionally rests on the function of the control system to measure the behavioural element. Output is commonly measured as a surrogate for behaviour. However, at an extreme point where the appropriate outputs cannot be taken for granted, the behaviours cannot be measured with regard to the output resulting from behaviour. In this situation, the control system cannot precisely monitor and evaluate the output, which is derived from the behaviour. Moreover, to monitor and to evaluate an action does not necessarily mean to measure it quantitatively. The action can be monitored and evaluated with regard to the direction. Therefore, this study does not view the control function as limiting the measuring process, but rather as consisting also of the process of influencing behaviour. The influencing process may be carried out through the other four actors' elements that will affect the behaviour by driving the action toward the achievement of the desired ends.

Traditionally the motivational aspect has been viewed with regard to the reward system. However, aside from the reward system that emphasises the financial dimension and rank, it is suggested that the use of scientific dimensions such as scientific publications, seminar attendance, and patents can also be used.

Domination, power and decision space may be influenced by four dimensions of control tools (directional, bureaucratic, scientific and financial). For example, directional and bureaucratic dimensions may limit the decision space of the actor, therefore making a decision possible only within a particular area. In turn, those dimensions of control tools will also reduce the power and domination of the actor in influencing his or her peers in making a decision. The reduction of power and domination may result from delimiting the decision space. The scientific and financial dimensions may also have the same effect on decision space. When the independent panel or expert rating can evaluate the appropriateness of the scientific quality proposed, the actors' decision space would be bound by that quality. Similarly, the financial dimension as described by the budget availability would also limit the actors in making a decision.

Actors and Control implementation

The relationship between the *actors* and the *control implementation* refers to the use of the control type to influence behaviour through the other four actors' dimensions. However, it is difficult to describe this relationship without involving the characteristic of the desired ends. In a perfect situation, the formal and surveillance control type may be applied to influence motivation and to measure the output that results from the behaviour. In addition, it can also be used to monitor and evaluate whether the actors operate within the decision space that is given, and to monitor whether or not the actors have a significant power in dominating their peers in making a decision. However, in an imperfect situation, the use of formal and surveillance types of control may be less appropriate and may lead to dysfunctional behaviour. Therefore, under an imperfect situation, cultural control may be a significant factor involved in control systems.

Control tools and Control Implementation

The relationship between the *control tools* and the *control implementation* refers to the use of the tools employed in the implementation of the type of control. As the instruments of the control function, the control tools may be used by the formal and informal control type. However, most of the control tools as depicted in table 4.2 seem to have a quantitative expression, although some of the control tools may have qualitative characteristics such as bureaucratic evaluation, political public affairs, directional constraint and general policy guidelines. Moreover, the majority of those control tools may be used in performing the formal control rather than the informal type of control. Though it is difficult to place a clear boundary on the use of control tools between formal and informal control, in some ways the use of control tools in those two types of control may be distinct, and needs to be defined by reference to those two control types.

The characteristics of control tools that are used by formal the control type are clearly defined in the literature. These control tools may refer to written norms However, the characteristics of informal tools are rarely found in the literature. Ouchi (1979, p. 845) stressed the importance of informal control tools by stating that,

> the student of organizational control should take care to understand that clans, which operate on ceremony and on ritual, have forms of control, which by their nature are subtle and are ordinarily not visible to the inexperienced eye.

Examples of the tools used by informal control that may be found in the literature and include tools include shared values (Hopwood, 1974) and personal objectives (Jaworsky, 1988), mutual commitments among employees toward objectives (Hopwood, 1974; Ouchi, 1979; Jaworsky, 1988), and norms (Jaworsky, 1988; Lebas & Weigenstein, 1986). In turn, as the informal control contains surveillance and cultural control, the control tools that are used by surveillance and cultural control may also be distinct.

The formal control type may use any or a combination of the four dimensions of control tools. However, the surveillance control type may only use the bureaucratic dimension of the control tools. Moreover, the cultural dimension of the control type may use either the directional or the scientific dimension of control tools.

Acknowledging the presence of these four control dimensions will broaden the comprehension of the control concept. However, a description of the use of these dimensions is required. The dimensions may be complementary. However, in exercising control, it is possible that one dimension will be more dominant than other dimensions, depending on the situation being dealt with by the organisation (Hopwood, 1983). In relation to the stages of implementation, there may be different control tools used during input, process and output controls. Pillai, et al (2002) examined the situation in the R&D project selection phase, project execution phase, and implementation phase. They found the use of different control tools during the projects' phases.

Though the relationship among the dimensions seems to be conspicuous from the above discussion, the degree of combination between perfect and imperfect situations may occur in a practical situation. Therefore, the relationship among the control elements has potential to be explored. The above discussion has indicated the appropriate use of the content embodied in each core elements of the control systems in perfect and imperfect situations. Table 4.3 presents a combination of core elements in two possible situations.

A perfect situation allows the control functions to use both the yardstick and directional dimensions of the desired ends. In relation to the actors, it would also be plausible to use monetary and hierarchical promotion, which is measured by the output, by using motivational devices to encourage behaviour toward the achievement of the desired ends. Moreover, in a perfect situation, the potential of influencing others and the source of power for that capacity may come from the formal hierarchical base. In turn, the decision space can be clearly defined and can be based on the formal distribution of authority. In a perfect situation, the control tools that mostly contain internal values such as bureaucratic, financial and some of the scientific dimensions may dominate the control function. In turn, the use of formal and surveillance control types may dominate the control function in a perfect situation.

In an imperfect situation, where the environment is uncertain and the expected output is unclear, the yardstick dimension seems to be less useful, and the directional element becomes significant. For this situation, the appropriateness of the actors' elements would also be affected. When the situation becomes uncertain, the cultural aspect may be significant in motivating behaviour. Moreover, in an imperfect situation, the decision space cannot be clearly defined. Furthermore, the domination, and power source may also come from informal interactions.

Table 4.3: The Influence of Organizational Environment toward the Choice of Control Elements.

Environmental Situations				
Control Elements	PERFECT		IMPERFECT	
Desired Ends	Yardstick			
	Direction		Direction	
ACTORS	Behaviour	through output	Behaviour	through culture
	Motivation	monetary & rank	Motivation	monetary, promotion,
	Domination	formal hierarchy		and professional accreditation
	Decision space	formal hierarchy	Domination	formal & informal
	Power source	formal hierarchy	Decision space	formal & informal
			Power source	formal & informal
CONTROL TOOLS	Internal values		external and social values	
FORMS/STYLE	Formal & Surveillance		Cultural	

An imperfect situation may also influence the use of the control tools. In an imperfect situation, the control tools that contain external and social values such as directional and scientific dimensions may play important roles in the execution of the control function. Similarly, in an imperfect situation, the cultural control type as part of the dimension of control type may play a significant role in the execution of the control function.

Summary

The concept of control is found to focus on environmental certainty and ignore the situation of uncertainty. To enlarge understanding on the description and essence of management control system, this study proposed a new approach to describe the elements of management control systems in a more complete manner. Four core elements of management control systems are proposed in this chapter: *Desired ends*, *Actors*, *Control implementation*, and *Control tools*. The content of each core element, and their use in a perfect and imperfect situations have also been discussed through out the chapter. The element of desired ends has been found to contain two sub-elements, namely *yardsticks* and *directional*. In the perfect situation, both elements of desired ends may be used appropriately. However, under an imperfect situation, the yardstick dimension seems to be less useful, and the directional element becomes significant.

Five aspects of the *actors'* element have been identified. They are *behavioural*, *motivational*, *domination*, *power,* and *decision space*. The appropriate usage of these elements is also influenced by the perfect and imperfect conditions. In the perfect situation, monetary and hierarchical promotion can be used as motivational devices to encourage behaviour toward the achievement of the desired ends. However, when the situation becomes uncertain and shifts toward an imperfect situation as dealt with by a R&D organisation, something other than monetary and hierarchical promotion such as such as reputation and professional acknowledgment is required to be used to motivate the behaviour. In a perfect situation, the potential to influence others and the source of power for that capacity may come from the formal hierarchical base. In turn, the decision space can be clearly defined and can be based on the formal distribution of authority. In an imperfect situation, the decision space cannot be clearly defined, and the potential to influence others will have a greater chance to occur. However, the power source of the potential to influence others may arise from informal network.

The element of control implementation contains two sub-elements *control types* and *stages of implementation*. The *type of control* is distinguished into two groups in this chapter namely: *formal* and *informal control* in which the informal control type is proposed by this study to be implemented trough *surveillance* and *cultural* control. The uses of those formal and informal controls are suggested to be influenced by perfect and imperfect situation. In a perfect situation, the use of formal and surveillance control may dominate the control function. However, in and imperfect situation, cultural control may play a significant role.

Three critical points where the control function will be executed are suggested in this chapter: *input*, *behavioural* and *output control*. However, the use of combination of sub-elements of the control tool at those three critical points may be influenced by perfect and imperfect situations. In a perfect situation, the control tools that mostly contain the internal values such as bureaucratic, financial, and some of the scientific dimensions may be emphasised in used by the control function. In an imperfect situation, the control tools that contain external and social values such as directional and scientific dimensions may play important roles in the execution of the control function.

The element of *control tools* is proposed to consist of two sub-elements namely *dimension* and *value of representation*. This study proposes four dimensions of control tools: *directional*, *bureaucratic*, *scientific*, and *financial*. The use of these dimensions may be emphasised depending on the characteristics of perfect or imperfect situation and the type of desired ends dealt with by an organisation. Apart from these dimensions, it is argued in the chapter that the control tools play a role as agent to connect the value of desired ends and actual performance. Therefore, the control tools should be attributed by a fair value that appropriately represents the desired ends and the actual achievement made by the actors. Throughout the chapter, the study proposes three values of representations that need to be considered in using the control tools: *external*, *internal* and *social* value. Each value may contribute to the construction of the dimensions of the control tools, in which they may be use differently in a perfect and imperfect situation.

The next chapter contains discussion of the method used in conducting the research by this study.

CHAPTER FIVE

Research Method

Introduction

Case study research is one of the many ways of conducting research. Many studies in social science have been done using case study research (Yin, 2003), and a call has been made to use this method to conduct research in accounting (Humphrey and Scapens, 1996). Every research method has its strengths and weaknesses as case study research does.

Eisenhardt (1989) describes the strengths of case study research in its typical data collection methods, as well as accomplishing various aims such as describing a case, testing a theory, or generating a theory. Further, Eisenhardt (1989) described the weaknesses of case study research as simplifying the complexity of a theory, and being idiosyncratic. Other authors described the strengths and weaknesses of case study research using four perspectives (Hagg and Hedlund, 1979) and made a call to conduct empirical research in management accounting (Kaplan, 1986) in which case study research was one of the suggested methods.

This study uses case study research on multiple sites in the government sector in Indonesia. The study uses interviews, observation and documentation as well as telephone interviews as its data collection technique. The data used in the study is qualitative.

This chapter consists of seven sections. The next section consists of a discussion of case study research including its definition, strengths and weaknesses. The third section contains a discussion of the process of preparing for case study research. The discussion includes an overview of how to design a case study. This section then is used to lead to the fourth section. Section four presents the process of this study, the research questions, and the type of case study research method used.

Section five of the chapter covers a discussion of the various data collection methods found in the literature, including their strengths and weaknesses respectively. This section then goes on to indicate the data collection methods used by this study. Section six contains a discussion of the various data analysis techniques commonly used by case study research including their distinctiveness and requirements of each method. After discussing various methods, this section explains the analysis method chosen by the study. Finally, the chapter will close with a summary.

Case Study research

Case study research is one of many ways of conducting social science research (Yin, 2003; Stake, 1995). Case study research may be viewed differently by different authors. According to Sarantakos (1998, p. 191),

> Case study research involves studying individual cases, often in their natural environment, and for a long period of time …and employs a number of methods of data collection and analysis.

Furthermore, according to Sarantakos (1998) case study research can be used in both quantitative and qualitative research to a different extent and for different reasons, which was summarised by Sarantakos (1989, p. 193) as follows;

> …case studies in quantitative research are employed (1) as a prelude to the real research; (2) as a form of pre-test; or (3) as a post research explanation of the main study. In all cases it is obvious that case studies are not used as an autonomous research project but as a supplement to other studies.
>
> In qualitative research, case studies research do not serve as a stepping stone to quantitative studies but as a research enterprise of their own, aimed at developing hypotheses or even theories. They are not second-rank research or a supplement to quantitative studies, but a research model that is as significant and worth pursuing as quantitative research.

> As a scientific inquiry, case study research has the aim of studying in an open and flexible manner social action in its natural setting as it takes place in the form of interaction of communication and as interpreted by the respondents… This type of case study research in the qualitative field illustrate its main criteria … Among these criteria are openness, communicativity, naturalism and interpretativity.

Hagg and Hedlund (1979, p. 137) use Webster's dictionary to define the definition of a case as "what actually exists or happens", from which they draw the implication of that definition to the meaning of case study as they point out that "case studies try to get at what really goes on" (Hagg and Hedlund, 1979, p. 137). In similar vein, Stake (1995, p. 237) also said that a, "… case study is both the process of learning about the case and the product of our learning." Yin (2003, pp. 13-14) defined a case study more precisely by saying that,

> …a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident… (t)he case study as a research strategy comprises an all-encompassing method-covering the logic of design, data collection techniques, and specific approaches to data analysis.

Hagg and Hedlund (1979) viewed case study from four perspectives; the holistic point of view, a critique of empiricist notions, involved research and from the perspective of change, process and history. Stake (1995, p. 239) described the holistic point of view as viewing social phenomena and human dilemmas because "…the nature of cases are situational and influenced by happenings of many kinds." Hagg and Hedlund (1979, p.137) went on to say that,

> …social processes, including the process of accounting, are bounded, with the boundary specifying the whole. A case study therefore becomes a way of investigating just what the boundaries of a particular process are. And even if the boundaries are considered to be known beforehand, it is necessary, according to this perspective, to scan the whole area thus framed in order to understand the meaning of a single observation within the boundary.

Considering the critique of empiricist notions, Hagg and Hedlund (1979) pointed out that the use of pure and simple sense data was the basis of knowledge. Furthermore, they said that,

> …since in many fields of social science inquiry, including accounting, there is no recognized theory or even basic epistemology to guide the researcher in the selection and interpretation of 'strategic data', a good approach is to try to develop theories on the basis of rich investigations of social phenomena, not prematurely delimiting the field of observation. In this sense, as from the holistic point of view, the critique of empiricist notions leads to making the boundaries and ways of conceptualizing single parts of reality, problematic, and thus subject to investigation (Hagg and Hedlund, 1979, p. 137).

Involved research is part of the action research tradition in which Hagg and Hedlund (1979) favor case study research. Three advantages of action research pointed out by Hagg and Hedlund (1979, p. 138) were;

> …when one is interested in changing social systems, one often has to get deeply involved in the situation in the terms of the other participants in the process…. Another vein of involved research does not necessarily insist upon a normative ambition on the part of the researcher. Instead, the crucial assumption is that the most effective way of learning about social processes is by experimenting with them. The third point of view related to the two previously mentioned traditions of involved research, is the hermeneutic emphasis on understanding rather than explanation.

The perspective of change, process and history used by Hagg and Hedlund (1979) was based on a view of social reality as being dynamic as they pointed out that,

> ...the role of case study approaches has, as its core, a view of social reality as dynamic. The traces of dynamic processes at a given points in time should be interpreted as the result of a complex interplay of historical development. Perhaps the only laws worth looking for in social science, according to this perspective, are laws of change and development, rather than of static structure. This notion leads to an emphasis on the history of existing social phenomena and their development, and possibly reproduction, through interaction with other phenomena and processes.

In a similar vein Eisenhardt (1989) suggested that three strong points of theory building arose from cases such as; the chances of generating a novel theory, the testability of an emergent theory, and the empirical validity of the resultant theory.

Eisenhardt (1989) suggested that the possibility of generating a novel theory is related to,

> …creative insight [*which*] often arises from the juxtaposition of contradictory or paradoxical evidence… Building theory from case studies centers directly on this kind of juxtaposition. That is, attempts to reconcile evidence across cases, types of data, and different investigators, and between cases and literature increase the likelihood of creative reframing into a new theoretical vision (Eisenhardt, 1989, p. 546).

Regarding an emergent theory, Eisenhardt (1989) said that,

> (m)easurable constructs are likely because they have already been measured during the theory building process. The resulting hypotheses are likely to be verifiable for the same reason. That is, they have already undergone repeated verification during the theory building process (Eisenhardt, 1989, p. 547).

Finally, the resultant theory was mentioned as being likely to be empirically valid as it is by being intimately tied with the evidence which will be consistent with the empirical observation (Eisenhardt, 1989, p. 547).

Many calls from accounting scholars for the conduct of empirical research in accounting using case studies can be found in the literature (Humphrey and Scapens, 1996; Hagg and Hedlund, 1979; Kaplan, 1986). Kaplan (1986) focused his argument on the area of management accounting and proposed case study as one of the empirical research methods. According to Kaplan (1986, p. 442), case study performs an intense examination of the sites and provides a rich description of an actual situation at the site, and collects multiple data through various data collection methods such as interview and observation to at least describe the context in which it operates. Having those characteristics, case study may provide an in depth description and understanding of a particular problem (Kaplan, 1986, p. 442).

In his concluding remark, Kaplan (1986) pointed out three significant benefits of case study research for management accounting academics;

> Firstly, case studies provide the basis for other forms of research activities... Second benefit from descriptive case studies arises from the discipline they provide to seek out interesting organizations or interesting practices. A third benefit of case studies accrues more to our teaching than to our research activities. Having rich descriptions of cost accounting and management control practices in actual organizations will enhance greatly our ability to communicate with students about the strengths and limitations of alternative schemes (Kaplan, 1986, pp. 445-446).

Humprey and Scapens (1996) took a position to consider the purpose of case study as to obtain more understanding of accounting practice by saying that,

> We believe that case studies of accounting practice are a vital, albeit not the only, way of informing such debate and enhancing understanding of both day to day organizational complexities of such practices and the interrelated influence of wider social and political contexts. However, knowledge developed through case studies will be dependent on the way the cases are constructed and their findings communicated (Humphrey and Scapens, 1996, p. 94)

As to understand the practice of accounting in its social setting, Humprey and Scapens (1996, p. 100) mentioned that,

> In terms of case-based accounting research, such a view of theory is liberating, setting researchers free to use existing theory, metaphors and prior cases to enhance their understanding of accounting practice and develop new theory through case studies.

Like other research methods, case study research also has its limitation. Eisenhardt, (1989, p. 547) pointed out two possible weaknesses of theory building from cases; firstly, the theory yielded may be overly complex, and secondly, building theory from cases may result in narrow and idiosyncratic theory. Regarding the second weaknesses, Humphrey and Scapens (1996, p. 98) argued by saying that,

> No case study researcher can claim to provide an objective assessment of events. All case studies represent interpretations by the researcher as to the nature of the organizational or social reality.

Consecutively, Hagg and Hedlund, (1979) also discussed criticism toward case studies on two stands; firstly, for not providing any basis for generalisation, and secondly, case studies are appropriate for generating hypotheses, but not for testing them which is more concerned with being explanatory. Yin (2003) argued that case study research could also be used as explanation, thus he divided case study research into three categories; exploratory, descriptive, and explanatory case studies (Yin, 2003, p.3).

There is no intension of this study to become involved in the debate concerning the relevance of case study as this has been answered by Hagg and Hedlund (1979, pp.139-141). Nevertheless, Hagg and Hedlund (1979) suggested seven important aspects that need to be considered by a researcher in using case study research, they are (Hagg and Hedlund (1979, p. 142) ;

1) The reasons for getting involved with this or that case can often be vague and the choice beyond the control of the researchers.
2) The delineation of the system being studied in a case should be motivated and the consequences of drawing particular boundaries should be taken into account and discussed.
3) There must be a necessary element of distance from the pressures of the case situation.
4) It is important in case studies, as in all kinds of research, to relate observations and specific hypotheses to some general framework or frameworks.
5) A case study should always be related to knowledge outside the case itself.
6) There are great possibilities for learning continuously during a case study by checking impressions, hypotheses, and theoretical frameworks against other people's ideas frequently and systematically.
7) Related to the previous point, the checking process also means that the researcher's value – and their implications – can become more explicit.

The case study research design

In designing a case study research Yin (2003) pointed out five important components (Yin, 2003, p. 21); a study question; its propositions, if any; its unit(s) of analysis; the logic linking the data to the propositions; and the criteria for interpreting the findings. According to Yin (2003, p. 22) the research questions which are most appropriate in case study research are "how" and "why" questions. A study proposition as the second component is not compulsory for case study research particularly for exploratory case study (Yin, 2003, p. 22). The unit of analysis refers to the unit being studied which can be an organization, individual, or individuals within an organisation (Yin, 2003, pp. 23-24). The fourth and the fifth components being "linking the data to the propositions; and the criteria for interpreting the findings" are the least well developed in case study (Yin, 2003, p. 26). Using the study of Campbell (1969), Yin (2003,pp. 26-27) suggested one way for linking data to the propositions and interpreting the findings can be done by using pattern matching of several cases or using a time series pattern. Yin, (2003, p.26) also mentioned that "…currently, there is no precise way of setting the criteria for interpreting these types of findings." However, a case study that has no propositions may apply the logic linking the data and the interpretation of the findings to the theoretical framework developed prior to the fieldwork.

Research questions

This study attempts to answer the research questions of "how" management control systems are applied in R&D organisations in government units in Indonesia and "why" they are applied in such a way. The study is not about examining hypotheses rather it uses a theoretical framework of management control systems to investigate the "how" and "why" questions in relation to the existence of the variables developed in the management control systems framework. Therefore, this study does not claim to be an explanatory case study, rather it is a descriptive case study.

According to Yin (2003, 28) prior to data collection, there is a need to begin constructing a preliminary theory. This effort may be done through a literature review of a related topic to that being studied. Therefore, the use of a theoretical framework prior to field work is one of the important components in case study research (Yin, 2003). The role of a theoretical framework before the field work in case study research is also supported by some authorities (Humphrey and Scapens, 1996; Eisenhardt, 1989; Kaplan, 1996). Humphrey and Scapens (1996, p. 88) for example mentioned that:

> A theoretical framework is regarded as an essential starting point for any case study, but it is argued that it should be capable of being challenged and refined as a result of the research process.

Furthermore, Humphrey and Scapens (1996, p. 91) described the purpose of the theoretical framework in a case study by saying,

> …clearly, no researcher can avoid approaching a case study without some prior theoretical framework, no matter how ill-specified it might be. However, while clarity in specifying this framework will offer an identifiable structure for the research process.

In a similar vein, Eisenhardt, (1989, p.536) also held the same thought by saying that,

> …a priori specification of constructs can also help to shape the initial design of theory building research. Although this type of specification is not common in theory building studies to date, it is valuable because it permits researchers to measure constructs more accurately. If these constructs prove important as the study progresses, the researchers have a firmer empirical grounding for the emergent theory.

Through the literature review, the study developed and proposed a comprehensive management control system framework by constructing four core elements that needed to be considered in designing the management control systems; Desired ends, Actors, Control Implementation and Control Tools. The control framework then is used by the study to investigate how and why the control systems were applied in three R&D units in the government sector in Indonesia.

The study attempted to see the complete picture of the practice of the management control systems; therefore, the study investigated the practice from both sides; the units being controlled, and the units that perform the control function. The three units being controlled are the R&D project for the Textile industry Bandung, the R&D project for the Metal, Machinery, and Electronic Industry, Bandung, and the R&D Project for Biological Resources, Bogor. The three units that perform the control function that were investigated by the study are the Agency for Research and Development in Industry, the National Planning Agency, and the Directorate General of Budget.

Regarding the unit of analysis, the study examined individuals or groups of individuals in those six government units. The key individuals used by the study comprises the scientists in the three R&D projects, the project managers, the head of the R&D centre, the Chief of Administration of the R&D centre, and the secretary of the projects. The key informants used from the three units that perform the control function include; the director of the Directorate of Culture, Science and Technology of the National Planning Agency, the sub-head of the directorate, the head of the Agency for Research and Development in Industry, and the sub-head of the Directorate General of Budget.

This study is a descriptive case study that has no proposition or hypotheses to be tested, rather it has developed a conceptual model to be compared to the management control systems applied in those three R&D units. The practice of management control systems found from the field work will be linked and analysed using the four core elements proposed by the study. The existence and/or the absence of the components comprised in the four core elements will be explored and analysed. Apart from the data regarding the practice of the management control system, the study uses the historical background of the country which may influence the choice of such practice. The historical background was explored from the era of colonialism until the time during the Soeharto regime. The extended period after the economic and political crisis of 2004 is also taken into consideration in an attempt to discover the reason why such practice was chosen to be used.

Data Collection

Preparing for data collection is a critical phase in conducting case study research. Internal factors including the preparation of a questionnaire, understanding the broad culture and language of the sites being studied are part of it (Yin, 2003; Hagg and Hedlund, 1979). An external factor such as obtaining access to the sites is another problem that may be faced by a researcher in conducting a case study research.

The different situations that may be dealt with by case study researchers was mentioned by Yin (2003, p. 72) when he said that,

> (d)oing case studies involves an entirely different situation. For interviewing key persons, you must cater for the interviewee's schedule and availability, not your own. The nature of the interview is much more open-ended, and an interviewee may not necessarily cooperate fully in answering the questions. Similarly, in making observations of real-life activities, you are intruding into the world of the subject being studied rather than the reverse, under these conditions, you are the one who may have to make special arrangements to be able to act as an observer (or even as a participant observer). As a result, your behavior-and not that of the subject or respondent-is the one likely to be constrained.

Prior to the field work, various preparations were made. As the study is about the management control systems applied in R&D organisations, the sample sites must be involved in R&D activities. At the beginning, the choice was between the government and the non-government sector, as well as the R&D activities that ranged from basic research to product development activities. Various organizations were searched for, and listed including their address and contact number. Having the list, the next step was to obtain letter of introduction from head of the School of Accounting and Finance, University of Wollongong, Australia.

The letters then were sent to the intended sites in Indonesia, and replies were awaited. Unfortunately no replies were received after two months. Having this problem, the author then made contact with some connections in the government sector in Indonesia to find out the existing list of R&D projects in the government sector. Once the document was obtained a choice was made regarding the R&D projects and the amount of their budget. In order to get access to the sites, there should be a letter from someone in a high position in the government unit to introduce the author to the sites. Therefore, the first visit was undertaken during June to July 1992 to obtain a letter of introduction from the Deputy of Administration of the Agency of the Assessment and Application of Technology where the author had been employed for about fifteen years as a financial controller. The letter then was brought to the sample sites personally to get approval.

The Agency for the Assessment and Application of Technology is headed by the Minister of State for Research and Technology. The agency is also a government unit that performs R&D activities and could also be used by the study as one of the research site. The reason not to use the agency was to avoid subjectivity. In addition, the experience and practical knowledge gained by the author from working for this agency may be used to understand the practice implemented by other government institutions.

The second visit was made during December 1992 to May 1993. The location of the sample sites were spread over three cities. The three units that perform the control functions are located in Jakarta, the capital city of Indonesia. Two of the R&D projects, the R&D project for the Textile industry, and the R&D project for the Metal and Electronic Industry, were located in Bandung, which is about 200 kilometers from Jakarta. Another project, the R&D Project for Biological Resources was located in Bogor, about 50 kilometers from Jakarta. The difference in location and the distance between the sites’ location required the author to travel from one to another more frequently, and to plan ahead in contacting the key person before visiting a site. It was common that an appointment to visit one site was only available at the same time for another. To deal with this situation, sometimes the author had to make a choice of priority and re-arrange the visit.

Regarding data collection techniques, Yin (2003, pp. 85) offers six possible sources of evidence for a case study research. They are documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts. Each of these sources has its own strengths and weaknesses. Yin (2003) provides the strengths and weaknesses of each source of evidence as presented in table 5.1 below.

Table 5.1: Six Sources of Evidence: Strengths and Weaknesses

Please see print copy for Table 5.1

In order to be able to use those source of evidence effectively there are three principles that are needed to be followed (Yin, 2003, p.97); the Use of Multiple Sources of Evidence; the Creation of a Case Study Database; and the Maintenance of a Chain of Evidence. The Use of Multiple Sources of Evidence is very important for case study research as it will enable the researcher to develop converging lines of inquiry which is a process of triangulation (Yin, 2003, p. 98). The Creation of a Case Study Database refers to the way of organizing and documenting data colleted for case studies, while Maintaining a Chain of Evidence is related to the ability of the researcher to link the data collected to draw the facts found by the study.

The data for this study was collected in three ways; interviews, direct observations and documentation. During the site visits, the unstructured interviews were done with various individuals as part of the unit of analysis. The individuals or group of individuals from the controllee group (the R&D project group) who were interviewed included; the project leader, the chief administration officer, the researchers or scientists, the treasurer, the head of the R&D centre, and the staff for the planning division of the centre. The individuals from the controller group (the units that exercise the control function) who were interviewed including; the director of the Directorate of Culture, Science and Technology of the National Planning Agency, the head of the Agency for Research and Development in Industry, and the sub-head of the Directorate General of Budget. In addition, telephone interviews were also done during the years 2004 and 2005 with various individuals in this group including, the sub-head and staff of a unit within the Directorate of Culture, Science and Technology of the National Planning Agency, and the sub-head and the staff of the Directorate General of Budget.

During the field visit, observation was also done as part of the data collection technique. Due to the distance between the sample sites, the observation was done mostly of their R&D projects. The author visited each of the sites for at least one to two days in a week. It must be noted that the working day was six days a week from Monday to Saturday. The observation was done by attending the meetings between the researchers of the units on various occasions. Observing how the researchers set the project’s goals, the setting of the proposed budget for the projects, the setting of the project's plan and, attending seminars on the preparation of the research proposal were part of the observations done of the controllee group. In addition, observation was also done on how the project's treasurer as well as the planning staff filled in the project's proposal forms.

Observation of the controller group was done only during the budget meeting. To obtain access to the budget meeting was also a crucial part of this study. As the budget meeting was considered to be confidential, various paper-work, and a letter of introduction had to be obtained prior to the attending of the budget meeting.

Documentation is also part of the data collection technique used by this study. Various documents used by the study included the project proposal, the projects' goals, the government regulations, and the organizational structure as decided by ministerial decree. Most of the documents were confidential which only allowed them to be sighted and not copied. The government regulations regarding the standard operating procedures, as well as the internal policy of the units are also part of documents used by the study to understand how and why the practice of management control systems were used. Apart from documents sighted during the field visit, several documents were also obtained through the web site of related institutions such as the National Planning Agency and the Directorate of Budget.

From the discussion above it indicates that the study followed the first principle as it used multiple sources of evidence. In addition, during the data collection the comments from interviewees were cross checked with other interviewees or the documents.

Unfortunately, since most of the documents were confidential, most of the data bases were the summary notes which were taken during the field study. Those notes then had to be translated into English and presented as a body of the report. This situation was also expected to happen by Yin (2003, p. 101) who said;

> …however, with case studies, the distinction between a separate database and the case study report has not yet become an institutionalized practice. Too often, the case study data are synonymous with the narrative presented in the case study report…

Data Analysis

There are five major techniques for case study analysis documented by Yin (2003). The first technique is the Pattern Matching technique, which is one of the most desirable techniques that can be used for either explanatory or descriptive case study. Yin (2003, p. 116) considered this technique because it;

> …compares an empirically based pattern with a predicted one (or with several alternative predictions). If patterns coincide, the results can help a case study to strengthen its internal validity.
> If the case study is an explanatory one, the patterns may be related to the dependent or the independent variables of study (or both). If the case study is a descriptive one, pattern matching is still relevant, as long as the predicted pattern of specific variables is defined prior to data collection.

The second technique is Explanation building which is mainly relevant to explanatory case studies and has been commonly cited as part of a hypotheses generating process. In this technique a phenomenon to be explained is stipulated as a presumed set of causal links (Yin, 2003, p. 120). The third technique is Time Series Analysis such as used in experiments and quasi-experiments. The fourth technique is Logic Models which Yin (2003, p. 127) describes by saying that

> (t)he logic model deliberately stipulates a complex chain of events over time. The events are staged in repeated cause-effect-cause-effect patterns, whereby a dependent variable (event) at an earlier stage becomes the independent variable (causal event) for the next stage.

The last analysis technique is Cross-Case Synthesis which applies specifically to more than one case. In this technique, several cases will be considered as individual cases, and then cross case syntheses can be performed.

This study concerns management control systems for government R&D organisations in Indonesia. Although three R&D projects were used as research sites, they were all under government regulation and mostly comply with the government rules and regulations. The study will compare the control framework developed with the practice of control applied to those three R&D units. Therefore, the data analysis used by the study is the Pattern Matching method.

The control framework proposed by the study consists of four core elements; Desired ends, Actors, Control Implementation, and Control Tools. Each of these contains various aspects that may be applied differently in different situations. The analysis is done by comparing how those elements are used in practice with the pattern of the proposed framework of the management control system.

Summary

Case study research is one of many ways of conducting research in social science, including research in the accounting discipline. As one way of conducting research, case study research is 'both the process of learning about the case and the product of our learning' (Stake, 1995, p. 237). Like any other research method, case study research has its strengths and weaknesses.

Hagg and Hedlund, (1979) argued that the strengths of case study research may be viewed from four perspectives; the holistic point of view, the critique of empiricist notions, involved research and from the perspective of change, process and history. Eisenhardt (1989) pointed out the three strong points of case study research as; the chances of generating a novel theory, the testability of emergent theory, and the empirical validity of the resultant theory. Kaplan (1986) in turn described three benefits of case study research as; to provide basis for other forms of research activities, to seek out interesting organizations or practices, and to contribute to teaching activities in terms of a rich description of a particular practice. Humprey and Scapens (1996) pointed out the strength of case study research as obtaining more understanding of accounting practice and to assist in the developing of a new theory.

Apart from its strengths, case study research has also its weaknesses. Eisenhardt, (1989) indicated two possible weaknesses; the theory yielded may be overly complex, and building theory from cases may result in narrow and idiosyncratic theory. Hagg and Hedlund, (1979) indicated two limitations of case study research as it does not provide any basis for generalisation, and case studies are appropriate for generating hypotheses, but not for testing them.

Case study research can be used in either quantitative or qualitative research, as well as being used as a single case or a multiple case study. Regarding its purpose, case study research can be categorized into three types; exploratory, descriptive, and explanatory case study. This study is a descriptive case study.

There are five important components in designing case study research (Yin, 2003); research questions; its proposition if any; its unit(s) of analysis; the logic linking the data to propositions; and the criteria for interpreting the findings. This study attempts to understand 'how' and 'why' management control systems are applied in R&D organisations in government units in Indonesia. This study is not about examining hypothesis rather it is about investigating the existence of control elements developed prior to the field work and to gain understanding of how and why they are used. Therefore, this study does not claim to be explanatory case study research, rather it is descriptive case study research.

In order to gain a rather comprehensive understanding of the practice, this study investigated the practice of management control systems from two research site groups; the controller and the controllee. The units of analysis used by this study are individuals and/or groups of individuals as key informants who are employed in those two site groups. Three R&D projects were used by the study as research sites for the controllee site's group; the R&D Projects for the Textile Industry, the R&D project for the Metal, Machinery, and Electronic Industry; and the R&D Project for Biological Resources. For the controller site's group this study used three government institutions they are; the Agency for Research and Development in Industry, the Directorate of Culture, Science and Technology of the National Planning Agency, and the Directorate General of Budget.

Through the literature review, this study proposed four core elements of management control systems framework that need to be considered in designing the systems, they are; Desired Ends, Actors, Control Implementation, and Control Tools. Since this study has no proposition or hypotheses testing, then the data collected from the fieldwork was linked to the control framework developed prior to the field visit. Apart from data gathered from the fieldwork, the study also used the historical background of the country which may influence the choice of management control systems practiced.

Three data collection techniques were used by this study; interviews, direct observations, and documentation. Interviews were done during the fieldwork with various key informants including the project leader, the scientists or researchers, the head of the R&D centre, the chief administration officer, the treasurer, the staff of the planning division of the centre, the director of the Directorate of Culture, Science, and Technology, the head of the Agency for Research and Development in Industry, and the sub-head of the Directorate General of Budget. Telephone interviews were also done with various key informants including; the sub-head and staff of a unit within the Directorate of Culture, Science and Technology of the National Planning Agency, and the sub-head and staff of the Directorate General of Budget. Observation was done of the three R&D projects as well as during budget meeting between R&D project personnel and budget committee from the Directorate of Budget. This study uses a documentation technique to collect data from relevant documents such as project proposals, project's goals, regulations, organizational structure, and ministerial and presidential decree.

Since this study is a descriptive case study research, it uses the Pattern Matching method in data analysis. This study compared the pattern of the control systems practiced to the control systems framework proposed by this study, to explain how and why such practice was chosen by the units under investigation.

The next chapter will discuss a brief history of Indonesia from the era of colonialism to the current period of reform.

A Brief History of Indonesia

Introduction

This study involves the investigation of certain government institutions in Indonesia to determine their use of management control systems. In order to understand the circumstances of the examples explored, there is a need to describe their background. This chapter provides a brief history of Indonesia, from colonialism until independence and beyond and attempts to indicate the influence of the colonial era on the current practice of government administration.

The chapter covers the history of Indonesia in six parts. The first part concerns the colonial era begun by the Portuguese, the British, and the Dutch. The second section discusses the establishment of an administrative group to run the archipelago during the period of Dutch colonialism. The third part presents the conditions that were evident during the Japanese era. Part four discusses the period at the beginning of the independence period. This is followed by a discussion of the New Order and the last part is about the period of reforms. Finally, the chapter will close with a summary.

The Colonial Era

Indonesia is an archipelago that consists of 17,508 islands spread between the Indian Ocean and the Pacific Ocean[1]. The country had a population of 222 million people in 2006[2]. The population consists of a number of ethnic groups, the number of which is still unclear. However, according to the Ministry of Education and Culture

[1] Department of Internal Affair, http://www.indonesia.go.id/home_01.html, accessed 11-07-05, 17:59.
[2] http://en.wikipedia.org/wiki/Indonesia#Demographics, assessed 22 August 2006, 18:50

there are at least 500 major ethnic groups with different local languages and cultural backgrounds[3].

Prior to the colonial era, the archipelago consisted of many kingdoms that were spread through the entire territory. Some of the great kingdoms that are well known in Indonesian history include the Sriwijaya, Majapahit, Samudra Pasai, and Gowa kingdom. Since then, Indonesia has been influenced by at least four countries; Portugal, the Netherlands, Britain, and Japan, in which the Netherland influence is considered the most significant (Sutherland, 1979).

At the beginning of the sixteenth century, Portugal was the first country to visit the archipelago and establish trading posts in many areas, specifically on the Malay Peninsula, now Malaysia and in the Moluccas (the Spice Islands) (Penders, 1977, p. 3). Ricklefs (2001, pp. 26-27) pointed out that in April 1511 Afonso de Albuquerque sailed from Portugal to Malacca which became the centre of the Asian trade network, and controlled the area. However, the Portuguese did not control the trade rather they relied upon Asian traders who transferred much of their trade to other ports and stayed away from the Portuguese monopoly area. After occupying Malacca, an exploratory mission under Francisco Serao was sent to the eastern part of the archipelago and occupied Maluku, Ternate and Tidore. According to Ricklefs (2001, p. 29) the most significant Portuguese cultural influences are to be found in these areas.

The Dutch war of independence against Spain, which broke out in the 1560s and lasted until 1648, brought a pressure for the Dutch to expand overseas (Ricklefs, 2001, p. 30). The first Dutch expedition departed for East Indies in 1595 under Cornelis de Houtman and arrived in Banten (West Java) in June 1596 (Ricklefs, 2001, p. 30). After sailing across Indian Ocean, there were regular voyages to transport the spices from Indonesia to Europe and these were controlled by four competing Dutch trading agents

[3] http//www.kebudayaan.depdignas.go.id/BudayaOnline, visit 18-7-2005, 9:45

in Banten, West Java. According to Ricklefs (2001, p. 31) the competition among those four companies was driving the profits down, therefore, in March 1602 they merged to form the United East India Company, called the VOC (Vereenigde Oost-Indische Compagnie).

During December 1794 to January 1795, the French invaded the Netherlands and took control. Meanwhile, in 1795 William V of the Netherlands issued a letter, which is well known as the Kew Letter that instructed Dutch colonial officials to surrender their territories to the British, in order to keep them out of the hands of French (Riclefs, 2001, p. 147). In January 1800, the VOC (United East India Company) was dissolved and became the property of the Dutch Government. However, there was little change as the officials remained the same and used their old ways to run the company (Riclefs, 2001, p. 144).

Having control of the Netherlands, in 1808, Napoleon Bonaparte sent Herman Willem Daendels, a Dutch army general, to be governor general in Batavia (now Jakarta) (Riclefs, 2001, p. 145). Daendels attempted to clean up inefficiency, abuses and corruption within the European administration by using a combination of zeal and dictatorial methods which achieved little but offended many (Riclefs, 2001, p. 145). In May 1811, Jan Willem Janssen was appointed as Governor General in Batavia to replace Daendels.

Since the Kew Letter, the British involvement did not take immediate affect until 1811 when the British began to proceed to the archipelago and occupied Batavia on 26 August 1811. At this, time the British appointed Thomas Stanford Raffles as Lieutenant Governor of Java (as the British had no Governor General for Batavia). The British stayed in the archipelago until 1816. During this short period, Raffles, who saw the Dutch rule as harsh and unfeeling made a great reform by introducing the land rate (land tax) system. With this system, the Indonesians were left free to use the land as they wished, but they had to pay the government two-fifths to one-half of their crops in cash depending on the fertility of the land (Penders, 1977, p. 3).

According to Ricklefs (2001, p. 150) during the period from 1812 to 1825 Java had several problems. The colonials interfered in court affairs and were involved in corruption, and intrigue. The Europeans and Chinese obtained and controlled the lease of the land for the sugar, coffee, indigo and pepper plantations in central Java, from Javanese aristocrats in need of funds. The impact was that the farmers had an obligation to pay government taxes, which forced them into the hands of moneylenders, who were mostly Chinese. Daendels and Raffles were the originators of a colonial revolution, which aimed to reform or destroy the indigenous institutions (Ricklefs, 2001, p. 150) but they led to worse than better.

Raffles did not have enough time to fully implement his ideas, as in 1814 the British Government handed back the East Indies to the Dutch. In 1816 the Dutch Commissioners-General arrived in Java to take over the archipelago and appointed Van der Capellen as Governor General for Batavia from 1818 to 1824 (Penders, 1977, p. 6). Van Der Capellen put a new policy into effect to end the abuses of the private leasing of land and he abolished such leases. The result of the abolishment of the leases was the suffering of the Javanese aristocrats who had paid the lease fee in advance to the European and Chinese leaseholders (Ricklefs, 2001, p. 151). The pressure led to rebellion which spread throughout Central and East Java and resulted in a war, which is called the Java War and was led by Dipanegara from, 1825 to 1830. In March 1830, Dipanegara came to negotiate with the Dutch and arrested. The Dutch held him in custody until he died in 1855 (Ricklefs, 2001, p. 152).

By 1830, the Dutch controlled the whole island of Java (Ricklefs, 2001, p. 155). The Java War had cost the lives of 8000 European and 7,000 Indonesian soldiers, and at least 200,000 Javanese (Ricklefs, 2001, p. 153). In addition, the war also created a financial burden for the Dutch government. To deal with the situation the Dutch government thought to make the colony generate a profit and contribute to the mother country. A proposal came from General Johannes van den Bosch, which suggested a cultivation system that is also called the Culture System. The Dutch King approved the van den Bosch's proposal and appointed him to implement the proposal. van den Bosch departed for the colony in July 1829 with two million guilders in cash and two million in credit (Penders, 1977, p. 7), and arrived in Java in January 1830 to be governor until 1833 (Ricklefs, 2001, p. 156).

Soon after his arrival in Java, van den Bosch started to implement the cultivation system in which the Javanese villages owed a land tax to the Dutch government, which was normally about 40 per cent of the main crop (Ricklefs, 2001, p. 156). The villages had to pay the land tax in cash to the government. To be able to pay the land tax, the villages were forced to cultivate export commodities such as coffee, sugar, indigo, and spices and sell these commodities to the Netherlands Trading Company for a low and fixed price. The company was set up in 1824 and heavily invested in by the King. The company acted to monopolise trading and transport the product to European markets as well as acting as a banker to the Dutch government (Penders, 1977, p. 7).

The success of van den Bosch in ruling the colony made the Dutch budget change from deficit to surplus by more than 832.4 million guilders between 1831 and 1877 (Penders, 1977, p. 7). According to a letter by van den Bosch, he had remitted more than five million guilders in 1832, more than ten million in 1833 and more than thirty million guilders in 1834, to the mother country (Penders, 1977, pp. 15-30). The implementation of the cultivation system was not without problems. Many letters indicated opposition to the implementation of the system. J.C. Boud the Secretary General of Colonial Affairs summarised a letter from Major General de Eerens, and from L. Vitalis (cited in Penders, 1977, pp. 21-24). The de Eerens letter (cited in Penders, 1977, pp. 21-22) concluded by saying,

> …if it depended on us to make the Javanese happy, then no sacrifice would appear to me to be too large, but all our philanthropic dreams have only led them into popular uprisings and wars. Hundreds of thousands of people in Java have been slaughtered because we wanted to make them happy in accordance with our knowledge. A sound knowledge of Javanese character, economic life, and views is required before any good can be done in this respect, and I feel that I should advise Your Excellency to change as little as possible in the existing situation. They [the Javanese] cannot be protected enough against the Europeans and Chinese. It is not their chiefs, who are so often given a bad name but to whom the Javanese nevertheless remain faithful with unbreakable loyalty, who suppress them-at least not in their opinion-but the bloodsuckers I have just named, who, if not checked, torture them. Their activities should be carefully watched.

A more severe situation was described by Vitalis's report on 29 January 1835, which noted (cited in Penders, 1977, p. 24),

> Truly their situation is lamentable and really miserable. What else can one expect? On the roads as well as in the plantations one does not meet people but only walking skeletons, which drag themselves with great difficulty from one place to another, often dying in the process. The regent of Sukapura told me that some of the labourers who work in the plantations are in such a state of exhaustion that they die almost immediately after they have eaten from the food which is given to them as an advance payment for the produce to be delivered later. If I had not witnessed this myself, I would have been hesitant in reporting this….

The news of the situation in the archipelago only reached Holland after the mid 1840s. According to Penders (1977, p. 31) Baron van Hoevell, a minister of the Dutch Reformed Church, was one of the most prominent colonial reformers. He had been involved in a demonstration in Batavia and had petitioned for freedom of the press, the establishment of secondary schools in the colony, and representation of the Indies in the Dutch parliament. A budget study by J.H. Boeke in 1886 and 1888 showed evidence of how the people in the archipelago were suffering in which the income of the Indonesians was far below the cost of living, while they still had to pay the interest and the tax (Penders, 1977, pp.50-52). Another criticism came from Eduard Douwes Dekker a former colonial official in his great novel 'Max Havelaar' published in 1860 where he used pseudonym ‘Multatuli’ which means ‘I have suffered a great deal’. Penders (1977, p.32) described the affect of the novel by saying that it was a story

> …in which the inhumanity and immorality of colonial rule in Indies were vividly portrayed. Max Havelaar caused a public outcry in the Netherlands that greatly aided the final onslaught on the Culture System by the Liberals… The forced cultivation of some crops was quickly abolished…

This criticism led to the end of the use of the forced cultivation systems, which were progressively abolished from 1862, on many crops and finally in 1916 for sugar plantation (Penders, 1977, p.32). Other criticisms of the administration included requests to improve the education of the indigenous people, as proposed by J Habbema in 1904 and C. Snouck Hugronje in 1911 (cited in Penders, 1977, pp.155-157). Since then, the colonial government started to establish a western education system for the indigenous people, which gave them a greater opportunity to access education. At the beginning, there were two types of government primary school systems available; First class schools designed for the upper class and Second class schools for the general population (Ricklefs, 2001, p. 200). The First class schools, which were in the local educational system, were turned into the Dutch system in 1914 and were named Hollandsch Inlandsche Schools (HIS) and the Hollandsch Chineesche School which begun in 1908. After attending the HIS, the next level was the Meer Uitgebreide Lagere Ondewijs (MULO), which was junior high school and was established in 1914. The MULO were also designed for the upper class of society (Ricklefs, 2001, p. 201). In 1919, the Algemene Middelbare School (AMS) a general middle school was also established for university entrance, and the Hoogere Burgerschool (HBS), higher middle class schools for the pupils to enter university in the Netherlands. In 1900, other educational institutions were also created such as the Opleiding School voor Inlandsche Ambtenaren (OSVIA), a training school for local officials mostly in Java, in towns such as in Bandung, Magelang, and Prabalingga. In 1900 to 1902 a school for training native doctors which was called School tot opleiding van inlandsche artsten (STOVIA) was also opened (Ricklefs, 2001, p. 199)

The Bureaucratic Policy during the Dutch Colonial period

At the beginning of the twentieth century, the Dutch government started to decentralize the public service. The idea was to avoid a gigantic administrative tasks budget burden by replacing European officials with natives at the lower levels of the public service as they were paid a lower rate (a letter of J. W. T. Cohen-Stuart letter in 1907, cited in Penders, 1977, p.165). The proposals to employ local officials were complementary to the decentralization law of 1903, which had not been satisfactorily implemented (Penders, 1977, p.121).

According to Penders (1977, p. 122) in May 1918 the Dutch parliament approved the establishment of a colonial council which was called Volksraad (People's Council). The Volksraad had few powers, it was consulted on the budget, it was also able to propose and give advice to the Dutch government, but could not make decisions, as the power to make decisions still belong to the Dutch Parliament (Sutherland, 1979, p.64 and Penders, 1977, p. 122). In 1922, the Dutch Parliament approved Constitutional Reforms, which allowed its colonies in the East Indies to take care of their internal affairs as much as possible (Penders, 1977, p. 124).

Since the decentralization policy came into affect, bureaucratic standardisation became an urgent issue between 1910 and1915 (Shuterland, 1979, p.2). In order to respond to the Constitutional Reforms the Dutch government in Java created a bureaucratic elite for local administration, which was called Pangreh Praja (the Rules of Realm) who filled the lower position of the local government (Shuterland, 1979). Its role was clear to become the ruling elite to fill the gap between Europeans and natives and simultaneously became an agent for the Dutch government (Shuterland, 1979, p. 1).

The use of local leaders as agents of the Dutch government had been used for a long time as a strategy to control the colony. Shuterland (1979, p.3) noted that it had been exercised particularly in Java since 1602 where the people used ranged from rural leaders to local princes. As noted, the Dutch instituted two classes of government official, the higher class called BB (Binnenlandsch Bestuur or European Civil Service) and the Pangreh Praja as the lower class. According to Shuterland (1979, p. 15) many of the BB officials were Indo-European or Eurasian, and it made the interaction between these two levels distinctive, as mentioned by Sutherland (1979, p. 2) when she said,

> (t)heir interaction was not simply that of administration superior and inferior, but was also a continuing bargaining between elites of two races and of two cultures. Each group had its own vested interests, its own traditions and received wisdom, its own values, perceptions and prejudices.

The educational systems brought a change and allowed the natives to be educated under the Dutch system as well as to learn the Dutch language and culture. Many of the natives were well educated even though this education was limited to the upper class of the local society. Therefore, the Pangreh Praja was dominated by a group of Javanese aristocrats called *Priyayi* as the governing elite of Java. Shuterland (1979, p. 31) commented thus on their behaviour:

> Ideally, the native officials were benevolent dictators over the people, and each was in turn subject to the same sort of dictatorship from his superiors. The bond between superior and subordinate *priyayi*, like that between priyayi and people was said to be a continuation of the classic Javanese *kawula-gusti* (servant-lord) relationship. …It was modeled on the family connection between brothers or father and son….

Before entering the service, the candidate had to serve an apprenticeship. This allowed personal relationships to be established and this helped to stimulate his career in the work place. However, the recruitment system was subjective in which all forms of sycophancy and nepotism flourished (Shuterland, 1979, p. 33).

After 1908, the era of change began (Ricklefs, 2001). This was indicated by fact that the native society started to establish Western style associations on which to base their activities such as; the Excellence Endeavour (Budi Utomo), the Moslem trade union (*Sarekat Dagang Islam*), the Muhammadiyah (founded by reformist Moslems), customs workers, assistant teachers, and government employees union. The native political power then became split into, or at least a combination of three sub groups; *priyayi*-the group of natives who were well born and/or had a blood or close relationship with the Javanese aristocracy, *intellectual*-those who had completed a Dutch education, and *santri*- the devout Moslem society. Sutherland (1979, p. 61) noted that which most surprised and frightened the Dutch and native officials was the Moslem trade union.

According to Shuterland (1979, p. 140) the year of 1927 was an era of negative thrust and polarization between the Dutch and the native communities. This was indicated by growing political awareness and the Moslem movement. One of the important situations was in 1941 when the Indonesian communities formed an Indonesian People's Council. Unfortunately, this effort did not last long as in May 1942 Japan occupied Java as the next colonial overlord. The native civil service created by the Dutch was far from ready to look after itself at this time. Shuterland (1979, p. 144) pointed out that

> (i)t has been said that the native civil service of nineteenth century Java underwent intensive bureaucratization, that it became mechanised and routinised while its social function was defeudalised. To varying degrees, all these somewhat alarmingly named processes did occur, but they were far from complete, even by the end of the colonial period. Although it might seem that there had been an inexorable march of progress, with administrative structures and practice becoming increasingly systematic, in reality much old wine remained to fill apparently new bottles.

The era of Japanese reign

The Japanese occupation of the archipelago started in 1942 and continued to 1945. The occupation damaged many of the existing administrative systems, which were built during the Dutch era. The entry of Japan leading to the occupation of the country was facilitated by PUSA (the Union of Acehnese Moslems) who had contacted Japan and laid a plan to assist the attack (Ricklefs, 2001, p. 248). The PUSA, which was formed in 1939 and led by Mohammed Daud Beureu'eh, created sabotage against Dutch on 19 February 1942, three weeks before the Japanese landed (Ricklefs, 2001, p. 248). In April 1942, the Japanese attempted to stimulate a mass movement by using the slogan "Triple A Movement", which derived from the nation of Japan as the leader of Asia, the protector of Asia, and the light of Asia (Ricklefs, 2001, p. 251).

By helping the Japanese, it was expected that the Japanese would give credit to the Islamic leaders. However, the Japanese did little while still being aware that the Islamic leaders could refuse to cooperate as they did largely with the Dutch (Ricklefs, 2001, p. 249). At the beginning of the occupation the Japanese started to destroy the Western influence, they forbade the use of Dutch and English, and promoted the use of Japanese, and in some places it was done with violence and led by local Islamic figures against European, Chinese, and native Christians (Ricklefs, 2001, pp. 248-250).

Destroying the administrative systems made the situation worse than better, therefore the Japanese had no choice but to rely upon experienced Indonesian leaders to run the administration (Ricklefs, 2001, p. 248), including the Pangreh Praja (Shuterland, 1979, p.153). The era of Japanese occupation was the worst period for the country. The currency was only worth 2.5 per cent of its face value, mortality rates increased and fertility dropped. This made the archipelago a land of extreme hardship, inflation, shortages, profiteering, corruption, black markets, and death (Ricklefs, 2001, p. 249).

The Japanese begin to realize that they would have to use local leaders to mobilize the masses of Java and they started to use the pre-war nationalist movement leaders, such as Sjahrir, Hatta and Soekarno (Ricklefs, 2001, p. 251.) To support the war, the Japanese needed huge resources from the colony and therefore they began to promise the involvement of the natives in the affairs of government in Java (Ricklefs, 2001, p. 254.) In October 1943, a youth organization called PETA (the Protector of Fatherland) was established by the Japanese as an Indonesian volunteer army. To control the Moslems, the Japanese also established Masyumi (the Consultative Council of Indonesian Moslems) (Ricklefs, 2001, p. 255.) This organization was led by Hasyim Asjari, the founder of NU (the Rise of the Religious Scholars) which is now the biggest Moslem organization in Indonesia. Hasyim Asjari stayed in Jombang, east Java, and therefore the effective head of the organization was his son Kyai Haji Wachid Hasjim (the father of Abdurrahman Wahid, the fifth President of Indonesia at the 1999 election after Habibie).

According to Ricklefs (2001, p.256) on 7 September 1944, the prime minister of Japan, Koiso promised independence for the East Indies, however, this promise never set the date for independence. In February 1945, the Japanese troops in Blitar (east Java) were attacked by PETA, the Indonesian volunteer army trained by the Japanese. Following a rapid disintegration of their military position, the Japanese started to show an effort to honour their promise of independence by setting up BPUPKI (an Investigation Committee for Preparatory Work for Indonesian Independence). The members of this committee

> …represented most of the surviving middle-aged leaders of Java from all the main schools of thought. Radjiman Wediodiningrat was in the chair, while before him sat Sukarno, Hatta, Mansur, Dewantara, Salim, Soetardjo Kertohadikoesoemo, Abikoesno Tjokrosoejoso, Ki Bagus Hadikusumo, Wachid Hasjim, Muhammad Yamin and others. The Japanese were naturally determined that when independence came it would be in the hands of older leaders whom they felt they could deal with rather than the unpredictable younger generation (Ricklefs, 2001, p.258).

The Investigation Committee finally produced a national constitution called UUD ’45 and took a nationalist position as that pleased all the leaders by using Pancasila (the five principals) as the official philosophy of the country, rather than using the Islamic doctrine. Ricklefs (2001, p.258) described this as follows;

> In the Investigation Committee in Jakarta, Sukarno urged that his version of religiously neutral nationalism should be adopted. Since this was indeed the only basis upon which the other leaders could agree, Sukarno carried the day. In his speech of 1 June he laid out his doctrine of Pancasila, the five principles which were become the official philosophy of independent Indonesia: belief in God, nationalism, humanitarianism, social justice and democracy. While these principles were sufficiently unobjectionable and ambiguous to receive general acceptance, Islamic leaders were unhappy that Islam seemed to play no special role.

By July 1945, most of the Japanese authorities agreed to grant the independence of Indonesia in a few months (Ricklefs, 2001, p. 259), however, on 6 August 1945 the first atomic bomb hit Hiroshima, followed by the second on 9 August 1945 that hit Nagasaki. On 15 August 1945, Japan surrendered unconditionally and left Indonesia with no administration in charge. At this stage Soekarno, Hatta and other older leaders were unsure of what to do. The young activists kidnapped them and forced them to declare Indonesian independence. This was declared on the morning of 17 August 1945.

The New State

The new Nation was led by Soekarno, Hatta and other leader of the older generation. However, the beginnings of independence were not without problems. The Japanese troops were still there even though they had less power, the Dutch attempted to take back the archipelago for the second time, and domestic conflicts among leaders occurred. Many foreign troops also came into the archipelago for their own reasons. The British and Australians aimed to evacuate western and Indo-European communities.

As was documented by Ricklefs (2001, pp. 262-270) the Japanese troops controlled the major cities until 10 October 1945. The Dutch and the British troops entered Jakarta in mid September and on January 1946 the Dutch re-occupied Jakarta. Australia occupied major cities in the eastern part of the archipelago in October 1945. According to Ricklefs (2001, p. 275), the Dutch remained in Indonesia and attempted to negotiate their position by offering federal status to Indonesia in which the Dutch queen was the symbolic head of the state. However, from November 1946, there was unrest in the eastern part of Indonesia. In February 1947, the Dutch troops led by Captain Raymond 'Turk' Westerling, executed a massacre in South Sulawesi (Ricklefs, 2001, p.275). This action increased anti Dutch feelings and finally the United Nations became directly involved in the conflict. In January 1948, an agreement was signed on the USS Renville in Jakarta harbour between the Dutch and the republicans and reached a resolution for cease-fire. The Dutch meanwhile forced the idea of federal states by setting up an East Sumatra State, South Sumatra, Madura, and East Java and this finally created a military conflict (Ricklefs, 2001, p. 282). A diplomatic solution was made at a Round Table conference at The Hague from 23 August to 2 November 1949. Both parties came to agree on such matters as the Dutch queen as symbolic head, Soekarno as the president and Hatta as vice-president, and various guarantees for Dutch Investment. In addition, Indonesia was made responsible for the East Indies debt of 4.3 billion guilders, much of which was incurred in attempts to destroy the revolution (Ricklefs, 2001, p. 284). Confrontations continued to happen.

In late January 1949, the UN Security Council accepted Indonesia as a new country and a full transfer of sovereignty was completed by 1 July 1950 (Ricklefs, 2001, p. 283). At the beginning, Indonesia was formed as the RIS (Republic of United States of Indonesia) but this only lasted until 17 August 1950 when it became the Republic of Indonesia with a unitary constitution and Jakarta as its capital city (Ricklefs, 2001, p. 285). As it had multi-ethnic population, a number of problems arose soon after independence. Political parties based on religion and doctrines such as Protestant, Catholic, Islam, Nationalist, Communist, Proletarian and so forth as well as military groups that arose from different Japanese and Dutch training groups came into effect. All of these groups disagreed on whom should sit in the cabinet and in parliament as well as the direction the state should take (Ricklefs, 2001, p. 282). For administration, as the Dutch and Japanese had, the Republic also relied upon the Pamong Praja (formerly Pangreh Praja before 1946) which was created during the Dutch era. As the Republic started with a multi-party system, the existence of the Pamong Praja, who were mostly Javanese and remained loyal to the Javanese culture, was questioned by the more democratic and populist parties (Shuterland, 1979, p. 156).

A resistance came from the minority groups who were involved in the revolution because they saw that the Javanese, Muslims and leftists dominated the Republic. One of these groups was led Dr Soumokil, who in April 1950 proclaimed a Republic of South Maluku in Ambon. However, this rebellion ended in November 1950 by an agreement to transport the groups and their families to the Netherlands (Ricklefs, 2001, pp. 285 and 295). Moslem rebellions also occurred in South Sulawesi in 1951, which was led by Kahar Muzakkar, in West Java the Darul Islam rebellion was led by Kartosuwirjo, as well as PUSA (the Union of Acehnese Moslem) on 19 September 1953 (Ricklefs, 2001, pp.297 and 301). In December 1956, an uprising in North Sumatra (which contributed half of the nation's foreign exchange in 1956) was led by Colonel Maludin Simbolon, one of the army's most respected officers, and required greater autonomy for the region (Ricklefs, 2001, pp. 307-309). However, he was defeated on 27 December 1956. In February 1958, a rebellion called PRRI (Revolutionary Government of the Indonesian Republic) announced its independence in which Colonel Simbolon was one of the cabinet members. In May 1958, the government was able to drive out the rebels finally and was met with little resistance.

It was impossible to develop the existing administrative system until 1957, as the country was so unstable. Ricklefs (2001, p. 311) noted that,

> …the ultimate irony of the years 1950-7 was that as the nation fell apart, it also became one. Rarely was there more truth in the national motto *bhinneka tuggal ika* (officially but slightly inaccurately translated as 'unity in diversity').

The situation at the beginning of 1958 was not conducive to national development. The national philosophy of Pancasila (the five principles) became the centre of a debate in the Consultative Assembly (Upper House) in which the Islamic parties requested consideration of the Jakarta Charter (which used the Islamic law) as part of the country's philosophy. The involvement of the military in politics as well as the communist party made the situation more difficult. The increasing power of the communist influence in the government cause resentment among the Moslem groups and created an unpleasant situation politically. Starting from 1964, the functional elements of the country then formed into two major groups the Communists and the anti communists, which consisted of many high ranking military officials, Islamic, and many nationalist groups (Ricklefs, 2001, p. 334). In addition, the economic situation of the country also contributed to the difficulties where inflation was rocketing and prices rising about 5 times for the year with the exchange rate for the US dollar increasing nearly 10 times by the end of 1966 (Ricklefs, 2001, p. 338).

On 30 September 1965, the communist group kidnapped and slaughtered six top ranking generals and one lieutenant. The situation became critical, and on 2 October 1965, General Soeharto accepted the task from Soekarno to restore order and security in the country (Ricklefs, 2001, p. 346). The dead bodies of the murdered generals were found on 3 October 1965 and the army started to blame the communists behind the scene. According to Ricklefs, (2001, p. 347) the situation was getting worse and massacres targeting communists occurred all over Indonesia. In October 1965, the killing started and lasted until the beginning of 1966 (Ricklefs, 2001, p. 347). On 11 March 1966, Soekarno signed a document called Supersemar (11 March letter of instruction) to give Soeharto full authority to restore order, government functioning, and protect Soekarno (Ricklefs, 2001, p. 349). During June-July 1966, the Provisional People's Consultative Assembly requested Soekarno to explain the country's mismanagement, the corruption, and his role in the coup attempt, and to forbid him from making any presidential decisions (Ricklefs, 2001, p. 351). According to Ricklefs (2001, p. 351) in January 1967, Soekarno told the Assembly that he did not have any prior knowledge about the coup attempt. The situation now became clear and it made Soeharto the new leader as he held the letter of instruction (Supersemar). The Provisional Upper House ratified the letter and then the assembly called for the next election in 1968. Finally, on 12 March 1967, the Provisional People's Consultative Assembly took the power from Soekarno and appointed Soeharto as acting President until the next election.

Given the situation the new state had to deal with in its early years, there was no opportunity for the government to develop its administrative system. Therefore, until the end of Soekarno's era, the administrative systems still operated under the Dutch system, with may be a little modification.

The New Order

Indonesia was governed under Soeharto from 1967 until 20 May 1998. Many developments were made during this period including the administrative systems, which were parallel to his concept of centralized government in which most of the administrative systems were designed to be homogenous (Ricklefs, 2001, p. 373). The use of accounting systems is presented in this chapter, while other administrative procedures are presented in the following two chapters as the study uses data from this era.

Soeharto started to rule the country in the difficult conditions left by Soekarno's regime. The friction among people occurred at least on three fronts; politics (communist and non-communist), ethnic groups (Javanese and non-Javanese; Indonesian and Chinese), and religions (Moslem, Christian and others). Unrest was still occurring at the end of 1970 in relation to those differences. In addition, the foreign debt left by previous regime amounted to US$2.36 billions (Ricklefs, 2001, p. 352).

According to Ricklefs (2001, p. 345) there was little knowledge about Soeharto before he came into power. He is of Javanese ethnic origin from rural central Java and like most Javanese; he held the popular version of Orthodox Islam and the spirit of the realm of Java. Having this background, Soeharto was not popular with Moslems but was popular within the military groups. As a multi religious society, Indonesia was not far from conflict at the beginning of this era. Ricklefs (2001, p. 355) noted that in April 1967, a series of violent incidents occurred when Moslems attacked Christians churches in Aceh, and in October 1967, serious anti-Christian riots occurred in Makasar (Sulawesi). Under the new regime, it was made clear that the military would use force to stop this violence.

Soeharto quickly started his strategy by calling his regime the New Order (Orde Baru). He attracted Western nations, particularly on cleaning up communism. He also finally received support from the World Bank and the IMF. Since he had a close relationship with Chinese businesspersons, it was the time for him to hold them tight and use them to contribute to the development of the country. Soeharto considered that the military’s role was critical; therefore, he took control over the four military services (Army, Navy, Air Force, and Police) in August 1967 and placed all services directly under his authority (Ricklefs, 2001, p. 356). On the political front, he also controlled the parliament with his ruling party, called Golkar (Functional Group). Having this support on hand, Soeharto centralized the power under his control.

From 1971 to 1981, Indonesia experienced rapid economic growth with an average annual growth of 7.7 per cent (Ricklefs, 2001, p. 366). Other sectors such as education had also a great improvement. During this era, the population growth was also significant. In order to reduce the increasing population, the government introduced family planning, which became the most successful program of its type in the world (Ricklefs, 2001, p. 371). During this era, the intension to decentralise some development and planning functions to the provinces and districts were drawn, which indicated by Basic Law No. 5 in 1974. Unfortunately, there was no political will from the regime to share the power with other areas.

King (1988) conducted a study on civil service policies of Basic Law No. 5 in 1974 regarding the decentralization policy in two areas in Sulawesi (Celebes island), which are distant and culturally distinct from Java, “the bureaucratic centre” (King, 1988, p.251). The study indicated that the application was contrary to the intension by saying,

> A series of regulations combined political purging with administrative reform and increasingly tightened central control over the bureaucracy (King, 1988, p. 259).

An example of such regulation pointed out by King (1988) was that the authority to appoint, promote, move and discharge all employees within the ministry was held by the minister in Jakarta. It should be noted that the President appointed ministers to head government departments or institutions. Finally, King (1988) concluded that the decentralization agenda was unsuccessful and he noted that,

> (a)fter more than a decade of decentralized programmes (INPRES) and a basic law giving-autonomy to the regions, the policies governing the civil service seem to result in ever-greater centralization. They promote a ‘brain drain’ out of the regions into agencies of the central government, restrict too severely recruitment and hiring at the local level, create situations where bureaucratic requirements take precedence over individual qualifications in appointments and promotions, and reinforce the barriers to bureaucratic communication. The New Order’s continued preoccupation with tight, central control prevents it from enacting policies that might achieve more balance, and thereby better promote political stability and show the central government to be truly strong (King, 1988, p.259).

During Soeharto’s era, indeed the country was well controlled, stable and had few security issues. This may have been caused by various regulations as indicated by King (1988), as well as the use of military force to maintain the security and the indoctrination of ideological homogeneity to its citizens with the Five Principles (Pancasila) in 1978 (Ricklefs, 2001, p. 373). Unfortunately, corruption was also rife, nepotism, and family connections were in favor in this time. The situation led to an unrest, which forced Soeharto to step down from power on 20 May 1998.

Reform

During the last period of Soeharto's regime, the vice president was Dr. BJ. Habbibie and he became the third president, for 17 months, from 21 May 1998 to 20 October 1999. According to Ricklefs (2001, p. 392) Habibie is a well-educated person who obtained his doctorate in aeronautical engineering in 1965 from Thechische Hochschule in Aachen, West Germany. In 1974, he was appointed Vice-President and Director of Technology of Messerschmitt enterprise (an aircraft manufacturer) in West Germany. However, he was called to return home by Soeharto in 1974 (Ricklefs, 2001, p. 392). He was appointed Minister of State for Research/Chairman of The Agency of Assessment and Application of Technology and asked by the President to set up high-technology state enterprises. Some of these companies are IPTN (aircraft manufacturer), PAL (shipbuilder), and Pindad (ammunition manufacturer). Ricklefs (2001, p. 392) described Habibie as a unique combination as he has a civilian background, academic brilliance, Islamic piety, a closeness to Soeharto, and had Bugis and Javanese parenthood.

At the time when Soeharto stepped down from power, the economy of the country remained a disaster in which inflation reached 80 per cent. In addition, riots and killing occurred everywhere including the attacking of churches in some areas. Violence and killing still occurred in various areas, such as in Kalimantan, Ambon, Poso (Sulawesi) and Aceh until the beginning of 2005. According to Ricklefs (2001, p. 408) in the light of the condition of the country, the achievements of Habibie were remarkable including giving independence to East Timor and the starting of the new autonomy policy.

At the 1999 election, the highest number of votes were obtained by the PDI-P (Indonesian Democracy Party of Struggle) led by Megawati, a daughter of Soekarno (the first Indonesian President). However, the People's Consultative Assembly/Upper House (MPR) led by Amin Rais (a leader of second largest Islamic group called Muhammadyiah) appointed Abdurrahman Wahid (a leader of the largest Islamic group called Nahdulatul Ulama/NU) as the fourth President of Indonesia, and Megawati as the vice president. Abdurrahman Wahid is a son of former NU leader Wahid Hasjim and grandson of Hasjim Asjari the head of Office for Religious Affairs during the Japanese occupation (Ricklefs, 2001, pp. 255-256). He studied at Al-Azhar University, Cairo and University of Baghdad during 1968-1970 (Ricklefs, 2001, p. 378). He has Javanese parenthood and has a quite unique personality as described by Ricklefs (2001, p. 378) who said that

> (h)is thinking, public speaking and writing emphasised Islam as a religion founded rationality, with a commitment to tolerance and social pluralism.

During his presidency, Abdurrahman Wahid encouraged pluralism and openness and he allowed Chinese Confucians to celebrate their ceremonies openly (Ricklefs, 2001, p. 419). At the beginning, his presidency was full of hope and promise for the future of Indonesia, but later on, many of his statement were confusing and led to criticism and disagreement. His presidency only lasted until July 2001, when the same People's Consultative Assembly in a special meeting removed him from the presidency and made Megawati the fifth president of Indonesia.

Abdurrahman Wahid left Megawati with many unsolved problems. The turmoil in Ambon between Christians and Moslems that killed over a thousand people remained unsolved, the economy was unstable and corruption rife. Megawati found it was hard to solve these problems, which became worse near the end of her duty. Nevertheless, one of the political outcomes made during Megawati's time was the implementation of direct voting for a President. Therefore, the election in 2004 applied direct voting without intervention by the People's Consultative Assembly (MPR). Another significant policy during her presidency were administrative changes in the use of double entry system for government administration to be on trial in 2003[4], as well as Unifying Budget to replace routine and development budget systems to be on trial in the 2005 financial year[5].

The implementation of direct voting in the election of 2004 brought Susilo Bambang Yudhoyono (SBY) as the sixth president of Indonesia and Muhammad Jusuf Kalla as vice President started 20 October 2004[6]. At the beginning, Indonesia was in a very difficult situation. Indonesia suffered from the Tsunami disaster that killed at least 250 000 people, and various acts of terrorism. However, this study is only able to describe the situation until the beginning of the presidency of Susilo Bambang Yudhoyono. Nevertheless, it is clear that after the Soeharto regime, there was little chance for the following presidents to deal with the administrative system. Although, there were some changes proposed such as the new budgeting procedure and the accounting system during the era of Megawati, these are only at the trial stage in which full implementation is expected in 2008.

The Accounting System in the Government Sector in Indonesia

The accounting systems of the government of Indonesia were inherited from the Dutch. This system is called the ICW (Indische Comptabiliteitswet) it was issued in 1864, and was applied in 1867[7]. It is a single entry system that was used by Indonesia

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[4] The Finance Ministry decree No. 337/KMK.012/2003
[5] The Presidential decree no. 21/2004, issued on 5 August 2004.
[6] The World Factbook, http://www.cia.gov/cia/publications/factbook/geos/id/html, visit 21-11, 2005.
[7] Explanation of Republic of Indonesia Law no. 17, 2003 about State Finance.

until 2004. There was an effort to change it in 1968, but the change was not to the accounting treatment but just a change in the financial administrative act. The Minister of Finance mentioned it in his speech to the International Financial Management Conference in September 1986 in which he described the change as only to translate the system into Indonesian while the contents remained the same as in the ICW (Yujana, 1992, p.25).

Another effort for change was made in 2003 when Megawati was in power, through the Finance Ministry decree No. 337/KMK.012/2003. This decree was issued on 18 July 2003 to regulate the use of the double entry systems by the government backdated to 1 January 2003. It is uncommon to backdate a regulation on the use of accounting systems. Because Indonesia is, a large and diverse country it was difficult to implement the decree and therefore the new system has only been used on trial up to time of this study.

In the following year, Megawati also issued Government regulation No. 21, year 2004, regarding budgeting systems. This regulation put in order a change from the use of two budgets (Development and Routine budgets) into one budget called the "unified budget". The regulation was issued in 5 August 2004, which was about the election time, to be effective in the 2005 financial year. As the new system is currently on trial, the budgeting systems concerned in this study are those before the change.

Researchers in Indonesia

One aspect of the historical development of Indonesia that is relevant to this study is the way that public servants are promoted. This system dates back to the Dutch period and is still in use. There are two career path for civil servant in Indonesia; the structural (Struktural) and the functional (Fungsional) career path. The structural career path is provided specifically for employees in the bureaucracy that perform administrative tasks. The functional career path is specifically offered to employees who do not perform administrative and routine tasks such as, teachers, lecturers, auditors, and researchers (scientists).

The system of promotion is different between these two career paths. Under the structure career path the promotion is related to an advancement of two factors, hierarchical position (i.e. sub-head, head, director, director general) and official grade. The promotion to a hierarchical position is dependent upon a need and position availability. The promotion along the official grade occurs every four years for employees who have no hierarchical position, with an exception for very sophisticated performance. The employee who has a hierarchical position however, may be promoted in their official grade in a period of two years, but this is limited to three times during the employment period. The performance of employees under the structural career path is measured by eight criteria[8]**:**

1. Loyalty
2. Work Performance
3. Responsibility
4. Obedience
5. Honesty
6. Cooperation
7. Initiative
8. Leadership

Under the functional career path, promotion would only be an advancement of the official grade. The functional career path is evaluated based on criteria different to that of structural career path, for example, researchers are evaluated based on the two elements presented in table 6.1 and 6.2; Main Criteria and Supporting Criteria (BPP. Teknologi, 1991). The main criteria consist of three aspects Level of Education, Scientific Publications, and Technology Acceleration. The supporting criteria consist of four aspects: Dissemination of Science and Technology, Involvement in Scientific

[8] Translated from Daftar Penilaian Pelaksanaan Pekerjaan Pegawai Negeri Sipil.

Activities, Supervising Scientists Candidate, and Scientific Acknowledgment. Every aspect consists of a detailed description of elements that are weighted by credit points. The accumulation of the credit points obtained by a researcher is used as performance criteria to qualify for promotion to the next official grade.

Table 6.1: Main Criteria of credit points achievement for Scientist

Please see print copy for Table 6.1

Table 6.2: Supporting Criteria of credit points achievement for Scientist

Please see print copy for Table 6.2

As presented in table 6.3, the official grade of the researcher in a government institution in Indonesia is classified into four levels from the lowest to the highest level as; Research Assistant, Research Adjunct, Researcher, and Expert. The first three levels consist of two grades, Junior and Senior, whereas the last Expert level contains three grades: Junior, Senior and Main. In addition, cumulative credit points obtained during the period of the service define the position of the researchers along the levels. However, the performance must achieve at least 70% of main criteria and 30% of supporting criteria.

Table 6.3: Required Credit point of Positions for Scientist

Please see print copy for Table 6.3

The functional career path for researchers has been found to be different to the structural path. The functional path is linked to scientific achievement, which may encourage the researchers to conduct R&D activities. This model indicates that the scientific dimension plays an important role in the career path of the researcher. However, the small amount of allowance given to each level does not seem to support the system. For example, a fresh graduate PhD researcher may only obtain a position as Research Adjunct, and will receive a maximum allowance of IDR 140,000 per month, which is about 100 Australian dollars. Considering that scientific research has no national boundary, this will make the payment rate for the researcher in Indonesia very low compared to international conditions. In addition, as the qualification in terms of education and knowledge is significantly high, while the salary rate is low, the researcher may be forced to find another part time job and that will affect the effort on the R&D activities.

Summary

Indonesia had a history of colonialism by several countries; Portugal, Netherlands, Britain, and Japan. The longest period of colonialism was under the Netherlands, which lasted about 350 years. During the Dutch colonial period, the government administration was centralised in Batavia (now Jakarta). The Dutch used Indonesian as part of the system where they occupied lower level positions in the civil service. Most of those people were Javanese, and therefore, the Dutch adopted the culture by establishing a bureaucratic elite called Pangreh Praja. These elite were used as agents of the colonial power to deal with society as well as to serve the colonial state. Near the end of the Dutch era, a western education system was also established, including OSVIA, a training centre for native officials. Unfortunately, during this era corruption, nepotism, and other subjective measures flourished and were carried forward to the period after the end of colonialism.

Japan came into power for nearly three and a half years. During this era, the Japanese tried to eliminate the western influence including the administrative system. Unfortunately, they had to rely upon the existing Indonesian officials and therefore there were insignificant changes to the existing system.

Indonesia obtained its independence in 1945, and gained full sovereignty in 1950. The first president of the new state was Soekarno who stayed in power until 1967. During this period, the country was unstable and therefore the government administrative system remained the same as during the Dutch era. From then until 1998, Indonesia had its second president, Soeharto, who occupied the position for 32 years. In this era, there occurred significant progress and development in Indonesia, which was indicated by rapid economic growth. During this period, the government administrative system was highly standardized and centralized by Jakarta. It seems that Soeharto applied a similar strategy to the Dutch, or perhaps the condition of the nation was suitable for it. Unfortunately, corruption, nepotism, and many irregularities flourished during this period, and he lost power in 1998. The government accounting systems were also similar to those used during the Dutch era; the only change was the translation of the Dutch administrative law called ICW into the Indonesian language.

After Soeharto, came a period of reform. Unfortunately, instability, social conflict, riots, killing, and terrorism were some of the situations that occurred during this time. Habibie, Abdurrahman Wahid, Megawati and Soesilo Bambang Yudhoyono were the presidents since 1998 to the present (2006). The government accounting system during the era of the New Order was inherited from the Dutch and it is called ICW. Changes in the accounting system and budgeting system took place in 2003 and 2005 when Megawati led Indonesia, but they are still on trial and have not become commonplace.

Scientific researchers in Indonesia follow a career path called the functional (fungsional) career path. They are assessed differently to those in the bureaucracy. Their evaluation is mostly based upon scientific dimensions including level of education, scientific publication, technology acceleration, dissemination of science and technology, involvement in scientific activities, involvement in scientist candidates, and scientific acknowledgement. Unfortunately, the reward and salary rate seems to be unbalanced to the qualification required. These systems may also work to discourage the researchers to be involved in R&D activities.

The next chapter will be presents a discussion of the practice of management control implemented by the units under investigation that execute the control function.

CHAPTER SEVEN

The Study

Introduction

A R&D project proposal in the public sector in Indonesia will go through an internal and external selection process before it is funded by the government. Several government institutions are involved as bodies that are external to the unit making a proposal but these external bodies are still part of the public sector, and this study has investigated three of them. They were the National Planning Agency (Bappenas), the Agency for R&D in Industry (BPPI), and the Directorate General of Budget (DJA). The investigation was conducted by visiting the sites, observing the practice, collecting documents, and interviewing relevant authorities.

This chapter presents the data collected from fieldwork. It begins with the data collection method used by the study, and is followed by a description of the relevant government institutions, and R&D projects in Indonesia. The budgeting process in the government sector consisting of three phases is also discussed, and followed by the accounting system practiced during the time of the New Order. Further, the chapter presents the data collected beginning with the National Planning Agency (Bappenas), then the Agency for R&D in Industry (BPPI), and the Directorate General of Budget (DJA).

The background, organisational structure and the goals and the function of each of these institutions are described in this chapter. The management control practiced by the agencies during the approval process will be presented and discussed in the chapter. The use of control dimensions such as the scientific, bureaucratic, financial and directional dimension will be identified in the execution of the control systems. In addition, data from the observation of a budget meeting concerned with the selection of R&D projects is also presented. Finally, a summary of the discussion will be presented.

The sites and data collections

The data collection was done in two periods. The first data collection was carried out in 1993 for the 1994 budget period, through observation, interview and documentation. The second data collection took place in 2004 after the political crisis in Indonesia and was done through interview and documentation. The Planning Agency (Bappenas) and the Directorate of Budget (DJA) play an important role in the budgetary process so these two government institutions were taken as sites of interest samples for the study in 1993.

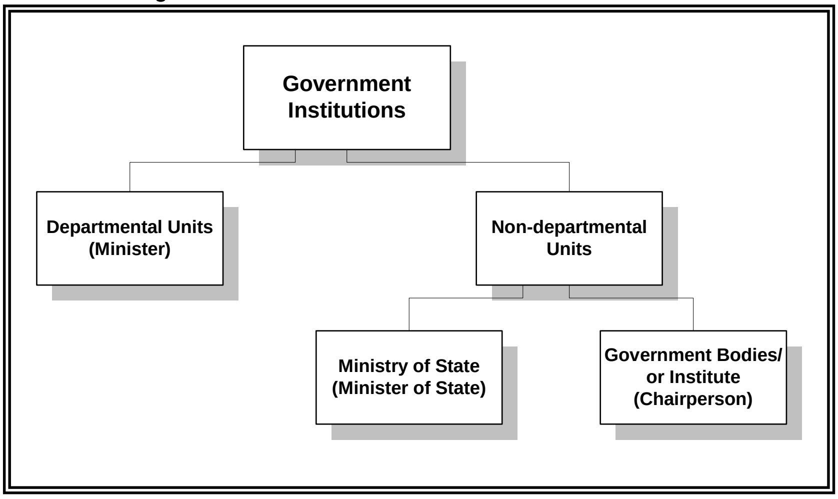
During data collection in 1993 three core sites were initially selected, one of them involved the Indonesian Institute of Science (LIPI), and the other two the Ministry of Industry. However, during the visit it was found that all projects under the Ministry of Industry were under the control of the Agency for Research and Development in Industry (BPPI), which also acted on behalf of the Ministry of Industry. Therefore, the Agency for R&D in Industry was selected in addition to the National Planning Agency, and the Directorate of Budget. Furthermore, to investigate whether there were changes in government policy in relation to the control systems practiced since 1993, the study again carried out interviews with and obtained documentation from the National Planning Agency and the Directorate of Budget in 2004.

The study investigated three R&D projects. Two projects were administered by the Ministry of Industry these being the R&D Project for the Textile Industry, Bandung; and the R&D Project for the Metal and Electronic Industry, Bandung. The third project was administered by the Indonesian Institute of Science and was the R&D Project for Biological Resources.

Government institutions in Indonesia

There are two types of government institutions in Indonesia, Departmental Government units that are also called ministries and Non-departmental units (LPND). A Departmental Government unit is led by a Minister of the department (see figure 7.1).

Figure 7.1: Government Institution in Indonesia



The Non-departmental unit consists of two entities; the Ministry of State, and the Bodies or Institutions (Badan atau lembaga). The Ministry of state is led by Minister of State and the Institutions or Bodies (Badan atau lembaga) and is led by a Chairperson. R&D projects may arise from these two types of government institutions. For further discussion, the Departmental Government units will be referred as to Departmental units and the Non-departmental Government units as Non-departmental units.

Government R&D projects in Indonesia

The R&D schemes within the government sector in Indonesia can be classified into two types, the Single Institution Based Research Scheme (SIBRS) and the Multi Institutions Based Research Scheme (MIBRS). The SIBRS is a R&D project that is operated on behalf of a particular government institution. The SIBRS is treated as a unit within the institution rather than a project of an individual researcher. Under this type of scheme the project's budget is distributed as part of the institution's budget. The

MIBRS began in 1992/1993. This scheme involves more than one institution and consists of a variety of arrangements such as the Partnership Excellence Research Scheme/PERS and the Integrated Excellence Research Scheme/IERS. The Partnership Excellence Research Scheme (PERS) is a collaborative R&D project between government and industry. The Integrated Excellence Research Scheme (IERS) is a research project that is funded by government and is classified into: Domestic and International collaboration.

The difference between Single Institution Based Research Schemes (SIBRS) and Multi Institutions Based Research Schemes (MIBRS) is not only related to fund donors but is also related to research areas in R&D activities. The SIBRS may include a project on R&D activities that is relevant to the mission of the institution while the MIBRS is more specific within a development activity rather than basic and applied research. Since the MIBRS may involve institutions other then public sector and has specific arrangement, this study focuses on the Single Institution Based Research Scheme (SIBRS).

The Budgeting process in the government sector in Indonesia

The government budget in Indonesia can be catergorised into two types (Kunarjo, 1992, pp. 115-129): the Development Budget and the Routine Budget. The Development Budget is a budget that arises from non-routine sources such as foreign loans and aid to finance projects in government institutions. The Routine Budget arises from routine revenues such as revenue from taxes, and natural resources and is used to finance operating expenditures such as salaries and wages, and maintenance cost (Baswir, 1992, pp. 38-39). R&D activity in the government sector is formed as a project and uses Development Budget; therefore this study focuses only on the Development Budget.

In every five year period the country will execute a general election to choose members for the Upper House (MPR) and the Lower House of the parliament (DPR). The Upper House will select a president and define the National Guidelines (GBHN). The role of the Lower House (DPR) is to control the operation of the cabinet including approving or rejecting proposals from the cabinet. The National Guidelines are guidelines that will be used by the cabinet to develop a proposal for a long-term plan called Repelita (Five Years of National Development Plan). Since 1999 the Repelita has been called the National Development Program (/PROPENAS). The plan basically consists of the strategic goals of the country.

An interesting component that was set out in the National Guidelines 1993-1998 was the incorporation of science and technology as a target. The commencement of this component indicated that the government was beginning to consider the significance of the role of science and technology to accelerate the development of the national economy as well as its management control systems[9].

The interviews done in 2004 indicated that the procedure for the 2004 budget was still the same procedure as in 1993. Although some changes of the name of some documents occur the function of these documents remains the same[10]. Three major phases must be carried out before a project is approved: the *Preliminary phase*, the *Project proposal selection phase*, and the *Project budget selection phase*.

Preliminary phase

The *Preliminary phase* (see Figure 7.2) starts with the Ministry for Finance issuing a memorandum to require all government institutions to propose for the following year, an annual program and budget with regard to the National Guidelines.

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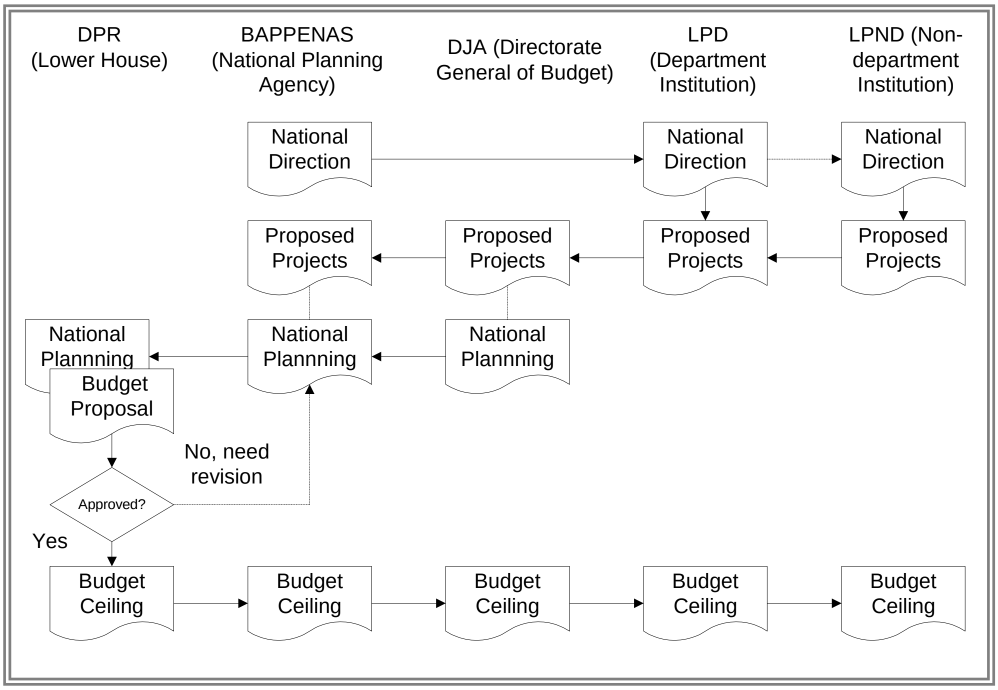
[9] Menteri Negara Riset dan Teknologi, 1993, pp. 1-4
[10] Interview with Mr Rahmat Mulianda from Bappenas by telephone 6 August, 2004.

The preparation of the preliminary projects' activity plan is supervised and compiled by the National Development Planning Agency and the preliminary budget is supervised and compiled by the Ministry of Finance through the Directorate General of Budget.

The project proposal should be presented in three forms; Terms of Reference (TOR), Working Paper (LK) and List of Proposed Projects (DUP). The Terms of Reference is a form that contains a brief qualitative description of the project. Twelve Terms of References were collected during the visit in 1993, and every Terms of Reference document consists of four items: Research Topic, Research Background, Research Purpose and Target, and Research Time Table. The Working Paper is a form that contains a computation of the project's budget and consists of four items: the Sub-project, the Activities within the sub project, the Substance within the activities, and the Budget items. The Proposed Project List contains the summary of the project. The detail of these documents will be discussed in relation to the core samples presented in the following chapter.

Figure 7.2: Preliminary Phase of Project Proposal



The proposed projects are then summarised by the head of the institution or the ministerial office and are sent to the National Planning Agency (Bappenas) and the Directorate General for Budget. The preliminary projects' activity plan will be used by Bappenas to generate an annual operational plan (REPETA) and the compilation of the preliminary budget is used by the Ministry of Finance to develop a National Budget Proposal (RAPBN). These documents are sent to the Lower House in Parliament (DPR) to obtain approval. The National Planning Agency and the Directorate General for Budget will have various meetings with the committee in the Parliament.

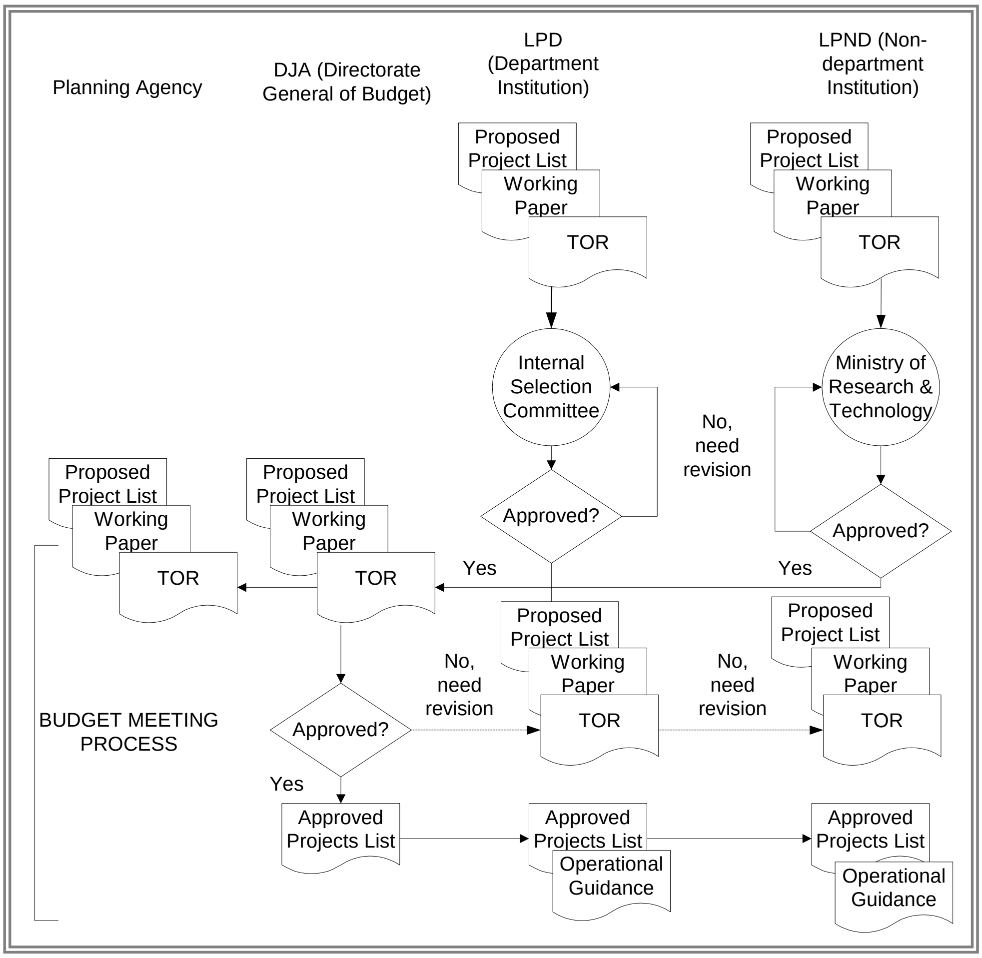
When the annual Operational Plan and the Budget Proposal has been approved by the parliament, these two documents become the Annual National Plan and the Annual National Budget (APBN). However, in this phase the content of the National Plan and the National Budget are more general in terms. As a plan the National Plan only describes the projects listed in general terms rather than in detail. In a similar vein, the National Budget only describes the amount of budget allocated to every government body, which is called Satuan dua (Budget Ceiling). Finally, these two documents are distributed to related government bodies to be used as a basis to propose the projects in detail.

Project proposal selection phase

The *Project proposal selection phase* starts with the development of a project proposal in detail by using the Budget Ceiling as guidance (see Figure 7.3). A project proposal from a Departmental unit must be examined and selected internally by a committee within the department. At this stage control functions may be involved and will be discussed in more detail in the section on each core sample site. A research project from a Non-departmental unit however, will be assessed by an internal committee and also by the Ministry of State for Research and Technology.

The output of the project proposal phase is the final draft of the Terms of Reference, the Working Paper and the Proposed Project List approved by an internal selection committee for the Departmental unit and by the Ministry of State for Research and Technology for a Non-departmental unit. These two documents are sent to two institutions; the Directorate of Culture, Science and Technology of the National Planning Agency, and to the Directorate General of Budget of the Ministry of Finance. For further discussion the National Planning Agency will be called the Planning Agency and the Directorate General of Budget will be called the Directorate of Budget.

Figure 7.3: Project Proposal and Budget Selection



Project budget selection phase

Having these documents, the *project budget selection phase* begins with the Directorate of Budget arranging a budget meeting with related institutions (see Figure

7.3). The meeting will be attended by personnel from the Planning Agency, the Directorate of Budget and the R&D project. The budget meeting will be led by the Directorate of Budget and the process is called "c*osting*". The meeting focuses on the appropriateness of the budget figures on each project's items.

The output of this process is called the Approved Development Budget (DIP/Daftar Isian Proyek) which is the Proposed Project List that endorsed by the Directorate of Budget and will be attached to a form called Operational Guidance (PO/Petunjuk Operasional). The operational guidance form provides operational guidance, and is issued by the head of the institution, such as the Minister or the chairperson of the institute. The Approved Development Budget and the Operational Guidance will be sent to various related institutions such as: the Planning Agency, the Indonesian Audit Board (BPK), the Financial and Development Supervisory Agency (BPKP), the National Accounting Bureau (Bakun), the Accounting Information Processing Centre (PPDIA), the State's Treasury (KPKN), Project's institution, and the Project's leader.

Accounting System Practiced during the era of the New Order

Each department/ministry/unit/project has a Treasurer (Bendaharawan) who administers the financial aspects of the government sector in Indonesia. This occupation needs to be distinguished from the practical role of "Treasurer". This role has been divided into three: the Treasurer for Inventory (Bendaharawan barang), the General Treasurer, and the Special Treasurer (Yujana, 1992, pp. 142-144). The Treasurer for Inventory refers to an officer who is responsible for administering all non-cash assets. The General Treasurer is the lowest managerial position (Kepala Seksi) in the government's treasury units such as the central bank, the government's banks, the post office, and the overseas government representative's office. The General Treasurer is responsible for administering the income and expenditure that occurs in the institution. The position of Special Treasurer is classified into two types, Special Treasurer for Non-tax Income and Special Treasurer for Expenditure. The Special Treasurer for Non-tax Income is responsible for receiving, administering, and depositing government income from non-tax activities into the government's account. The Special Treasurer for Expenditure however, is responsible for administering government expenditure that occurs in a government institution including R&D projects.

As there are various types of treasurer found in the government sector, this study limits the term of treasurer to refer to the Special Treasurer for Expenditure for R&D projects, and this person will be referred to as the project's treasurer in further discussion. The project's treasurer is the only person responsible for receiving the funds from the government, maintaining the funds, administering the transactions, and providing the financial reports. The funds received from the government are limited to the amount of budget that has presented in the Approved Development Budget (DIP), which will be referred as to the Development budget in further discussion. Only the project leader has authority to change the budget allocation from one item to another within the same project.

The accounting system in the government sector in Indonesia used a cash based system and single entry to record the transactions. However, from 2003 the government of Indonesia has proposed the use of the double entry system which still under trial until 2005, and single entry continues to be used.

The practice of accounting for government projects in Indonesia begins with the approval of the project budget and is presented in the Development Budget form. Each month the project treasurer is requested to provide a monthly financial report. The monthly financial report consists of two types of reports. First, the Cash and

Development Budget Position Report which focuses on the position of the development budget (see Figure 7.4), and second, the Cash Position Report which emphasises on the cash position (see Figure 7.5).

Figure 7.4: Cash and Development Budget Position

Please see print copy for Figure 7.4

The project's treasurer is the only one who is responsible for administering the project's finances within the accounting systems. Managing the funds, providing supporting documents, justifying the transactions, recording the transactions and preparing the financial reports are all part of the task of the treasurer. A single person, who is the project's treasurer, handles all the financial processes, and there is no reliable report that can be used to counter check the practice. By doing it this way, it seems that the internal control system is weak. Though the project's leader does a counter check by signing the document to justify the occurrence of a transaction, this practice seems to provide a great chance to challenge the reliability of the accounting records. In addition, the role of auditor was also limited. The internal auditor called Inspektorat Jenderal will perform an audit quarterly, and once a year and audit will be carried out by an external auditor from at least two institutions: the Financial and Development Supervisory Agency/BPKP, and the Indonesian Audit Board/BPK.

Figure 7.5: Cash Position Report

Please see print copy for Figure 7.5

The practice of the accounting system in the government sector in Indonesia seems to be merely a justification of past action without being able to give an input for future action. More precisely, there is difficulty in identifying the control function exhibited by the recording system apart from the use of the budget on each item to limit financial decisions.

The accounting system seems to be assigned to general practice in the government sector in Indonesia. There was no evidence found to indicate a specific report to link the research output with the financial aspects of that research. Even efficiency measurements, which measure input in relation to output, could not be found.

The National Planning Agency (Bappenas)

Background

The National Planning Agency is a Non-departmental government institute that is responsible to the President of The Republic of Indonesia. The organisation was established through Presidential Decree No. 80 1967 jo. Since 1967 several changes to improve the functions and tasks of the Planning Agency have been made including changes of organisational structure. The presidential decree number 35 in 1973 pronounced that the function of Bappenas was to assist the President to determine policies regarding the national development plan, and to give an appraisal of the execution of the national development plan. The nine main tasks of the Planning Agency are to[11]:

1. establish the short and long run national development plan,
2. coordinate and integrate all functional or regional development plans into a national development plan,
3. maintain coordination with the Ministry of Finance in developing the National Budget Proposal,
4. maintain coordination with pertinent government units to set up lending and investment policies,
5. maintain coordination with pertinent government units to set up loan acceptance and usage policies,
6. monitor the preparation and improvement of the national development plan, and to synchronise all projects' programs.
7. evaluate the execution of the national development plan, and to consider making adjustments needed by each project and program.
8. survey and assess the establishment of the national development plan, and to make

[11] Translated from Presidential decree, number 35, 1973, section 3.

an evaluation of the execution of the national development plan.

9. do other tasks assigned by the President.

Regarding the Presidential Decree number 7, of 1988, there are seven deputies in Planning Agency, and these deputies are responsible to the chairperson of the Planning Agency as depicted in Figure 7.6. One of the bureaus that are involved with R&D projects is the Directorate of Culture, Science and Technology, formerly called the Science, Technology, Aerospace, and Maritime Bureau. This bureau was chosen by the study as one of the supplementary samples, therefore its role in the control process will be discussed briefly. For further discussion the study will refer to this unit as the Science and Technology Bureau.

There are two main tasks of the Science and Technology Bureau that are related to research and science affairs[12]:

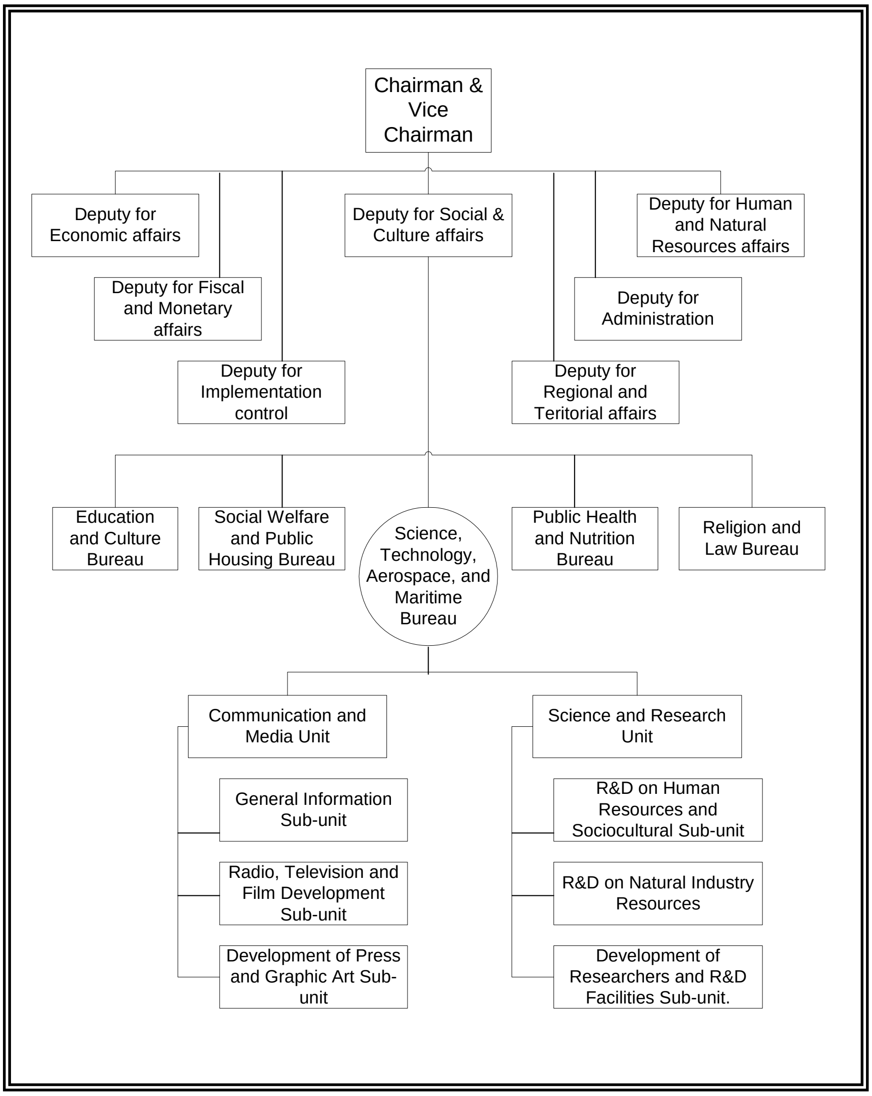
1. To prepare materials for establishing the policies, planning, programs, and development projects including the development funds to improve the research and science effort, to monitor and to list policies and information that are relevant for research and science.

2. To survey and observe the preparation, monitoring, evaluation, and report of the execution of the plan, policies, program, and projects of the development of research and science.

The above tasks indicate that the bureau is involved in various activities that are related to the R&D operation including project evaluation and selection, and the monitoring function. It could be said therefore that this unit exercises a certain degree of control over the operation of R&D projects.

[12] Translated from internal document of Bappenas.

Figure 7.6: Organisational Structure of the National Planning Agency



Project selection process

An interview was conducted with the head of the bureau to discover his opinion on the connection between a R&D project's goals and the national development plan. He said[13],

> …the connection of the project's goals and the national development plan is difficult to identify. The output of the R&D operation is a report about a new technique, method, or product. On the other hand the objective of national development however is related to changes in the society toward a better life. The indicator that is used to define development is through the income per capita (GNP). The influence of R&D output on the GNP cannot be seen in a short time. It is a long-term process that involves various efforts.

[13] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.

Regarding these difficulties, a further question was raised on how it would be solved. In response to this question he said the following[14]:

> Therefore there is a need for qualified personnel who are capable of giving a recommendation on the appropriateness of a R&D project proposal for the national development program. Nevertheless, all the project's goals should address the research priorities which have been defined in the National Primary Program for Research and Technology (Punas-Ristek) and link it to the needs of the industry.

Regarding the existing practice of project selection, the head of the bureau made the following comment[15]:

> The current practice of project evaluation and selection that is done by internal committees of the government units is ineffective. This is indicated by the many inappropriate proposals that were proposed.

Further questions were raised regarding the application of his views when the relationship of the R&D output with an industry sector is weak by nature such as for basic research. In response to this question, he said that[16],

> …every research proposal should have a hypothesis to be tested. Even if the result contradicts the expected hypotheses, it is also a result that may bring a benefit for future development. Therefore, the criteria should be set by an expert team who base the selection on scientific criteria as applied by a Multi Institutions Based Research Scheme (MIBRS). The involvement of the expert team in the project evaluation and selection process is expected to improve the quality of the project that will be funded. The expert team refers to the list of Indonesian scientists who are members of the Indonesian National Research Council that consist of professors and senior researchers.

Presidential Decree No. 1, 1984, established the Indonesian National Research Council (DRN) on 7 January 1984. According to the head of the bureau, the National Research Council (DRN) is not involved in the selection of the research programs as it should be. The Council is an advisory body to the Minister of State for Research and Technology and is responsible for coordinating the following tasks (DRN, p. 7):

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[14] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.
[15] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.
[16] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.

1. Formulation of national programs of prime importance to research and technology
2. Observations (monitoring and evaluation) on a continual basis with regard to the planning and implementation of the National Program
3. Appropriate direction and adequate supervision of research and technology.

Regarding the criteria that should be applied in selecting a R&D project, the head of the bureau made the following comment[17],

> …various practical criteria may also be employed such as the probability of success, the technological advances, the time frame, and the budget. However, the appropriateness of emphasis on each of these elements to be applied to different types of research projects should also be considered, and must be set in detail.

However the head of the bureau also considered the quality of basic research by mentioning the following:

> The quality of basic research is very difficult to measure. One indicator that represents the quality of the output from basic research is its ability to be published in a scientific journal.

According to the head of the bureau, there are five general criteria that are commonly used by the Planning Agency to select the proposals[18]:

1. Science and Technology that can solve an actual problem of national development or is able to encourage technology for national development
2. Science and Technology that has competitive advantages in terms of leading in technology internationally
3. Science and Technology that fulfils market demands (especially the local market)
4. Science and Technology that does not have negative impact on the environment
5. Science and Technology that optimises use of national resources

Considering the selection procedures that involve the Directorate of Budget in selecting R&D projects, the view of the head of the bureau was also sought. Regarding this matter he said that[19],

> …the rigidity of the operating procedures and bureaucracies in selecting the

[17] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.
[18] Interview with head of the unit Dr. Triono Sundoro, 19 January 1993.
[19] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.

> research projects are still ineffective and obstruct the projects' operation. This situation is reflected in the budget meeting between the research institution, the DJA and the Planning Agency. In this meeting there is too much subjectivity used in negotiating the budget, and therefore the budget meeting would seem to be just a formal requirement for a justification that the budget procedure has been followed.

A discussion was undertaken with a group of staff of this unit who were involved in the budget meetings. They indicated that they experienced difficulties in selecting proposals in some areas. The difficulties were related to defining the technical suitability of a research project, the appropriateness of the project regarding the budget required, and difficulties in relating the expected benefit from the R&D operation with the objective of the national development. Therefore, basically they were applying the role of the planning agency by saying that [20]

> The role of the Planning Agency is to coordinate the activities of all government projects particularly to avoid an overlapping of the projects' program within a department or among departments. Basically program or research topic selection is placed on the internal unit of the ministry, whereas the financial evaluation process is placed on the Directorate of Budget. By doing so, the task of the Planning Agency would not be on technical or financial screening, rather, as a programs' coordinator. If sometimes in the budget meeting the Planning Agency gives a suggestion in correcting the amount of budget, it is only because the Planning Agency has such experiences about the price of a certain budget items such as price of material, office furniture, and traveling costs.

It can be said that the role of the Planning Agency is to ensure that the project's program does not overlap with other research projects, and the project's goals are in line with the national development plan.

Project Control and monitoring system.

Apart from the problem in the project and selection process, this institution was also having problems in controlling and monitoring the operation of the project as the head said[21],

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[20] Discussion with a group of Staff of the Planning Agency, 7 February, 1993

[21] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.

> …there are some difficulties in monitoring the operation of a R&D project. The difficulties would be related to the non-physical product output, and the need to have a certain degree of knowledge of the discipline of the research area to adequately assess performance. Nevertheless, the current practice of the selection process is to ensure that the project has an appropriate planning and direction toward scientific achievement. The appropriate scientific direction and planning system can be used to indicate the possibility of projects that have a high degree of success, and operate to find a new product, process or technique in the required area of study. Once a project has been accepted it means that the best project has been chosen. Then the modification that occurs during the project's duration may be tolerated as long as it remains within the appropriate direction.

The role of the Planning Agency in controlling the project's operation is facilitated by a report form called the Quarterly Report Form (see Figure 7.7). This report contains five components: general information, financial information, activities and targets, progress, and the individual who provide the report (see Figure 7.7).

Another unit that was involved in monitoring the projects' progress was Bappeda, which was a planning unit on behalf of the local government and was placed in every province. As can be seen in Figure 7.7, the Local Planning Agency is required to put comments on the progress of the project. The reason for involving the Local Planning Agency in monitoring the project is to ensure that the project's progress is still relevant to the development of the local area.

Furthermore, in controlling the project's operation it was also mentioned by the head of the bureau that[22],

> …the use of a bureaucratic mode of control would not be enough. Therefore, the use of a scientific recommendation as performed by the National Research Council (DRN) and the panel is important as a complement to the existing selection criteria. The use of a scientific dimension as another criterion for controlling the project will bring some advantages to the current practice of project evaluation and selection. For example, research duplication may be reduced, an unsuitable project may be rejected, and further it will save the government budget. Though the scientific aspect is dominant in controlling the project, the role of budget control is still needed. Even though the proposal requires a significant

[22] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 27 January 1993.

amount of funds, but if the proposal is highly qualified, it will be supported. However, when a particular research project fails, the Planning Agency can require an explanation from the researchers and from other independent sources such as National Research Council (DRN) and the panels to confirm the situation dealt with by the project.

Figure 7.7: Form B-1-Quarterly Report

Please see print copy for Figure 7.7

As discussed earlier there are two R&D schemes in practice; Single Institutions Based Research Schemes and Multi Institutions Based Research Schemes. Regarding these two schemes, the head of the bureau said that[23],

> …the researchers are professional and independent and therefore there should be a space for self-control. However, to be effective the use of self-control should be followed by a proper salary rate, and this can be accomplished in the Multi Institutions Based Research Scheme. In the current system, the salary is based on the standard rate for government employees and could not be supplemented by any additional incentive. Therefore, under the Multi Institutions Based Research Scheme the researchers will be offered a contract to be involved in a project, and will receive additional payment from the project. The payment by the project will be based on the official rank and the task or position that is held in the project. By doing so, the researchers will receive payment from two sources, the project and their institution where they are employed.

The comments of the head of the bureau indicated that under the Single Institution Base Research Scheme, the R&D project is on behalf of a single government institution. The disadvantage of this approach can be considered to be three fold: a) the project's goals are to fulfill the tasks and functions of the institution where the project is established rather than the national development program. Therefore the R&D project would at most benefit the institution rather than national development, b) the outputs of the R&D project such as basic and applied research are difficult to connect directly to industry, and therefore it is difficult to assess their effectiveness. This situation would bring a chance to the project to hinder its effective operation, and c) an inadequate communication network within units of the government institution or among institutions in the government sector would make for less effective coordination, and would not bring adequate benefit for the national development program. For example, the lack of communication between Non-departmental Government Institutes and Departmental

[23] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 27 January 1993.

Government Institutes may make the projects overlap by proposing similar research activities on different topics.

During the financial year, internal auditors and/or external auditors will audit R&D projects. These audits are performed by an internal audit unit of the government unit (Inspektorat) and by external auditors called the Financial and Development Supervisory Agency and Supreme Financial Audit. The view of the head of the bureau on the role of the auditors was summed up by the following comment[24],

> In controlling an R&D project their role is limited to ensure obedience to standard operating procedures. This practice is only part of administrative control and is not concerned with the inner part of the operation.

The data collected indicated that the Planning Agency emphasised project selection to ensure that the project goals were adequately related to the Annual Operational Plan. Although the use of goals to select the project was difficult and may be far from accurate particularly for a basic research project, the goals in terms of directional qualities seemed to play an important role. It was indicated by the criteria used by the Planning Agency that R&D projects should be directed towards the national benefit. In addition, the involvement of independent scientists as a selection committee to screen the project also played an important role for control. This practice indicates the importance of the scientific dimension in selecting the project as a complementary element to the current practice that emphasised the bureaucratic and financial aspects. Furthermore, the recommendation from the selection committee can also be used to facilitate the control function in monitoring the project's progress. Financial dimensions such as the budget may also play an important role, but it may only be used to keep the project within the budget limit.

[24] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 27 January 1993.

The Agency for Research and Development in Industry (BPPI)

Background

The Agency for Research and Development in Industry (BPPI) is a unit under the Ministry of Industry that is responsible for encouraging and coordinating the R&D activities within the ministry. For further discussion this unit will be referred to as the Agency for R&D in Industry. Any unit within the Ministry of Industry that is involved with R&D activities is under this institution. The organisational structure of this institution is presented in Figure 7.8.

Figure 7.8: Organisational Structure of the Agency for R&D in Industry

Please see print copy for Figure 7.8

There are seven units in the Agency for R&D in Industry including, one unit as a secretariat, and six as functional units. Two of the functional units deal with R&D functions such as the R&D Centre for Industry and the R&D Centre for the Engineering Industry. The other four units are supporting units for the R&D functions such as: the Centre for the Development of the Industrial Climate, the Centre for the Exhibition & Visualization of Industries, the Centre for Industry, and the Centre for the Engineering Industry.

There is a difference in the organisational structures of the two units that are responsible for R&D functions and the other four supporting units. The supporting units have a mechanistic structure, whereas the R&D units have a combination of a mechanistic and organic structure (Gibson, 1981, p. 110). For example, the R&D Centre for Industry is beneath the Research Programs & Facilities unit and the Industrial Researchers Group. The former unit is a supporting unit and is structured in a mechanistic form, whereas the later unit is the unit that is responsible for the R&D operation and is structured in an organic form (see Figure 7.8). A group leader leads each area of study.

Project Selection, Monitoring and Evaluation

In performing its functions as coordinator for R&D activities within the ministry, the Agency for R&D in Industry performs the evaluation and selection tasks for all R&D project proposals. In an interview with the head of the agency, it was mentioned that the project proposals are evaluated and selected based on two main criteria: priority rank and objectives[25]. The priority rank criterion refers to the task and function of the ministry in developing the country. Therefore it relates to the priority of projects which pursue the objectives of the Ministry of Industry.

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[25] Interview with Head of the agency Mr. Bachrum SE, February, 1993

The objective criterion is developed from three concepts of national development (Trilogi Pembangunan): Growth, Equal Distribution, and Stability. The definition of growth in this context is interpreted by the agency as an industrial growth that is represented by increasing export from the industrial sector. This interpretation then is taken by the agency as a criterion to evaluate and select proposals. Accordingly, the implementation of this criterion was indicated by the following comment from the head of the agency[26]:

> …the expected output of the proposal must be directed toward obtaining a finding of a new technology process or a new product that directly or indirectly will increase exports from the industrial sector. The definition of R&D output to increase exports may include improvement of a product's quality, improvement of efficiency in producing a particular product, enable the industry to diversify products, and/or exploit natural resources.

The concept of Equal Distribution (Pemerataan) is defined by BPPPI as to give the society an equal opportunity for living including an opportunity for business. As most of the businesses in Indonesia are small businesses then the concept of 'Pemerataan' is interpreted by the Agency for R&D in Industry as to accelerate small industries. This criterion then is used to evaluate and select the project proposal in terms that the expected output of the proposal should be directed toward a development of a new prototype, or a new processing technology that can be used in particular by small businesses. The concept of Stability (Stabilitas) is defined by the agency as to maintain the industry environment, by creating industry that does not create environmental problems. This criterion is used in project evaluation and selection that focuses on new technology with low environmental impact, or a new technology to reduce waste from industry.

[26] Interview with Head of the agency Mr. Bachrum SE., February, 1993

Every month each project will prepare a progress report and send a copy to the agency. The progress report will be used by the agency to assess project progress. Though the agency postulates that it is difficult to define the progress quantitatively and in physical terms, the progress may be indicated by various qualitative factors. For example, how far the testing has progressed, to what extent the results have been implemented, and how far the effort in training the small industries has progressed. In addition, the progress report will also consist of the use of funds from each source. The financial information may be used to calculate the percentage of funds being used, and can be compared to the percentage of completion of activities. It may be calculated from the activities that had been done divided by total activities of the project, or from days that have been used divided by total days budgeted for the project. The comparison process will provide a warning signal to indicate a project that is in a critical situation, and that will lead the agency to assess in more depth the condition of a particular project. From this assessment the decision may be made to provide more funds, to discontinue or to postpone the project until the next fiscal year.

The above data indicates that the role of the Agency for R&D in Industry is to coordinate all the research and development under the Ministry of Industry. In coordinating these activities, the agency should evaluate and select the project proposal in relation to the role of the ministry in the national development program. The control system applied by the agency along the project evaluation and selection process is focused on the directional dimension. The use of the directional dimension in this context is related to the goals of the ministry.

During the project duration, the control system applied by the agency may consist of directional and financial dimensions. The use of the directional dimension is indicated by the evaluation of the project progress in relation to the project's goals that have been set in advance. The use of the financial dimension alone cannot be used to accurately reflect the project achievement; rather it is limited to providing a critical signal regarding the project's financial position.

A similar condition was also found when assessing the output of the R&D function. The achievement of project goals such as an implementation of the R&D output may indicate a focus on the use of qualitative criteria that leads to a directional dimension rather than a quantitative dimension. Although the Agency for R&D in Industry was also found to use the budget as a base for a decision to postpone or drop the project, a further investigation on the project's condition that may lead to the provision of more funds indicated the emphasis on the directional dimension. It can be suggested that since the function of R&D activities is to produce knowledge, it seems to be appropriate to involve the scientific dimension to monitor the progress and to assess the value produced by R&D project.

The Directorate of Budget

Background

The Directorate is a unit of the Ministry of Finance, and is lead by a Director General who is accountable to the Minister of Finance. According to the Ministry of Finance decree number 2/KMK.01/2001, dated January 2001 the main task of the Directorate General of Budget is to manage the National Revenue and Expenditure Budget in accordance with the policy made by the Minister of Finance and which is based on existing law and regulation[27]. Therefore, its task will include the evaluation and monitoring of the budget of the R&D project.

The organisational structure in Figure 7.9 indicates that the Directorate General consists of one supporting unit, which is called the Secretariat for the Directorate, and

[27] Translated from document of DJA, cited from www.anggaran.go.id/anggaran/dja_profil?id=1, accessed 1 November 2004.

six operational units, which are called Directorates. Two of the six directorates are related to the budgetary selection process that is a focus of this study. They are the Directorate for Budget Sustainability I (Direktorat Pembinaan Anggaran I) and Budget Sustainability II (Direktorat Pembinaan Anggaran II). A director heads every directorate. There are two main tasks for Directorate for Budget Sustainability I and II: firstly, to formulate, maintain and to evaluate technical policies regarding routine budget and development budgets and secondly, to develop routine and development budgets[28].

Figure 7.9: Organisational Structure of DJA

Please see print copy for Figure 7.9

Observation on Budget Meeting of the Project Evaluation Process

All of the proposed projects' budget must go through a budget meeting which is led by the Directorate General of Budget. A budget meeting dealing with projects that

[28] Translated from document of DJA, cited from www.anggaran.go.id/anggaran/dja_profil?id=1, accessed 1 November 2004.

were proposed under the Single Institution Based Research Scheme was observed by this study. One of the projects discussed in the meeting was from the Agency for the Assessment and Application of Technology (BPP. Teknologi), and another project was from the Agency for National Atomic Energy (Batan). The project from the Agency for the Assessment and Application of Technology was a non-R&D project that was continued from the previous year. It was a construction project to build a bridge from Madura to Surabaya, and the budget meeting for this project was a continuation of a previous meeting. The project from the Agency for National Atomic Energy was a research project to investigate nuclear waste in the environment. The project contained three research topics and required total funds of IDR 375 millions (approximately US$165,000).

The budget meeting for the project from the Agency for the Assessment and Application of Technology was attended by three personnel from the project, two from the Directorate General of Budget, and no one from the Planning Agency. During the meeting, the personnel from the Directorate General of Budget started to link the current budget with the previous year's budget and raised questions several times regarding the project's plan and detailed description of budget items as indicated by the following comment, "According to your plan, can you explain the steps of the construction?"[29]

In response to this question, the project personnel started to make explanations using various terminologies. Having the explanation the personnel from the Directorate General of Budget tried to translate the terminology found in the proposal into financial terms, so as to ensure the budget properly fitted the project's need as indicated by the following comment from the personnel from the Directorate General of Budget[30]:

[29] Obtained from Observation of the Budget Meeting, 2 February, 1993
[30] Obtained from Observation of the Budget Meeting, 2 February, 1993

…how do you calculate this item? You have to be careful. If you do not spend all the funds during the year, your next year’s budget will be limited to the total current expenditure.

The discussion was around the condition of the land under the sea to support the construction of the bridge. According to the project personnel, under sea conditions were to be surveyed by a contractor, and would be charged based on the quantity of construction points. The project’s personnel explained that there were various construction points under the sea that would cost the project. Every point consisted of several budget items. However, they were described in technical terminology that seemed to be not well understood by the personnel from the Directorate General of Budget. Finally, the personnel from the Directorate General of Budget required the project to show a proof that a contractor had agreed to do the survey as specified by the project's budget and programs.

After the formal meeting, the project's personnel followed the DJA supervisor into his room, and informal discussion continued. The project's personnel seemed to be appealing for suspension of the requirement for the contractor’s agreement. However, the personnel from the Directorate General of Budget denied his request by saying[31],

…if you can show me the evidence, we can arrange the next budget meeting to define the amount of budget.

Another budget meeting that was observed concerned the project from the Agency for National Atomic Energy. The unit is one of the government's units that deal with atomic and nuclear matters. The agency is a non-ministry institution. The project was a new project that consisted of several programs that were related to managing radioactivity/radiation in the environment. The project's location was in Yogyakarta. Five staff from the Atomic Agency, one from the Directorate General of Budget, and one from the Planning Agency attended the meeting.

[31] Obtained from Observation of the Budget Meeting, 2 February, 1993

At the beginning of the meeting it was noticed that the staff member from the Planning Agency held a list of questions, and a summary of the project proposal. It gave the impression that he had reviewed the proposal before the meeting. The meeting started by the person from the Planning Agency disagreeing with one research topic listed in the proposal. It was mentioned that the research topic was not essential for the current development planning, and therefore it was rejected.

One of the staff members from the project argued by saying that it had been reviewed and approved by the Ministry of State for Research and Technology (Ristek). Furthermore, it was also argued by another person from the project that the deletion of the topic would affect the total budget ceiling of the Atomic Agency. The person from the Planning Agency persisted with the request; otherwise the meeting would have been cancelled. Having this conflict the personnel from the Atomic Agency had no choice other than to accept the request. When the request was accepted then the meeting was continued.

The next question raised by the Planning Agency was on the format of the List of Proposed Projects (DUP) form presented by the project. The staff from the Planning Agency required the project's personnel to change the format of the form and the way the budget items were calculated. Seeming differences in the format presented by the project created some difficulties for the staff from the Planning Agency to assess the proposal.

Considering the days of survey and traveling cost, the member from the Planning Agency put a request that the proposed program be revised when he said[32],

> …if the location is monitored every week (so) the number of personnel as well as official travel can be reduced, because every person can monitor more than one location.

[32] Obtained from Observation of the Budget Meeting, 2 February, 1993

According to the project's personnel, every sample area would be surveyed every week, and one staff member would be responsible for one surveyed location. Then, the result would be taken and analysed in the laboratory by staff. However, the staff from the Planning Agency still required the project to re-calculate the budget item.

During the controversy the staff from the Directorate of Budget raised questions about several budget items, and required re-calculation for several items; days of survey and traveling cost, material needed, purchasing of furniture, and miscellaneous expenses.

In the case of furniture, the personnel from the Directorate of Budget required the project to separate the budget item of “Table” from that of “Desk”. When discussing the miscellaneous expenses the personnel from the Directorate of Budget argued that the percentage of this budget item to the total budget was higher than the main activities. The project’s personnel argued that there was no regulation to forbid this matter. However after a long discussion, the Directorate of Budget personnel came up with a suggestion to switch some of this item to other research activities under the same project, so it would not affect the total amount of the project’s budget.

An interview was conducted with the personnel from the project, to determine their view of the meeting, during the time break. To obtain unbiased information, the purpose of the research was not expounded at the beginning, but it was explained at the end of the conversation. They said that they felt unsatisfied with the meeting. They felt a lot of pressure from the Directorate of Budget and the Planning Agency. They felt that the Directorate of Budget and the Planning Agency could dictate to the project what they wanted because they had power to do that. The most unsatisfactory situation was the rejection of the topic. It was mentioned that the Ministry of State for Research and Technology had approved the topic, so how could the Planning Agency reject it without any reason. If the funds were not enough, it is acceptable to postpone or even reject the topic, however in this case the budget was still higher than the proposed funds. Further, one of the project personnel explained that they had known the predetermined fund allocated to the project before they set up the proposal. Therefore, the reason behind the rejection was obscure. At the end, one of the personnel from the project made comment that[33]:

> …all researchers in the government sector should consider that this kind of situation occurs. No wonder the quantity of the project output will be set by the researchers regarding the amount of budget available, rather than quality.

It should be noted that during the observation there was no discussion of the project's goals and the appropriateness of a particular research topic in terms of the scientific dimension. The conversation mostly referred to the working paper that consisted of financial calculations of the project's budget items. In addition, there was no attachment of recommendations from the scientist on the project proposals.

From an interview with the person from the Directorate of Budget, it was found that there had been no changes to the standard operating procedures in the government sector regarding project budget selection from 1993 to 2004[34]. They though that significant change could take place in 2005. A further question was raised to obtain his view on the nature of the R&D project and the probability of approval or rejection of the budget. It was mentioned that[35],

> (t)he result of R&D activity cannot be known accurately in advance. We can only look at the requirement of the project stated in budget items and supporting documents. For material, supplies or equipment, we want it to be supported by a letter of offer from the supplier. While for travel expenses and wages, we use the standard price index for each area.

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[33] Interview with a staff from Atomic Agency, 2 February, 1993
[34] Interview by telephone with Sub-head of Budget C4, DJA, Drs Kisworo, 29 October 2004.
[35] Interview by telephone with Sub-head of Budget C4, DJA, Drs Kisworo, 29 October 2004.

Another interview was also undertaken with a staff member from the Directorate of Budget who usually deals with project proposals. He said that[36],

> …the output of a R&D project is intangible. It is a report that is very difficult to connect to the budget. What I do is to look at the Terms of Reference. I try to interpret the project background and its goals as much as I can. Then I look at the budget items and raise questions about any item that does not convince me.

The attendance of a staff member from the Planning Agency with various questions could explain the absence of the staff member at the first meeting. The meeting was about the budget which means that if there was no rejection from the Planning Agency, the project's program had been approved; otherwise, the Planning Agency would put questions or make a rejection at the first budget meeting.

The data from observation indicated that during the budget meeting two dimensions were used by the assessors (the Planning Agency and the Directorate of Budget) to evaluate and select the proposal: a directional and a financial dimension. The directional dimension was used by the Planning Agency to evaluate and select the proposal in relation to the direction that had been set in the Five Years of National Development Plan. In this case the directional dimension may contain two aspects such as the goals of the project, and the program proposed by the project as well as obedience toward operational procedures. The goals of the project are related to the objective and the expected contribution to the national development program. The operational procedure refers to the schedule, technique, or steps that would be performed by the project. The selection by the Directorate of Budget was limited to only the financial dimension. The financial dimension was used by the Directorate of Budget to define the project's financial boundaries without reference to the value of expected benefits. The

[36] Interview by telephone with a staff member at Budget C4, DJA, Eddy Pramono SE, 29 October 2004

project personnel in contrast focus on the scientific dimension. The different dimensions used by each party seem to be misunderstood by the other party and finally create the conflict.

In the case of the rejected topic proposed by the Atomic Agency, it indicated that though the topics had been selected and approved by the Ministry of State for Research and Technology, there was still a chance of rejection by the Planning Agency if the project's goals were not suitable to the direction of the national development plan. This situation led to an interpretation that though the Ministry for Research and Technology may also use the Five Years of National Development Plan to evaluate and select the proposal, it may be limited to the scientific appropriateness of the project for the current plan rather than the priority of the project. Therefore, the role of the Ministry for Research and Technology may only be used by the control system as an independent recommendation to define the appropriateness of the technological dimension of the project proposed. In the case of the request to re-calculate the budget, this matter is related to the operational procedure that will be performed by the project.

The existence of the three dimensions such as directional, financial, and scientific appropriateness reflects a mutual interaction that feeds information from one to another. The analogy of the interaction among those three dimensions is described below. The scientific dimension used by the Ministry for Research and Technology defines whether the project is appropriate to be executed scientifically. The proposal then will be selected by the Planning Agency that uses the directional dimension to define the relevance and priority of the research topics in regard to the current national development plan. Finally the financial dimension used by the Directorate of Budget would constrain the projects use of funds. In addition, the issuance of a budget ceiling for all government sectors that had been done prior to the project proposal may have caused the financial dimension to be less decisive in the budget meeting, as indicated from the observation that the project's budget was set in relation to the budget ceiling. The role of the Directorate of Budget in the meeting was found to mostly ensure that each budget item was properly calculated. However, the financial dimension performed by the personnel from the Directorate of Budget may also be related to the directional dimension. The rejection of a particular research topic or changes in the operational procedure would change the budget. Therefore, the function performed by the personnel from the Directorate of Budget was related to three aspects namely to review the calculations of the budget items, to set financial limitations on the project, and to verify the existence of the project by recording the project's budget into the Approved Projects List (DIP).

The information presented in the proposal seems to be not enough for the personnel from the Planning Agency and the Directorate of Budget to evaluate the budget proposal. This situation was indicated by the list of questions brought by the person from the Planning Agency to the meeting. In addition, the preparation made by the person from the Planning Agency would also indicate that the proposal had been reviewed internally by the Planning Agency, and the rejection of the topic could plausibly have been decided during the review. Through an interview with a staff member from the Directorate of Budget it was mentioned that he had never found a recommendation from the scientific selection committee attached to a proposal[37].

The difficulties in defining an expected benefit from the achievement of a project's goals may lead the personnel from the Planning Agency and the Directorate of

[37] Interview by telephone with a staff member at Budget C4, DJA, Eddy Pramono SE, 29 October 2004

Budget to ignore the discussion of the project's goals. On the other hand, this circumstance may lead the personnel from the project to perceive that the Planning Agency used an inequitable judgment to reject the topic. The perception of the project personnel of the decision made by the Planning Agency in rejecting the research topic increased dissatisfaction among the scientists and could lead to dysfunctional behaviour.

This problem may be affected by different organisational culture backgrounds. The personnel from the Planning Agency and the Directorate of Budget may exhibit a bureaucratic culture whereas the project's personnel may be used to a scientific culture. The bureaucratic culture may refer to the order of hierarchy within the organisation as well as the hierarchy of the goals within the government institution. The scientific culture may refer to the scientific achievement of a particular R&D project.

Cross-cultural incompatibility among those personnel may lead to misunderstanding of the role of each party. The person from the Planning Agency used bureaucratic culture to define the project's rank of priority regarding the achievement of the national development plan. However, less understanding of the scientific culture experienced by the person from the Planning Agency would be one of the possibilities that cause difficulties in explaining the decision made to the project's personnel. At the other end, the project personnel who had less understanding of the bureaucratic culture exercised by the personnel from the Planning Agency would cause the project's personnel to misapprehend the decision being made by the personnel from the Planning Agency.

Summary

Two types of government institutions in Indonesia were discussed: Departmental Government units (LPD) and Non-departmental Government units (LPND). The two distinct types follow a different procedure in proposing a R&D project. There are two types of R&D schemes practiced in the government sector: Multi Institutions Based Research Scheme (MIBRS) and Single Institution Based Research Scheme (SIBRS). The MIBRS is a project that may be funded by multi institutions, while SIBRS is on behalf of a particular institution and fully funded by government.

During the time of the New Order, two types of budget were found to be practiced by the government sector in Indonesia: the Development budget and the Routine budget. Any government project will be funded by the development budget, while a routine budget is only used to finance routine expenditure. In addition, to obtain a budget, the project must proceed through three phases: the preliminary phase, the project proposal selection phase, and the project budget selection phase. The output of the preliminary phase is the Annual National Operation Plan (REPETA) and budget ceiling (Satuan dua). The project proposal selection phase starts with developing a proposal for R&D project and using the annual plan and budget ceiling as guidance. The R&D project is selected internally by Departmental Government units (LPD) while for Non-departmental Government units (LPND) the proposed project must be selected by Ministry of State for Research and Technology. The proposal then is sent to the Planning Agency and the Directorate of Budget to be examined in the budget selection phase.

The role of the Planning Agency in selecting a R&D project is based on a directional dimension by using the Annual National Operation Plan as a broad criterion.

Although scientific dimensions were used by the internal committee of the project and Ministry of State for Research and Technology, the Planning Agency seems to require more emphasis on the directional dimension and questioned the independency of the existing committee.

The Agency for R&D in Industry (BPPI) which acts on behalf of the Ministry of Industry was found to use a directional dimension in selecting the project. The directional dimension was related to the goals of the ministry rather than national goals as used by Planning Agency. This practice was indicated on the use of priority rank and objectives to select the R&D project.

The Directorate General of Budget (DJA) is an institution which acts on behalf of the Ministry of Finance. The control function applied by this unit in selecting an R&D project is based on the bureaucratic and financial dimensions. This was found during the observation and interview. However, it was also indicated from interviews that the personnel of the Directorate General of Budget had limited knowledge of the essence of the project and had difficulty in being connected to the financial dimension. The role of financial dimension in this case is limited to ensure the project remained within the budget. Therefore, the role of directional, bureaucratic, scientific, and financial dimension seem to be important and complementary one to another when taken as a total. In practice each had varying degrees of prominence.

Regarding the accounting system practiced, the systems used a cash based and single entry model. The financial affairs of an institution or project are administered by a person called Treasurer (Bendaharawan). Under the systems the tasks of managing funds, recording the transactions, providing and justifying supporting document, and preparing financial report was on the job of the treasurer. Therefore, the internal control function under the system seems to be inadequate.

The next chapter will discuss the management control system applied to the R&D projects in the government sector in Indonesia

Management Control System Applied to R&D Projects

Introduction

In order to understand the management control system practiced, the study investigated three sites; the R&D Centre for the Textile Industry, the R&D Centre for the Metal, Machinery and Electronic Industry, and the R&D Centre for Biology. These examples are government institutions that conduct R&D activities. The investigation was done by visiting the sites, observing the practice, conducting interviews, and collecting relevant documents.

This chapter presents the background as well as the organisational structure and the goals of each example. The project evaluation and selection process is also presented in the chapter. Throughout the chapter, the control system practice is discussed with attention to the scientific, bureaucratic, directional, and financial dimensions. Furthermore, the accountability systems in operation during the project's duration and performance measurement of each example are also examined.

Finally, the chapter presents a summary of the discussion regarding the important points of the control systems practiced as well as the use of the control dimensions found by the study. The implications of the current practice is also summarised in this section.

The R&D Centre for Textile Industry

Background

The R&D Centre for the Textile Industry is a unit of the Agency for R&D in Industry, Ministry of Industry, and is located in Bandung, West Java. The unit had one main project called the R&D Project for the Textile Industry. In the fiscal year of 1993/1994, the project had a budget of 907,800 Australian dollars. The project contained two sub projects which were the R&D for Process/Product Technology and the Centre Facilities Sub-project. The first performed the R&D function, whereas the second sub-project provided facilities to the Centre.

The R&D for Process/Product Technology Sub-project consisted of twelve research topics which are called *tolok ukur*. Each topic had individual proposals including; budget, objectives, and Terms of Reference. The project was led by a Project Leader, and administered by a Project Treasurer. The Project Leader and Treasurer were appointed by the Minister of Industry through letter from the Ministry of Finance. Every project may consist of more than one research topic, and the study considers the goals of each topic as the project's goals. Every research topic contained a group of researchers and was led by a group leader.

Organisational Goals

There were several levels of organisational goals that were interrelated one to another in this centre. The Centre is under the Agency for R&D in Industry, which is one of the units of the Ministry of Industry. The organisational goals of the centre were developed in reference to the goals of the Agency for R&D in Industry and the Ministry of Industry. Finally, the goals of every research project should also be developed with reference to the goals of the R&D Centre for the Textile Industry. Unfortunately, there was a difficulty in accessing the formal goals of the R&D Centre for the Textile Industry; therefore, the study focuses on goals at the project level. Through documentation it was found that the R&D Project for the Textile Industry had three broad objectives[39];

1. To conduct research and development activities in the textile industry,
2. To enhance engineering and technological competence in the textile industry,
3. To restructure the textile industry.

[39] Summarized and translated from DUP of Proyek Penelitian dan Pengembangan Industri, 1993/1994.

To pursue those objectives, the activities of the project covered several areas of operation including[40] improving textile technology, improving the engineering of the equipment of the textile industry, providing solutions to the waste problems of the textile industry, and providing technical services for the textile industry. Every research topic proposed was developed within these areas. As presented in table 8.1, the goals of each research topic were found to have qualitative characteristics. The research topics consisted of continuing and new research topics for the year.

Table 8.1: List of Project's Goals for R&D in Textiles

Please see print copy for Table 8.1

[40] Summarized from TOR of the R&D Project for Textile Industry, 1993/1994.

Project Evaluation and Selection

The process of project evaluation and selection in the R&D Centre for the Textile Industry was found from an interview with chief administrator of the unit[41]. As presented in Figure 8.1, the initial ideas came from researchers, and were put in the Terms of Reference (TOR) as a research topic. Every research topic was assessed and selected in a seminar presentation. In addition, a continuing project that requested additional funds must also be assessed and selected through a seminar.

Figure 8.1: Terms of Reference (TOR)

Please see print copy for Figure 8.1

[41] Interview with the chief administrator of the Centre, Mr. Hadiono, BSc., 12 January, 1993

The group leaders who were scientists from various disciplines that were related to the textile industry and the project coordinator attended the seminar. The purpose of the seminar is to reshape the ideas, and to resolve the current problems faced by an existing project. If the research topic is acceptable then two other forms will be prepared; Working Papers (see figure 8.2) and List of Proposed Projects (figure 8.3)[42].

Figure 8.2: Working Paper (LK)

Please see print copy for Figure 8.2

Through the documentation it was found that the format of the List of Proposed Projects used in the centre was slightly different from the standard format. Nevertheless the form contained the same information as the standard format.

[42] Summarized and translated from existing documents of the centre, January 1993

When this matter was raised in an interview with the chief administrator, he said[43];

> This form is for internal use. We might have to revise the List of Proposed Projects many times before it is accepted by the head office. Moreover, all of the List of Proposed Projects should be summarised by the head office before they are sent to the Planning Agency and the Directorate of Budget. There is no problem with this form. However, once the proposal is accepted, then we will use the standard form.

Figure 8.3: List of Proposed Projects (DUP)

Please see print copy for Figure 8.3

[43] Interview with the chief administrator of R&D Centre, Mr. Hadiono BSc, 12.January, 1993

Source: R&D Centre for Textile Industry, DUP, 1993/1994

Those three forms were sent to the head of the centre to obtain approval. From an interview with a group of researchers[44], it was mentioned that the proposed topics were rarely rejected by the head of the centre. Though minor revisions may occur, there was no significant problem in obtaining an approval as long as the research topic was relevant to the function of the unit and had been accepted by the selection committee in the seminar. The minor revisions may be concerned with the amount of traveling cost, fixed assets, and the qualitative expression of the Terms of Reference (TOR). Most of the expressions in the TOR should be associated to the contribution of the centre to the national plan. When the approval was obtained, all proposals were sent to the Agency for R&D in Industry.

The Agency then evaluated and selected proposals in relation to the contribution of the topics to the role of the ministry and the national development plan. All the approved proposals were then sent to the planning unit of the Ministry to be compiled with proposal from other units. During August to September, a summary of the project proposals was sent to the National Planning Agency and the Directorate of Budget.

By January of the following year, the planning unit of the Ministry will be informed of the budget ceiling for the ministry by the Directorate of Budget. However, it should be noted that since year the 2000, the accounting period for the government sector starts from 1 January to 31 December, whereas before it was from April to March. The amount of the budget ceiling would be allocated by the Agency for R&D in Industry to each R&D Centre including the R&D Centre for the Textile Industry. Considering this budget ceiling, every R&D Centre may revise the proposals to fit the amount of budget allocated, and then it would be sent again to the Agency. When the

[44] Interview with a group of researchers, 19 January, 1993.

Agency approves the research topic and the budget, then all the documents; the list of Proposed Projects, TOR and Working Papers will be sent to the National Planning Agency and the Directorate of Budget.

During January to March of the following year a budget meeting between the project, the National Planning Agency and the Directorate of Budget will be arranged. The detail process of budget meeting had been discussed in Chapter Six. The output of the budget meeting is a list of projects that are approved to be funded. The list of the approved projects is presented in a draft of the Project Budget form (DIP) which is issued by the Directorate of Budget. The format of this form is the same as the List of Proposed Project (DUP). A copy of the Project Budget draft is given to the project personnel, and will be used to prepare Operational Guidance (PO). The Project Budget draft and Operational Guidance should be signed by the Minister of Industry, and will be sent to the Directorate of Budget. The draft of the Development Budget will be signed by the head of the Directorate of Budget, and it becomes a Project Budget, which means that the project has been approved and has been allocated a certain amount of funds.

Accountability

Every month the project's treasurer will provide a financial report that contains an accumulation of the budget consumed during the period. The financial report will be sent to the Agency of R&D in Industry, State Treasury, Inspectorate General, and the Finance Department of the ministry. The group leader should provide a technical report every three months, and submit it to the project leader. The technical report contains the progress of project's achievement on each step of the operation as has been set out in the TOR. In addition, the group leaders are required twice a year to make a presentation in a seminar regarding the progress achieved by each research topic.

Every three months the project's leader will provide a progress report which is called Form B-1 (Figure 7.7), and it is sent to internal units within the ministry such as; the Planning unit, the Agency for R&D in Industry, the Finance unit, and the Internal Audit unit (Itjen). The progress report (Form B-1) will also be sent to external units such as; the National Planning Agency, the Local Planning Agency (Bappeda), the Secretary of Local Government (Sesdalopbang), and the Financial and Supervisory Agency (BPKP). Regularly the project is audited by two bodies; the Internal Audit unit (Inspectorate General), and the Financial and Supervisory Agency (BPKP), which performs the external audit function.

Regarding the accountability system, the chief administrator said that[45],

> …the use of budget alone is not enough to monitor a project's activities. Similarly, the technical (scientific) aspect alone is still imperfect. Until now there is a need for an accurate and rational tool to measure the project's performance.

The comment indicated that he held the view that the financial dimension alone or the scientific dimension alone was insufficient to control the R&D activities. These two dimensions at least should be applied simultaneously for control purposes. In addition, through a discussion with the group leaders, it was mentioned that in assessing a project they considered that research activities were weighted regarding the project stage. For example a survey project would have different weight to library research, or laboratory testing[46]. However, when these systems were traced through the documentation, there is no such document indicated in practice. A cross examination of this practice was also undertaken with a group of researchers, who said they had never heard of this system[47].

[45] Interview with Mr. Hadiono BSc., 12 January, 1993
[46] Meeting with group leaders, 12 January, 1993
[47] Meeting with a group of researchers, 13 January, 1993

The Control Systems Practiced

In order to be able to identify the control systems practiced by the unit, the project selection process practiced by the R&D Centre for Textile Industry is presented in Figure 8.4. There were three stages of control functions implemented by the unit. The first stage of control existed during the evaluation and selection of the project proposals. The control system occurred in the first stage may be called input control. The second stage of control exists during the process of the project execution, which may be referred to as process control. The third stage of control may be applied at the end of a specified time period and may be referred to as output control.

The execution of input control can be seen in Figure 8.4 that uses control dimensions as they are noted in number from 1 to 7. This practice is confirmed as unchanged, from interviews with Mr. Rahmat Mulianda from Bappenas 6 August, 2004, with personnel from the Directorate of Budget Drs Kisworo, a Sub-head of Budget C4, and Eddy Pramono S.E. on 29 October 2004. The scientific dimension as noted in box 1 seems to focus on filtering the appropriateness of the topic, the hypothesis, the formula, the research method, and the probability of success. This control dimension may be applied by the selection committee and the project coordinator as well as the group leader. The purpose of this process would be to ensure the project is justified scientifically.

Once the proposal passes the scientific criteria, next step is a selection which is done by the head of the centre as noted in box 2. In this step the criteria used may be related to three control dimensions: directional, bureaucratic, and financial. The directional dimension used is to ensure that the proposed project is relevant to the goals of the centre. The bureaucratic dimension may be used to ensure that the proposal has complied with existing standard operating procedures by completing all required documents. Furthermore, the head of the centre will also consider the budget appropriateness, which is a reflection of the financial dimension.

Figure 8.4: Project Evaluation and Selection in R&D Centre for Textile Industry

Please see print copy for Figure 8.4

[48] Confirmed as unchanged from telephone interviews with Mr. Rahmat Mulianda from the Planning Agency, 6 August, 2004; Drs Kisworo, a Sub-head of Budget C4, and Eddy Pramono SE from the Directorate of Budget on 29 October 2004.

As in box 3, the Agency for R&D in Industry will select the project with regard to its goals on one hand, and the role of the ministry on another, this is related to the directional dimensions. It is also plausible that the Agency for R&D in Industry will also consider the bureaucratic dimension regarding the standard operating procedures, as well as the financial dimension in relation to the total research budget. In turn, the National Planning Agency as in box 4 uses the directional dimension to place a boundary on the projects' goals within the National Development Plan, and simultaneously reduce the chance for duplication.

Once the project is approved by the Planning Agency and included in national planning as well as in the budget ceiling, the head of the centre will assess the Project Budget draft as noted in box 5, and the Agency for R&D in Industry in box 6 using the same dimension as applied in box 2 and 3. Finally, during the budget meeting the Directorate of Budget will select the project by considering only the financial dimension as noted in box 7. The control system applied indicates that the project should be able to fit multiple goals from different organisational levels, and is restrained within the financial boundaries. The control function practiced could be said to use a combination of directional, scientific, bureaucratic, and financial dimensions simultaneously.

The second stage of control can be referred to process control which is done through a monitoring and reporting system. A formal report accountability system is indicated by a quarterly financial report by the treasurer through the progress report form (Form B-1), and a seminar presentation. It appears that three control dimensions are used at this stage to monitor the operation of the project; the financial, the bureaucratic, and the scientific dimensions. The auditor will use the financial dimension to ensure that the budget has been used appropriately during the period. Simultaneously, the auditor will also use the bureaucratic dimension to measure the compliance to the standard operating procedures in regard to the rules and regulations. Furthermore, the head of the centre and the Agency for R&D in Industry will also use the bureaucratic dimension to measure the project's compliance. The scientific dimension is also used to measure scientific achievement through a seminar presentation every six months. Since the quality of project goals is less measurable quantitatively, the use of the project goals as a directional dimension seems to be less significant at this control stage.

The third stage of control which is referred to as output control may be done at the end of the financial year to measure the performance. The control system at this stage may employ some dimensions such as, financial, bureaucratic, and scientific. The auditor including the external auditor such as the Financial and Development Supervisory Agency and the Supreme Financial Audit, may use the financial and bureaucratic dimension in controlling the project. The financial dimension in this case is related to the appropriateness of usage and the absorption of budget by the project. The bureaucratic dimension is related to the project's compliance to the existing standard operating procedure. The use of the scientific dimension may be reflected in various ways. In the case of a completed project where the project report will outline the project result including the scientific achievement as indicated by a possibility to be applied to a production process or reflected by a patent and publication in a scientific journal. In the case of an incomplete project, the scientific dimension may be used as a new scientific direction for the following year.

Apart from the control systems applied to the project, an individual researcher is also assessed. However, the assessment is based on the scientific dimension, which is indicated, by scientific achievement and the bureaucratic dimension such as the compliance with the standard operating procedures. The financial dimension seems would only be applied to assess the project rather than the individual researcher. When a particular project does not meet the budget, it will only affect the budget ceiling for the following year, or the subsequent rejection of the project.

The R&D Centre for Metal, Machinery and Electronic Industry

Background

The R&D Centre for Metal, Machinery and Electronic Industry (BBILME) is another research unit under the Agency for R&D in Industry (BPPI), Ministry of Industry, and is located in Bandung, West Java, Indonesia. This unit is lead by a Head of the Centre, and undertakes research and development on metal, machinery and electronic components. In the 1993/1994 financial year the unit performed one main project: the R&D Project for the Metal and Machinery Industry. The total budget of the project in the 1993/1994 financial year was 5,605,000 Australian dollars. The project consisted of four major sub-projects:

1. R&D Metal and Machinery sub-project
2. Development of a Network of Calibration and Testing sub-project
3. Technical Service to Metal and Machinery Industry sub-project
4. Centre of Calibration Service for Jakarta Area sub-project.

From the four sub projects, only the R&D Metal and Machinery sub-project executed a research and development function. The project was led by a Project Leader and administered by a Project Treasurer. Every sub-project was led by a Sub-project Leader, and every research topic was coordinated by a Group Leader. The organisational structure of the project is presented in Figure 8.5.

Figure 8.5: Organisational Structure of the R&D Project for the Metal, Machinery, and Electronic Industry

Please see print copy for Figure 8.5

Organisational goals

Although the project was allowed to define its own goals, the project's goals should relate to the direction that was given by three other goals in the hierarchy: the goals of the centre, the Agency for R&D in Industry, and the Ministry of Industry. Those three goals are used to delimit the boundaries of the project's area of operation. The organisational goals of the project were divided into two parts[49], Functional Objectives and Yearly Target. The functional objectives consisted of long-term objectives such as[50];

> …to execute research and development in process and product technology in order to improve productivity in the metal and machinery industry, and to improve the product quality.

For the financial year of 1993/1994 the yearly target was[51];

> …to produce 14 reports on research and development in process and product technology, 4 reports on the application of the research and development activities, one report on the development of the calibration network, one report on technical service for the engineering industry, one report on the calibration service for the Jakarta area.

[49] Summarized and translated from DIP of the R&D Project for Metal and Machinery Industry, 1993/1994.
[50] Translated from DIP form of R&D Project on Metal and Machinery Industry, 1993/1994.
[51] Translated from DIP form of R&D Project on Metal and Machinery Industry, 1993/1994.

Table 8.2: Project Goals of the R&D Project for the Metal, Machinery and Electronic Industry

Please see print copy for Table 8.2

The R&D sub-project on Metal and Machinery Industries contains fourteen research topics, and has its individual goals. As presented in Table 8.2 the project's goals were mostly characterised by a qualitative expression such as "gain a new knowledge to improve the production process or to develop a particular product".

Project Evaluation and Selection

The process of evaluation and selection of a project proposal involves various internal and external units such as group leaders, senior scientists or advisers, the head of the unit, and the Agency for R&D in Industry. As the centre is under the agency, it was found that the project selection process is similar to the R&D Centre for Textiles.

The process started with an idea or an existing condition of a particular project. The research proposal was prepared in a form called the Terms of Reference (see Figure 8.1) and presented in a seminar. The seminar will be attended by scientists from various disciplines including; the group leader and senior scientists that hold a position as adviser, and project leader. The selection process seemed to focus on scientific dimensions such as the appropriateness of the research topic, the research method, the formula or hypotheses to be tested, and the probability of success.

Once the proposal was accepted then the researcher prepared the List of Proposed Projects and a Working Paper. The three forms, the TOR, the List of Proposed Projects, and the Working Paper, were sent to the head of the Centre. At this stage, another process was executed to evaluate and select the research topic. However, it should be kept in mind that the project goals were set by the researchers as mentioned by the project's leader[52];

> …every research topic must cover the functions of the centre, and the major government program. The project's leader is not involved much in setting the research topic. Most of the tasks of the project's leader are focused on the projects' coordination, distribution and accountability for funds. However, the administration of the funds will be carried out by project's treasurer.

When formal approval from the head of the unit had been accomplished, those three forms then were sent to the Agency for R&D in Industry in Jakarta. The Agency then evaluated and selected all research topics within the ministry. The evaluation and selection process at this stage was focused on the appropriateness of the project's goals in relation to the role of the Agency as well as the ministry, and the National Guidelines. The budget proposal would be administered by the finance and planning department within the ministry. When the proposal was approved, those three forms were sent to the Planning Agency and the Directorate General of Budget. The proposal will be used by

[52] Interview with the project's leader, Ir. Rosidi, 18 January 1993

the Planning Agency to establish a Yearly National Plan and by the Directorate of Budget to develop the National Budget. Finally, the Directorate of Budget informs the ministry of the budget ceiling (Satuan Dua), and this will be used by the ministry to prepare a draft of the Project Budget, and revisions for the Working Paper and Terms of Reference as needed.

The Directorate of Budget and the Planning Agency then arrange a budget meeting with the project's personnel. When the proposal is approved, the Directorate of Budget prepares a draft of the Development Budget, and the project personnel will prepare the Operational Guidance. The Project Budget draft and Operational Guidance will be given to the Ministry of Industry, and the Operational Guidance would be signed by the Ministry. Both the Operational Guidance and the Project Budget draft are sent back to the Directorate of Budget to be signed. When the Project Budget draft is signed by the Directorate of Budget, it means that the budget for the project is approved and has been allocated in the National Budget (APBN).

In an interview with the project's leader[53], it was mentioned that the function of the Planning Agency is to screen the program proposed by government institutions so duplication of the program among government institutions or within an institution can be eliminated. The function of the Directorate of Budget however, dealt with the budget item. Moreover, he considered that in selecting the program The Planning Agency and the Directorate of Budget relied much on the scientists' recommendation. However, through an observation on a budget meeting, no such document of recommendation was found. Therefore the selection process during the budget meeting could be said to emphasise on the budget items.

[53] Interview with project's leader, Ir. Rosidi, 18 January 1993.

Through an investigation of the document, it was found that the Agency for R&D in Industry required a revision for the 1993/1994 budget proposal. This finding later was crosschecked with project's secretary who made the following comment[54];

> Basically the Agency for R&D in Industry does not involve itself much in revising the program, they emphasise the budget revision, because a limit of the budget of every government department, called the budget ceiling, has been set in advance when the government predetermines the proposal for National Budget. The approved budget ceiling then is distributed to development and routine budgets.

In the case of the 1993/1994 budget revision, the following is the explanation made by the project leader[55]:

> The budget portion has been set by the Planning Agency to the Ministry of Industry, from that the planning department in the ministry will set the portion of budget for every R&D centre. The R&D centre does not know how much of the budget portion will be distributed to the centre when the DUK is proposed. Only after the proposals are sent to Jakarta, they will let us know whether we need to revise the proposal. For the case of the revision for the 1993/1994 proposals, the budget proposed has been over the limit, so the project is required to reduce the proposed budget.

From observation, it was apparent that the revisions were done by the group leader, and it was only the amount of the budget that was changed rather than the program within a topic. In other words, the program was set in relation to the amount of funds available. There are some possible explanations that may be suggested for this practice: First, the budget proposed may have included a certain degree of mark up to anticipate the budget reduction in total. Second, since the project’s goals were in qualitative feature, it will allow the project to reduce the depth of the study in order to meet the budget limit. Third, particular desired activities may have been inserted into the project topics but do not appear in the Terms of Reference (TOR), so when the budget is cut down the desired activities will be deferred to the later years.

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[54] Interview with project’s secretary, Ms. Ellin, 18 January 1993.
[55] Interview with project’s leader, Ir. Rosidi, 18 January 1993

When these possibilities were raised during the interview with the project leader and the project secretary, they seemed to avoid a response by arguing that the revision is done by the researchers themselves. Therefore those possible suggestions have not yet been confirmed. The next topic of the interview was directed toward the relationship of the project and the centre. Accordingly it was stated that[56],

> (o)ne of the project's functions is to counterbalance the fluctuation of the centre's needs to handle its tasks. The R&D Centre for Metal, Machinery and the Electronic Industry as a government unit tends to be inflexible as caused by the budget that is sourced from the Routine Budget. The amount of this budget is relatively constant from year to year. As a technical unit, the centre deals with a variety of programs that need funds. For this circumstance some of task will be assigned as a project, so the project's fund can be used to cover the excess. This is possible because the development funds are flexible and dynamic and follow the needs.

The above comment indicated that dysfunctional behaviour took place by obtaining funds from a research project to finance non-research activities. Furthermore, this situation was possible when the scientist had more knowledge on the research operation than the controller. Therefore, it could be said that the dysfunctional behaviour that occurred at the sample sites is in parallel with previous studies (Hopwood, 1972; Birnberg, et al., 1983; Williams, et al. 1990; Jaworski & Young, 1992).

Accountability

The accountability system in this unit was found to be similar to that of the R&D Centre for the Textile Industry. A monthly financial report is prepared by the project's treasurer, and is submitted to the Agency for R&D in Industry, the Government Treasurer, the Inspectorate General, the Finance unit, and the Planning unit of the ministry. The Project Report Form (Form B-1, presented in Figure 7.7) is provided by the project's leader every three months, and is submitted to the Agency for R&D in

[56] Interview with project's leader, Ir. Rosidi, 25 January 1993

Industry, the Planning and the Finance unit of the Ministry, the Inspectorate General, the National Development Planning Agency, the Development Planning Agency for Local Government (Bappeda), the Secretary for Local Government (Sesdalopbang), and the Financial and Supervisory Agency (BPKP). The technical report however is issued by the group leader on a monthly basis, instead of three months, to the project's leader. Moreover, there is no regular seminar presentation by the group leader practiced in this unit. The seminar is performed depending on the needs, which commonly require one seminar within a period of three months.

It can be seen from the characteristics of the goals that they mostly involve efforts to gain new knowledge that can be transferred to improve the product's quality or the production process. This finding indicated that the project may operate through product development activities. Moreover, all the project's goals do not have a financial description to explain how much benefit can be expected from the output of the project. Therefore, though the goals are directed toward clear directions, they are still vague and it is difficult to link the input to output. The characteristics of the project's goals would require a control system that is different to that of a comparison process between input and output. Input would only be able to be used to limit the boundary of the project's operation with a difficulty to be related to output.

The Control Systems Practiced

The three stages of the control functions of input, behaviour and output control applied in this unit. The four dimensions of control tools such as the scientific, directional, financial, and bureaucratic dimensions are also found to be used during those three control stages. As can be seen in Figure 8.6 during the project evaluation and selection process at least the input control function was applied on various occasions as noted by numbers from 1 to 7.

The selection committee may use mostly the scientific dimension as the control function in box 1 when the researchers must present their research proposals in a seminar. The value of the scientific dimension is difficult to connect to the value of the financial dimension. This condition would encourage the control system to use the project's operation steps as set out in the Terms of Reference (TOR).

The project's activity plan is presented in a timetable, which may be used as a mediator to represent the aspect of scientific and financial achievement. For example, the absorption of a certain amount of the budget within a particular period is presumed to fairly represent progress during the period. However, as the R&D tasks contain a highly uncertainty situation, this practice may have severe limitation.

As can be seen in Figure 8.6, once the proposal is approved by the committee, the head of the centre may use bureaucratic dimensions to review the completeness of the documents, the goals of the project and the compliance with the existing procedures. In addition, the head may also use the financial dimension of the control system to ensure that the amount of the budget is realistic. Similarly, in box 3 the Agency for R&D in Industry will apply those bureaucratic and financial dimensions in selecting the project.

As an institution that constructs the Five Year National Development Plan, the National Planning Agency may use the goals of the proposed project as directional dimension that matches the national plan. In turn, the Directorate of Budget will use the financial dimension by focusing on the availability of funds to finance the project. Once the budget ceiling is set, the head of the centre and the Agency for R&D in Industry will use again those three dimensions, bureaucratic, directional and financial to adjust the proposal (see box 5 and box 6). The final control function applied during the selection process is the budget meeting which mostly uses the financial dimension.

Figure 8.6: Project Evaluation and Selection in the R&D Centre for the Metal, Machinery and Electronic Industry

Please see print copy for Figure 8.6

[57] Confirmed as unchanged from telephone interviews with Mr. Rahmat Mulianda from the Planning Agency, 6 August, 2004; Drs Kisworo, a Sub-head of Budget C4, and Eddy Pramono SE from the Directorate of Budget on 29 October 2004.

The second stage of control, process control, is applied using the monitoring and reporting system. Progress reports (Form B-1 in Figure 7.7) were used in this unit in which section four of the reports reveals the accomplishment of administrative tasks, physical targets, financial targets and the project's goals. The use of the form indicates the control practice of using bureaucratic, financial and directional dimensions. In the seminar presentation, which is conducted at least every three months, the project is monitored by using the scientific dimension to measure the achievement of the project. In addition, the auditor may use the financial dimension and the bureaucratic dimension to ensure compliance with the regulations and the appropriateness of using the funds. Therefore it can be said that during the process control, those four dimensions of bureaucratic, financial, directional and scientific were used simultaneously.

The third stage is output control which is implemented at the end of the financial year. At this stage the performance report and the seminar presentation, as in process control, which uses bureaucratic, financial, directional and scientific dimensions, will also be executed. Moreover, the use of the financial and bureaucratic dimensions will be emphasised by the internal and external auditor.

The R & D Centre for Biology (Puslitbang Biologi)

Background

The R & D. Centre for Biology is one of the research and development centres for natural science in Indonesia and is located in Bogor, West Java. This unit is part of the Indonesian Institute of Sciences (LIPI). The LIPI is one of the Non-departmental Government Institutes (LPND), which is headed by a Chairperson. The centre had three major divisions; Microbiology, Botany, and Zoology and employs 29 PhDs, 18 Masters, and 81 first-degree holders from various disciplines. Apart from the above assets, this unit also possessed five types of publication to facilitate scientific communication among scientists. The publications ranged from domestic to international including:

1. Reinwardtia (scientific, international)
2. Treubia (scientific, international)
3. BioIndonesia (semi-popular, domestic)
4. Warta Biologi (popular, domestic)
5. Alam Kita (popular, domestic).

Some professional organisations used the unit as their secretariat where the following publications were produced: Floribunda (plant taxonomy, scientific); ZooIndonesia (general zoology, scientific); Ekologi Indonesia (plant & animal ecology, scientific) and Fauna Indonesia (semi-popular).

Most of the purposes of the activities undertaken by the R&D Centre for Biology were to identify the behavioural aspect of an organism (Biota) and sometimes its chemical properties. The research activities in this unit were usually started with a research question in a form of a hypothesis, and then followed by a trial and error mechanism. Project selection was oriented toward economic and conservation needs. The economic purpose referred to the identification of potential organisms (Biota) that may be used for industry. The conservation purpose referred to the aim of maintaining or increasing scarce organisms (Biota), as well as keeping their balance in the environment.

The organisational structure of the unit is set through a decree from the chairperson of the Indonesian Institute of Sciences, No. 23/Kep/D.5/87 as depicted in Figure 8.7.

The structure seems to distinguish three functions; administrative, information and service, and the R&D function. The administrative function is carried out by an Administration Unit that consists of four sub-divisions. The information and service function are charged to the Service and Information Unit that consists of three sub-units.

The R&D function is performed by three Units; the R&D for Zoology, the R&D for Botany and the R&D for Microbiology.

Figure 8.7: Organisational Structure of R&D Centre for Biology

Please see print copy for Figure 8.7

The organisational structure of the R&D and the Non-R&D units were found to be different. The non-R&D units comprised mechanistic structures that were characterised by a formal authority and responsibility structure, whereas the R&D units used a combination of mechanistic structures such as the Museum, and Facilities sub-unit and organic structures as applied to the Researchers Group sub-units.

The Researchers Group sub-unit consisted of a group of researchers that were responsible for performing the main tasks of the centre by conducting the research and development function. All the researchers were grouped into the area of studies in this sub-unit. Each area of study was led by a group leader who was a senior scientist. However, there was no formal hierarchy line between the subordinates and the group leader in this sub-unit. In addition, there were no standard operating procedures for performing R&D tasks found in this unit, and there was no routine and repetitive task that required periodic reports. The main task in this unit was to perform a preliminary investigation of the area of studies, and present them as a project proposal. The Service unit was a unit that was responsible for the provision of facilities to support the operation of the R&D function. The Museum was a unit that was responsible for storing the output of the R&D function such as collections of a variety of organisms that are found by the R&D activities and to provide information to the public regarding the characteristics of the organisms.

There is a different communication channel in the mechanistic and organic structure. The mechanistic structure uses a formal reporting system as a channel of communication among the members, whereas the organic structure allows an informal network through personal communication among the scientists, and through a seminar. The organic structure seems to enable the scientists to communicate one to another at any time without being bothered by a periodic reporting system and routine tasks as in the mechanistic structure.

Organisational Goals

The tasks and functions of Puslitbang Biologi are defined in the letter of Chairperson of the Institute of Sciences No. 23/Kep/D.5/87, section 52 and 53 as follows (Puslitbang Biologi-LIPI, Bogor, Juli, 1991, pp. 2-3):

Section 52: R&D Centre for Biology has tasks to conduct R&D activities, improve scientists' capabilities, provide services and publish the science in biology in regard to the policies set out by the chairperson of the Indonesian Institute of Sciences.

Section 53: To perform those tasks in section 52, R&D Centre for Biology has the following functions:

a) to prepare R&D programs in biology

b) to conduct the R&D activities on the behaviour of flora, fauna and microbes

c) to perform research collaboration in biology with national or international institutions.

d) to improve scientists capabilities on biology.

e) to provide services and information on biology to the public.

f) to provide input for policy formulation on maintaining biological resources and their environment.

g) to make evaluation of the output from R&D activities in Biology and to provide reports

h) to administer these activities

The R&D centre for Biology then will set up its goals with reference to those tasks and functions. In setting the goals, the centre involves the scientists within the unit. Usually the scientists will propose potential areas of research to be included in the centre's goals. Therefore it is expected that the goals and planning will accommodate the aspirations of the scientists. Though various ideas are received, limited funds are available and only allow the centre to be involved in some topics during the year[58].

Within the National Development Plan for 1993-1998, the following goals were developed by the unit[59];

a)-to increase the numbers of collected specimens
b)-to increase the numbers of experts
c)-to improve the quantity and quality of biological information
d)-to improve the quantity and quality of research activities
e)-to improve the facilities (Building and Equipment).

[58] Discussion with a group of researchers, 3 March, 1993.
[59] Translated from Strategic and Operational Plan of R&D Centre for Biology, 1993.

Some of the above goals, particularly point c) and d) seem to be imprecise. However, those two points may contain the important goals for the unit. The Project Leader indicated the goals of the unit with the following comment[60];

> The goals in this unit are not easy to quantify, and have uncertainty regarding the output. Therefore, for us, the goals are better to be a research direction rather than things that have to be found or to be produced.

The research topics were developed by the researchers within the unit, and must be related to the goals of the centre. The goal characteristics of the unit seemed to create confusion among the researchers, as it was expressed by the following statement[61];

> The objectives in this unit are still unclear. If we are requested to produce a scientific finding on a particular commodity, it will be easier to do. However, those tasks and functions are too broad. Therefore, we are trying to develop and propose our own goals, instead of relying on the broad objectives as was given by the head office. However, in developing the unit's goals, those broad objectives are taken into consideration.

The project leader pointed out two approaches that could be used as a direction for basic research; institutional based and national direction based[62];

> ...the institutional based approach is to give a direction to fulfill the tasks and functions or the institution, whereas the national direction based approach is to put the needs of the society and business fist. The current approach used is still the institutional based approach.

Regarding the two approaches, he further suggested that[63];

> …the institution-based approach is inefficient, because there is a lack of coordination among the government institutions that gives a chance for a duplication of research effort. Besides, inefficiency may also occur in the provisions of research facilities such as building and equipment for the similar research efforts.

The lack of coordination that provides a chance for research duplication may occur between the units that are involved in evaluating and selecting the project proposals. Similar thoughts had been raised by the Head of Bureau in the Planning Agency as has been discussed in Chapter Seven. Although scientific selection is done

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60 Interview with the project leader, 8 March, 1993
61 Interview with a group of researchers in the unit, 8 March, 1993
62 Interview with the project leader, 8 March, 1993
63 An interview with the project leader, 8 March, 1993

by the Ministry of State for Research and Technology, it is only for Non Departmental Institutions (LPND). The scientific selection for R&D proposals from the Departmental Institutions (LPD) would not be done by the Ministry for Research and Technology, but rather by the unit itself. Having the existing procedures it seems that the burden would be placed on the National Planning Agency, while scientifically, the Planning Agency has a very limited knowledge. Therefore, the Planning Agency will only focus on proposed goals rather than the technical or scientific aspect of the proposal.

The project leader mentioned that the direction of basic research can be started from the needs of the industrial sector, and the basic research may be directed toward a basic characteristic of particular organisms that are needed by the industry[64]. The findings of the basic research may be further investigated by applied research and product development to bring the benefit of the biota to industry. He gave an example by saying that[65];

> …for example, Asiri oil (*an essential oil for perfume*) is very expensive and is consumed by industry. Using this direction, the contribution of basic research can be to identify the characteristics of the plant, from that another study can be done to find how to grow this type of plant so it will contain more oil in its tissue.

Moreover he explained the advantages and disadvantages of the national direction based approach by mentioning that[66];

> …the advantage of the National Direction based approach is to give more chances for various scientific disciplines to contribute to the research, and of course the research output will be more comprehensive. However, this approach may also reduce job opportunities for disciplines that have less relationship with the business sector. Finally, these disciplines will be in less demand and rare.

The project leader perceived that institutional boundaries may interrupt the integration of research efforts within the country when he said that[67],

[64] An interview with the project leader, 8 March, 1993.
[65] An interview with the project leader, 8 March, 1993
[66] An interview with the project leader, 8 March, 1993.
[67] An interview with the project leader, 8 March, 1993.

> …institutional boundaries should be eliminated. So every scientist from whatever institution they originated would have a chance to be involved in any research activities. The researchers will be encouraged to be involved in an integrated research activity without being restrained by their institutional tasks; they will have a broader perspective in conducting research, and interact with scientists from different disciplines. To do so, there is a need to establish a particular unit that is responsible for selecting the proposals. So, an integrated research program that is directed to fulfilling the needs of the national development can be obtained. This unit may consist of personnel from various related institutions, so the possibilities for research duplication will be decreased, and the project does not need to buy the research facilities that have been held by government institutions. Besides, the involvement of scientists from various disciplines will improve the quality of research output, and increase the possibility of it being applied into industry.

The tasks and functions of this unit are mostly related to the identification of potential organisms for economic and conservation purposes. The documents found in this unit indicated that the goals defined for the centre were to produce new knowledge in the area of biological resources. None of those goals were found to be connected to the industrial sector. Therefore, it could be said that this unit was only involved in basic research activities.

Project evaluation and selection

The data on the project evaluation and selection procedures in this unit was obtained from an interview with the project's treasurers who were also personnel in the planning division of the centre[68]. Two types of proposals were found in the R&D Centre for Biology (Puslitbang Biologi); proposals for a new project and for a continuing project.

Project proposal originated from the researchers with a research proposal. Such proposals are presented at a seminar, where they are evaluated by group leaders and senior scientists within the unit. The process of evaluation and selection was mostly based on the appropriateness of the proposal on scientific grounds such as, the theoretical background, hypotheses or formula, research method, and research planning.

[68] An interview with the project treasurers, 22 March, 1993

The group leaders and the senior scientists then make a recommendation to approve or reject the proposal. The recommendation is used by the project personnel to prepare three forms that are then attached to the proposal namely; the List of Proposed Projects (DUP), the Working Paper (LK) and the Terms of Reference (TOR). Those three forms are then sent to the head of the centre to obtain approval. The planning unit of the centre then evaluates and selects the proposals based on its priority rank regarding the goals of the centre.

From an interview with the project's treasurer, it was found that the yearly budget of the unit is calculated from the total current budget plus a 10 to 20 % mark up. According to the project treasurer, the mark up was placed to anticipate various factors such as increasing market price, research topic and/or budget reduction by the Planning Agency or the Directorate of Budget, or as an order from the head office in Jakarta. However, the practice of placing the mark up to anticipate a budget reduction was mostly applied by extending the project's period. So, when the external party revises the schedule, the expected amount of funds will still be in the project's budget, and the excess of funds can be used to finance the extension of the time schedule to finalise the tasks. Through observation, it was found that the total development budget for the unit was proposed to be increased by nearly 50% for the subsequent year. This matter was discussed during the interview with the project treasurer. He said that[69],

> …though the increasing of the next year budget may reach up to 50% more than the current year, it may not only be caused by the mark up, but also by topics that emerge for the next financial year.

Once the head of the unit approves the proposal, then a copy of the Terms of Reference (TOR) form will be sent to the Ministry of State for Research and Technology. The Ministry of State is responsible for evaluating and selecting all project

[69] An interview with the project treasurers, 22 March, 1993

proposals from the Non-departmental Government Institutions. The focus of the ministry was based upon the appropriateness of the scientific grounds and the goals of the research topic that should meet the policy on research and technology activities for the National Direction.

If the proposals are approved by the Ministry of State for Research and Technology, then those three forms (the List of Proposed Project, Working Paper and Terms of Reference) will be sent to the head office in Jakarta. According to the project treasurer, who is also a member of the Planning unit in the centre, the evaluation and selection done by the head office is to ensure that the goals of the project meet the goals of the centre and the Indonesian Institute of Sciences. He mentioned that, most of the time, the head office will accept the proposal[70]. Then all the proposals within the institution will be summarised and sent to the Science, Technology, Aerospace and Maritime Bureau (a unit within the Planning Agency), and the Directorate of Budget. The program proposed will be used by the Planning Agency to develop National Development Plan and by the Directorate of Budget to establish the National Budget.

The planning unit of the Indonesian Institute of Sciences in Jakarta will be informed by the Planning Agency and the Directorate of Budget regarding the total amount of budget allocated to the institution, which is called Budget Ceiling (Satuan Dua). The total budget will be apportioned by the planning unit of the Institute. It describes the budget limit and the activities that should be performed by every unit within the Institute of Sciences. Every unit, including the head of the R&D Centre for Biology, will allocate the budget to projects in terms of its importance to the current development planning. Usually the budget limit is much lower than the proposed budget, therefore the budget items need to be re-calculated and the proposals need to be

[70] An interview with the project treasurer, 22 March 1993.

revised. The revision through a bargaining process is done within the centre, between the planning unit and the researchers.

In many cases the items that would be reduced or eliminated are related to equipment, and travel expenses. In a minor case, a revision of the budget proposal may be done by the planning unit of the centre, particularly of the amount proposed for each budget item, but not on the total amount of the project's budget. This means that revision is made by switching one item to another and keeping the same total amount. According to the project treasurer[71], the revision of the total project budget should not occur, because prior to the preparation of the project proposal the researchers should have consulted the total amount available to the planning unit. When the proposal is approved it is presented in three forms known as 1) the Operational Guidance (PO), 2) the Working Paper (LK) and 3) the draft of Approved Projects list. These documents will then be sent to the Planning Agency and the Directorate of Budget.

On receipt of the documents, the Planning Agency and the Directorate of Budget, arrange a budget meeting with the project personnel. The output of the budget meeting is an approval from the Planning Agency and the Directorate of Budget of the project. At this stage the draft of the Approved Projects list then becomes an Approved Project list, which indicates that the project has been granted. The Institute will use the draft to prepare the Operational Guidance that is signed by the chairperson of the Institute. The Operational Guidance contains the budget of the project, the detail of which is set out in the Working Paper, and a description of the project including such matters as the appointment of the Project Leader, Project Treasurer, and Project Personnel. The Operational Guidance and the Approved Projects List then are sent to the Directorate of

[71] An interview with the project treasurer, 22 March 1993

Budget. The Approved Projects List then will be signed by the Directorate of Budget which indicates that the project can start.

During the interview with the project treasurer his opinion was sought regarding a rejection of a research proposal by the Planning Agency and the Directorate of Budget. The project treasurer seemed to be dissatisfied with the role of the Planning Agency and the Directorate of Budget when he made the following comment[72];

> Usually from nine proposals only four will be accepted by the Planning Agency and the Directorate of Budget. They cut the proposals subjectively. I hope that a certain percentage of the National Budget should permanently set aside a portion of funds for basic research. Meanwhile the research projects in this centre rely on the funds distributed in the Project Budget, which fluctuates and is uncertain.

One of the researchers was asked about the existing selection process in which they opposed the practice of the Planning Agency in cutting the proposal that had been approved by the Ministry of State for Research and Technology by saying[73];

> The proposals begin with a selection by the Ministry of State for Research and Technology. In this phase the Ministry of State for Research and Technology functions as a selector of the research programs. The Ministry of State for Research and Technology approval means that a proposal is worthy enough to be funded. However when the proposal comes to the Planning Agency which should only be responsible for coordination, the program is re-assessed. Sometimes when negotiating the budget, the Directorate of Budget will claim to re-assess the program. Mostly they cut off topics without any reasonable explanation. I think that most of the programs will not have enough funds, and therefore the results will be limited.

The dissatisfaction of the researchers may bring about some unbeneficial impacts on the operation of the unit. It mentioned by one of the senior scientists who was involved in the interview, that the researchers have to hide the basic scientific needs for the research, and expose the economic benefit of the project's goals[74]. He said that one way to expose the economic benefit is by mentioning the contribution of the project's

[72] An interview with the project treasurer, 29 March 1993.
[73] An interview with a Research Group 10 March 1993.
[74] An interview with a Research Group 10 March 1993.

output to industry and/or increasing farmers' earnings. Further, he also said that if the economic benefit was not disclosed in the project's goals, it would be difficult to get the project approved.

The exposure of the economic objective may mean that this element then becomes a criterion to measure project achievement. On the other hand, the researchers in this unit actually understood that the economic benefit of the project was beyond their control. They may only have control over the scientific findings; however this factor alone should not be mentioned in the project's goals. In addition, by placing the economic benefit as the project goal the project progress report would be fabricated and connected to that goal. It was also expressed by a researcher[75] that sometimes a particular project from an economic point of view is useless, but scientifically it is important. Regarding the task of this unit, the scientific aspect should be more dominant. When a proposal is significant for its scientific result, and there are no funds available, they have to deal with three alternatives: to cancel the proposal, to overstate the costing of other research topics, and to propose the topic but split it into several phases for each budget period. In most of the cases the second and or third alternatives were taken rather than the first. A group of researchers were asked for their views on how to solve this problem, and one of them said that[76],

> …the problem is not caused by the rigidity of the regulation, but it is mostly caused by the personnel selecting the project who do not understand the research environment. Usually they cut it without a clear explanation, or give an alternative. The project's personnel cannot argue, otherwise other research topics may be in trouble.

One of the researchers had an experience with a project, which had been approved by the Ministry of State for Research and Technology but rejected by the Planning Agency and the Directorate of Budget. He thought that a certain unit along the

[75] An interview with a Research Group 10 March 1993.
[76] An interview with a Research Group 10 March 1993.

negotiation line (*Planning Agency and/or Directorate of Budget*) had the power to intimidate the project's personnel and make the role of the Ministry of State for Research and Technology unimportant. In response to this thought, he was asked whether the Ministry of State for Research and Technology had ever rejected a proposal. In reply, he said that in some cases the Ministry of State for Research and Technology rejected a proposal; however, the reasons behind the rejection were clearly explained and acceptable. In contrast, the rejection, which was done at the budget meeting, was thought to be confusing. The uncertainty about what would and would not be accepted was said to cause frustration amongst the researchers. In a situation where the goals are fabricated in order to get the project approved, where the project's operations are largely irrelevant to the goals, the project personnel were confused about the direction that should be followed. Moreover it was said that if the direction was clear and within their control, such as to produce scientific finding rather than to increase economic benefit, more research output could be produced. In order to get the proposal approved, one of the strategies used was to make a personal approach by sending someone who had a personal relationship with the assessor. To do so, prior to the budget meeting the project personnel would find out who would execute the assessment. Though this strategy was often successful, it did not solve the problem. It was only a temporary relief to get the project approved and the budget allocated. The uneasy feeling was still there in relation to goals.

In addition, the project priority would emphasise the economic benefit that was claimed would be achieved by the project, and put the scientific findings as a secondary priority. Therefore, it was mentioned by one of the scientists[77], that most of the senior scientists were ashamed of the depth of the research findings, and their names were

[77] An interview with a Research Group 10 March 1993.

rarely found on the quarterly project report. For their professional satisfaction the researchers in this unit will continue to publish the research in more detail under their own name in a scientific journal rather than under the name of the centre. When the researchers were questioned about the scientific evaluation, it was mentioned that at this time the project performance was not evaluated based on scientific findings. The projects are mostly accountable as to how the funds have been used, whether it was completed on time and how the project complied with the rules and regulations.

The goal characteristic developed in this unit seems to be vague, and may create confusion among the personnel within the unit. An interview with four researchers who hold the second highest level of professional classification indicated that the way in which the personnel from external units such as the Planning Agency and the Directorate of Budget implemented the control systems led to increasing pressure on the researchers. Though the comments from the researchers conveyed dissatisfaction with the existing control systems, it may be influenced by the characteristics of the goals as well. The practice continues unchanged as indicated by interviews with personnel from the Planning Agency and the Directorate of Budget in 2004.[78]

Projects in this unit may be characterised as highly uncertain in relation to expected output. However, according to the project's leader this condition may not make the project exceed the budget limit, he went on to say[79],

> …in our case it is impossible that an unexpected element will make the project exceed the budget. All the sample elements have been listed before the fieldwork, and those elements are going to be tested. If a particular new element occurs or is identified, it will become another research topic, and perhaps will be proposed for the next budget period. The project may run out of funds during the action as a result of the Planning Agency or the Directorate of Budget cutting off the proposed budget. ...in this case the condition of run out of budget will be detected at the beginning of the project duration, and we can anticipate this situation by sending a request to

[78] interview with Mr Rahmat Mulianda from the Planning Agency by telephone 6 August, 2004 and with Sub-head of Budget C4, DJA, Drs Kisworo, 29 October 2004

[79] An interview with the project leader, 8 March, 1993

> escalate the budget or to extend the project duration. Moreover, this was rarely approved within the same period.

The above comment indicates that the project operation was limited to an investigation of a list of variables. When an additional variable is found, it will become another research topic that will be proposed in a future project. In addition, the above comment is found to be consistent with the possibility of narrowing the research coverage. If the budget is not enough to finance the appropriate investigation, the project may request additional funds, and/or extend the project duration. However, when the request is not approved, the project could reduce the investigation to suit the funds available. A more in depth investigation may be proposed in subsequent year's projects or topics. The weakness of the control system at this stage is due to the unavailability of a performance standard in terms of the scientific dimension. However, this may be due to the nature of basic research, or to some extent, the project personnel may not want to disclose an approximate process in performing the tasks in the proposal. By doing so, the researchers have a power to dominate the assessors.

Regarding performance measurement of scientific achievement, it was mentioned by the project leader that the use of scientific criteria is only related to individual scientists, which is measured by credit points obtained by the researchers. The project performance however, is very difficult to assess because[80],

> (t)he success of a project may be measured by various attributes such as scientific and administration. From the scientific point of view when a particular finding has resulted, it can be said that a project has fulfilled its task. However, the task of the unit is to find a new concept, and offer it to be used by society. Though a new concept has been found, if it has not been used, it has not achieved a real success. It might be better to put them in phase, so they can be valued in each phase. From the administration point of view it deals with how the expenditures are administered, how much has been spent, and how far the financial procedure is complied with. Therefore, the ideal performance measurement system should be able to balance the scientific and financial attribute.

[80] An interview with the project leader, 8 March, 1993

Accountability

Each project produces three types of report; weekly, monthly, and quarterly. Every Wednesday there is a seminar presentation by the scientists who are involved in a particular research project to present the project's progress. The weekly seminar reports focus on the scientific aspects. The monthly report mostly emphasises the financial aspects and is distributed to the internal units of the institution such as to the head of the Centre, and the Planning division as well as to the financial division in head office. The quarterly report describes the project's progress in relation to the time schedule that was presented in the Terms of Reference form and is presented in a form called the B1 Form (see Figure 7.7). The quarterly report is sent to the internal units of the institution and to external institutions such as the Planning Agency, the Directorate of Budget, and the Local Planning Agency.

An interview was held with the project leader and the head of the unit[81]. According to the project leader there were several control functions executed during the project's duration. Although the weekly seminar was perceived by the project leader as the one controlling the scientific portion, the head of the unit and the project leader mentioned that they were more concerned with the quarterly report. The quarterly report can facilitate control by making a comparison between the proposal and the progress being achieved in two aspects- the budget and the time schedule. The consideration of the budget is focused on the percentage of budget consumed during the project's duration. As long as the project does not seem to exceed the limit, it will be acceptable. However, the time schedule is also very important, because it may be used to monitor the project's progress. It can be used to monitor the achievement of the project at each

[81] An interview with the project leader the head of the unit, 9 March, 1993

critical point of time, to approximate the appropriateness of the project in consuming the budget, and to have an early indication of when the project needs additional funds.

Concerning the role of the internal and external auditor, one of the researchers expressed the following comment[82];

> The auditor mostly deals with how the record is kept, and how the funds are used. As long as all procedures are followed, all the supporting documents can be presented and are valid, and at the end of the year all the funds have been consumed it will be accepted.

The perception of the role of internal and external auditors in controlling the project was also expressed by the following comment[83];

> The auditors would have never come to the inner part of the research. They have never understood our difficulties. Therefore they deal mostly with the treasurer.

The author had a chance to attend and observe one seminar presentation in this unit[84]. The seminar started 10 AM and was attended by about 30 people; some of them were scientists that were known to the observer. The seminar was about a project's progress. During the seminar, various questions were asked in relation to the research method and alternative approaches. They used biological terminology. Apart from the questions, some suggestions also came from the audience in relation to how to solve the problem dealt with by the presenter. However, it was noticed that there was only one question regarding the financial aspect, raised by an attendee to ask the cost required to execute the technique proposed by the presenter. This question was answered by the presenter who said he was unsure about the cost, but it would be ascertained for the next project proposal.

After the seminar, an interview was undertaken with the project leader to ascertain whether the financial aspects were also discussed in the seminars. He said that the

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[82] An interview with a Research Group 10 March 1993.
[83] An interview with the project leader, 8 March, 1993
[84] Seminar presentation on 10 March, 1993

financial aspect was usually discussed separately from the seminar. The financial aspect was discussed internally with the planning unit of the centre and the project leader.

The Control Systems Practiced

The project evaluation and selection procedure at the R&D Centre for Biology is depicted in Figure 8.8. The control systems occur in three critical phases during the process. The first phase is during the project evaluation and selection process which is referred to as input control. The second phase is during the process of project operation through monitoring systems such as weekly seminars, monthly reports, and quarterly reports which are related to behaviour control. The third phase is at the end of the project which can be related to output control.

During the project evaluation and selection process, there are three dimensions of control tools employed; scientific, directional, and financial dimensions. These three dimensions are placed differently along the process. As can be seen in Figure 8.8, the execution of those dimensions is indicated by a number that is noted during the evaluation and selection process. The scientific dimension may be executed by two assessors, an internal assessor, and an external assessor. The internal scientific assessment is done by the committee that comprises internal members of the unit such as group leaders and senior scientists through a seminar presentation (box 1). The external scientific assessment is done by the Minister of State for Research and Technology as noted in box 3. Aside from using the scientific dimensions, the Ministry of State for Research and Technology may also use the directional dimension in assessing the proposal regarding the national direction for R&D. Furthermore, the scientific dimension may be applied again in revising the proposal regarding the budget availability (box 6).

The directional dimension may also be executed at different levels. The first level is undertaken by the head of the unit, which uses the task, and function of the unit to limit the research topic and the project's goals (see box 2). The second level is executed by the head office in Jakarta, which uses the task and function of the institution to limit the research topic and project's goals (box 4). The third level is done by the Planning Agency (box 5) that uses the National Development Plan to limit the topic and project's goals.

The financial dimension in this case refers to the financial boundary, which is imposed to limit the project's operation. However, the boundary is caused by the shortcoming of funds available, rather than cost benefit consideration between the input being spent and the expected output. This dimension is also executed at different levels during the evaluation and selection process. The head of the centre uses the financial dimension to match the project budget with the amount of funds allocated (box 7). In some cases, the head of the centre may have to postpone or reject a particular project's topic due to the limitation of funding. The decision to postpone or reject the topic may be based on priority rank, which is referred to the directional dimension to fulfill the functions and tasks of the centre.

A similar condition occurs at the head office level in Jakarta, which used the financial dimension, and priority rank to match the amount of fund allocated to the institution as noted in box 8. The directional dimension is executed by the Planning Agency in regard with the Annual Plan, and the financial dimension by the Directorate of Budget to match the amount of fund allocated in the Project Budget.

Figure 8.8: Project Evaluation and Selection in R&D Centre for Biology

Please see print copy for Figure 8.8

[85] Confirmed as unchanged from telephone interviews with Mr. Rahmat Mulianda from the Planning Agency, 6 August, 2004; Drs Kisworo, a Sub-head of Budget C4, and Eddy Pramono SE from the Directorate of Budget on 29 October 2004.

The execution of the control function during the second phase to monitor the project progress is implemented by using three dimensions of control tools namely; scientific, financial and bureaucratic, as expressed by standard operating procedure. The scientific dimension is used by the group leaders and senior scientists through the seminar. The financial dimension is executed during the monitoring process by using the monthly and quarterly reports. During this stage, the financial dimension will be used to indicate a critical financial condition faced by the project regarding the project's time schedule. At the same time the internal and external auditors use the bureaucratic dimension such as standard operating procedures to monitor the degree of compliance, and the financial dimension to measure the amount of budget consumed.

At the end of the project duration, the project is required to provide a report regarding the output of the project's operation. Two types of report are issued by the project namely; a scientific report and a financial report. The scientific report is used internally within the unit, and presented in a seminar presentation, which will be attended, by the group leaders, senior scientists, and other researchers. The presentation is on the scientific findings obtained by the project, and is not generally connected to the financial aspect. Therefore, at this point the control system purely uses the scientific dimension to evaluate the performance of the project.

The quarterly report is presented in Form B1 (Figure 7.7) and consists of mostly financial matters. There is no indication that the quarterly report is relevant to the scientific dimension. Moreover, there is no indication of a financial cost/benefit analysis being performed by internal and external units. The use of the financial dimension in this phase is limited to indicate the ability of the project to meet the budget rather than to achieve its goals. Furthermore, the ability to meet the budget will be used to base a decision on the project budget for subsequent periods.

Summary

The management control system applied to the three examples is discussed in this chapter. Two examples, the R&D Centre for the Textile Industry and the R&D Centre for the Metal, Machinery and Electronic Industry, are related to the Ministry for Industry, Indonesia. The other example, the R&D Centre for Biology, is related to the Indonesian Institute of Science. The Ministry for Industry is a Departmental Government Institution, while the Indonesian Institute of Science is a Non-departmental Government Institution. The difference in type of institution makes the procedure for project selection slightly different. The R&D project proposal from a Non-departmental Government Institution must be assessed regarding its scientific appropriateness by the Ministry of State for Research and Technology, while a proposal from a Departmental Government Institution is assessed by an internal committee within the unit.

The control systems practiced during the project selection process were found to use four control dimensions namely; the bureaucratic, scientific, financial and directional dimension. The Bureaucratic dimension in terms of standard operating procedure is found to be practiced by all units involved in the selection process. It indicates that all proposals must be presented in standard forms such as the Term of Reference, the List of Proposed Project, the Working Paper, the Project Budget and Operational Guidance. The scientific dimension was found to be practiced in all examples by the scientists through a seminar presentation. In addition, as a Non-departmental Government Institution, the proposal from R&D Centre for Biology was also assessed by the Ministry of State for Research and Technology, which may also apply the scientific dimension.

The financial dimension is found to be practiced by the planning unit of the centre and the planning unit of the government institution. The use of the financial dimension

in selecting the project was found to be placed more importantly by Directorate General of Budget. However, the use of the financial dimension is found to be less related to a project's output. No cost-benefit analysis was ever found to have been practiced by any institution involved in the selection process.

The directional dimension, which refers to organisational goals, was found to be practiced by some units at different levels along the hierarchy. The centre will assess the R&D project proposal regarding the goals and function of the centre. In the case of the centre on behalf of the Ministry for Industry, the Agency for R&D in Industry will assess the proposal in relation to the goals and function of the centre, the Agency for R&D in Industry. In addition, the Ministry for Research and Technology will also use the National Research Direction to assess the proposal from R&D Centre for Biology. The Ministry for Industry and the Indonesian Institute of Science as head office will assess the proposal regarding their goals respectively. Finally, the Planning Agency will assess the proposal regarding the Annual Development Plan (Repeta).

The goals of the project were found mostly to have qualitative attributes. As the Planning Agency and the Directorate of Budget have less understanding the scientific aspect and have difficulties in linking the input with expected output, the rejection of the proposal by the Planning Agency and the Directorate of Budget were felt to be unfair by the scientists. The use of different dimensions among the units involved creates problems. This situation becomes worse when the Planning Agency tries to force the power to reject the project as perceived by the scientists. Furthermore, it may create dysfunctional behaviour among scientists causing them to manipulate the project's goals, placing slack or on the budget, and reducing the quality of the R&D output.

Regarding the project's duration, the scientific, bureaucratic, and financial dimensions were found to be involved. The use of the scientific dimension was indicated by the scientists during the seminar presentation in all examples. The bureaucratic and financial dimension was found to be exercised by the internal and external auditors as well as the head of the centres. The bureaucratic dimension was reflected by the project's compliance with existing standard operating procedures, and rules and regulation, while the financial dimension was related to the assessment on the ability of the project to use the budget.

At the end of the period, the project performance was found to be assessed heavily on the financial dimension. The use of the scientific dimension such as requirement to be published in scientific journal or obtaining patent was not found by the study. In addition, the scientific dimension seems to be applied only to scientists individually to facilitate promotion.

The next chapter will present analysis of the management control system practiced by the sample sites by using the control framework developed in Chapter Four.

CHAPTER NINE

The Analysis

Introduction

R&D organisations experience more uncertainty in their operating environment than non-R&D organisations (Lawrence & Lorsch, 1967; Lorsch and Morse, 1974). This environmental uncertainty affects the choice of organisational structure (Gordon & Narayanan, 1984); goal setting (Cohen et al, 1972; Cooper et al, 1981; March & Simon, 1958; Lindblom, 1959; March, 1978); planning systems (McCaskey, 1974; Davila, 2000) and management control systems (Chenhall, 2003; Davila, 2000; Abernethy & Brownell, 1997; Hartmann, 2000).

Based on the findings in the literature, this study developed and proposed four core elements of management control systems that need to be considered by R&D organisation particularly when dealing with environmental uncertainty. These core elements and the data collected from the field study have been presented in previous chapters, and in turn, this chapter presents an analysis of how they were applied by R&D units observed.

The chapter consists of five sections and begins with a discussion of the effect of the colonial era and the postcolonial era on the choice of administrative systems, including management control, in the public sector. A discussion about the organisational environments experienced by the units under study will be presented in the second section. Using the concepts developed in Chapter Four, the third section contains a discussion of how the management control systems were applied by the units under study. The use of the core elements of the management control systems are discussed in this section including the importance of the actor in control systems as well as how the control types and control tools were applied to input, process and output control. Section four, consists of a discussion of the role of accounting in the management control systems applied by the units under study. The implementation of input, process, and output control is used to examine the role of accounting in practice. Finally, the chapter will close with a summary.

The effect of colonial era

Indonesia was under the control of the Dutch government for at least 350 years. The Dutch brought western administrative systems into the country. As a common practice, the administrative systems of the colony were set to be more centralised, so the country would be easier to control. The central administration was based in Batavia, which is now called Jakarta. The Dutch was conquered by Japan who occupied Indonesia from 1942 to 1945, which finally Indonesia obtained fully independent in 1950. At the beginning of independence, the country was led by President Soekarno who had to deal with poverty and riots everywhere as well as poor education. This situation meant that the country had no resources to develop its own administrative systems so it had to continue using the Dutch systems.

Through a political instability, Soekarno gave up power to Soeharto, who led the country from 1967 until 1998 under his regime called the New Order. It seems to be quite a difficult and time consuming process for a country to change its long-standing administrative systems. It was a great challenge to set proper administrative systems with a condition of 17, 508 islands, a huge population, and more than 500 major ethnic groups. Nevertheless, throughout the Suharto period there were many developments including the rapid growth of the economy from 1971 to 1981 as well as improvements in education. At some stage in this period the standard operating procedures in the government sector were developed, although the government's accounting systems still used the Dutch accounting practice, and the control systems remained centralised in Jakarta. An indication of the centralisation of power can be seen in the role of the Planning Agency and the Directorate of Budget who hold the power to approve a project.

Considering the situation of Indonesia, the standardisation of operating procedures in classified activities including R&D, not the centralisation of power, may be functional if it is properly managed. An intention through presidential decree during Soeharto's regime and again during Habibie to decentralise the control to provinces has issued however, the central government remain hold the control tightly (King, 1988). This practice may have been influence by the historical, political and cultural background. Through the history, the Dutch created a group of Javanese aristocrats called Pangreh Praja at lower level of government official to bridge the communication with the people (Sutherland, 1979). The Pangreh Praja was characterised by Sutherland (1979) as benevolent dictators, using classic Javanese relationship, which was modelled by family connections. Since the Dutch had pushed to leave the country by Japan, the bureaucratic rules would only rely upon the Pangreh Praja, even in the early stage of independence under Soekarno leadership.

Soeharto has a strong Javanese and military background. To deal with many problems left by Soekarno at the early period, Soeharto took control of the military, the parliament with his ruling party, and centralised the administrative system although during his leadership, there was a policy to decentralise the power into regions, it was only to fulfil the requirement of international community, while in practice remain unchanged (King, 1988). The centralisation of control led to the spread of corruption, nepotism, and family connection as had been experienced back in the colonial era. The lesson learned from colonial era particularly on the role of the Pangreh Praja that suit the Javanese culture in particular has an influence on the design of management control systems as to be centralised.

In 1998, the nation called for a change to clean up the country from corruption, nepotism, and family connection, which also meant a request to improve the government administrative systems. An economic crisis in Asia made the situation in Indonesia worse and finally forced Soeharto to step down from power which then replaced by Habibie. Habibie had Bugis and Javanese parenthood and only stayed in power for 17 months. At the beginning of this period, inflation was very high and riots as well as killing were everywhere, which meant that Habibie did not have much chance to develop the existing administrative systems, except to introduce regional autonomy.

At the 1999 election, Abdurrahman Wahid (the son of Hasjim Asjari a Javanese elite during colonial era) and his vice president Megawati (the daughter of Soekarno, the first president as well as a Javanese elite during colonial era) replaced Habibie. Unfortunately, Abdurrahman Wahid only stayed in power until July 2001; again, he had not much opportunity to develop the administrative systems. Megawati replaced Abdurrahman Wahid and stayed in power until the election of 2004. During her short period in office, Megawati tried to make administrative changes on the use of double entry accounting, and unifying budget. However, no changes occurred in the operational systems such as in standard operating procedures and forms for project proposals to indicate the decentralisation of control. So far, the changes in the recording and the budgeting system have not made any significant impact on the effectiveness of the management control systems practiced, rather they only improve the technical accounting, while the control remained centralised in Jakarta.

Finally, Susilo Bambang Yudhoyono and his vice president Yusuf Kalla, at the election of 2004, replaced Megawati. Since then many internal problems have been experienced by the country, including terrorism and the Tsunami disaster, and there is not much can be explained on their leadership.

The next section presents a detailed discussion about the organisational environment dealt with by the units under study.

The Organisational Environment

Various authorities have indicated that uncertainty might arise from internal and external elements of the organisational environment (Bruns & Stalker, 1961; Thompson, 1967; Lawrence & Lorsch, 1967; Duncan, 1972). These internal and external environmental elements may create different types of uncertainty including, lack of clarity of information and uncertainty of the action of external components. In addition, Place (1977) described the R&D activity as a learning process to produce new knowledge and in which the tasks needed to perform the activity may deal with uncertainty.

The data presented in chapter seven and eight indicates that the R&D units under study experienced a relatively uncertain environment because of uncertainty about the scientific requirements, the causal relationships of the task being undertaken, and the action of the dominant parties that were assigned to approve or reject the proposal. In relation to task uncertainty, the units investigated organised to deal with uncertainty. The R&D Centre for Biology, which conducted more on basic research, dealt with the uncertainty of the task itself that arose from scientific requirements. This may be because of the nature of basic research that focuses on producing knowledge, and was not arranged to meet the short-term requirements of external parties. Other units were involved in more applied research (the R&D Centre for Textile Industry, and R&D Centre for Metal, Machinery and Electronic Industry) were also required to deal with uncertainty concerning the tasks to fulfil either a scientific requirement and/or users' needs. The operation of applied research is not necessarily arranged to interact directly with external parties (Rockness and Shields, 1984), because at the beginning the needs of the users become an imaginative state created by the scientists.

Apart from the task itself, the parties that are involved in controlling the R&D units under investigation may create uncertainty. The Ministry for Research and Technology, the Planning Agency, the Directorate General of Budget, and the Agency for R&D can be classified into external elements of the environment. The management team at the centre, such as the Planning unit, can be classified as an internal environmental element. In relation to the action of dominant external parties, all the R&D units examined had to deal with the uncertainty arising from the action of the external parties particularly the Planning Agency and the Directorate General of Budget.

The Management Control Systems

This study proposed four control elements that need to be considered in the choice of management control systems. They are desired ends, actors, control types, and control tools. The existence and the use of combinations of those control elements will be discussed in the following sub-section.

Desired Ends

Some authorities suggested that perceived environmental uncertainty would affect the setting of organisational components including goals setting and goals characteristics (Dill, 1958; Simon, 1964-1965; Thompson, 1967; Daft, 1983). Chenhall

(2003) also suggested an investigation of the characteristics of operative goals and its effect on the choice of the management control system. Therefore, this study proposed two components of goals (which are called desired ends by the study) to be investigated, the *direction* and the *yardstick*. The *direction* is referred as a desired course to be followed rather than a goal to be achieved, while *yardstick* referred to the measurement of the achievement.

The study found that the goals of the projects of the units under investigation consisted of a learning process. The goals declared that the tasks were to investigate a certain operation that had never been done before. The purpose of this learning process is to produce new knowledge that can be used by further action to the benefit of society. Once new knowledge has been found, the next project will be assigned to translate this knowledge into production or for further research. The actions of the R&D activities were indicated to be a continuous process to define new knowledge. The new knowledge then can be used to produce a better product or a better way to produce the product than those that had been used previously, and/or to define new goals for further projects. Therefore it can be said, that the actions performed by the three units examined were a learning process to define new goals, rather than to accomplish a precise goal. The learning process would only have limited guidance from previous activities, and the means-ends relationship will be uncertain and underspecified as well as imprecise and difficult to be measured financially. For this circumstance, the appropriate planning system would be directional planning (McCaskey, 1974) rather than planning toward goals. Although there was an effort to use a project's budget as a yardstick to measure performance, it failed to capture the essence of the output, and acted rather to limit the project within a financial boundary.

Regarding the operational goals, this finding seems to be dissimilar to what is presumed in the literature in which the operational goals would be more concrete, specific and measurable, so they can be used as criteria to measure the performance (Daft, 1983). The imprecise desired ends preclude specification of a single set of control tools for specifying the desired results of an individual unit. Further, the self-set goals would probably be used as a basis for comparison. However, it must be kept in mind that a better control tool for the units investigated was what should have been achievable in the period under review and this would only be known now, rather than being based on assumptions made when the project commenced.

In addition, the projects' goals were found to be in a line with the function of the centre, the ministry and the National Development Plan. For example, the R&D project on the textile industry was within the area of the function of the R&D Centre for Textile Industry, complied with the role of the ministry, and in was line with the National Development Plan. A similar condition was also found to be practiced by the R&D Centre for the Metal, Machinery, and Electronic Industry, and the R&D Centre for Biological Resources. The relationship between these levels of desired ends can be seen in the process of project evaluation and selection of the government projects.

It is commonly mentioned in the literature that the operative goals that are set out for each unit within an organisation are derived from and parallel to the system goals (Daft, 1983). If this is so, then, all the task goals within the unit should be developed as a detailed description of the operative goals rather than the system goals (Daft, 1983). Moreover, as the task goals are set for the lowest level in the hierarchy, they are characterised by a clear and measurable quality. Therefore, the achievement of the task goals will simultaneously mean the achievement of the operative goals.

The desired end setting process practiced by the units investigated however was different to the setting process defined in the literature. The projects' goals that could be defined as task goals were not derived merely from operative goals, which are the goals of the institution. They were defined more directly from the system goals, the function of the ministry and the goals of the centre were used to maintain the project and remain within the domain such as the textile industry, the metal and machinery industry, or biological resources. The outputs of the R&D projects under investigation were not only expected to bring a contribution to science, but also to contribute to the achievement of the system goals. These findings indicated that the units operated toward the achievement of the system goals rather than the operative goals. This finding seems to be in parallel with the study of Abernethy and Stoelwinder (1991) where they found that professional organisations operate with a system goals orientation.

Since the researchers are considered distinct from the common employees, the attributes of the researchers in relation to the management control systems is discussed in the following sub-section.

The Actors being controlled

It was proposed by the study that the actor dimension consisted of five elements, behavioural, motivational, domination, power, and decision space. The behavioural element refers to the ideal behaviour to be performed by the actors being controlled. To be effective, the ideal behaviour should become a norm that is accepted and followed by the members of the organisation. The construction of this norm may be defined clearly in the formal control system and/or implicitly set out by the organisational culture, and would be used to assess the performance of the actors. Therefore, one way to identify the existence of the behavioural element in the control system is through an investigation of the performance measurement of the researchers practiced by the units examined.

The data presented in Chapter Six indicated two career paths for civil servants in Indonesia, a *structural* and a *functional* career path. The *structural* path was provided for non-researchers who hold bureaucratic and administrative position, while the *functional* path was provided for the researchers. The *structural* path used eight performance criteria which were mostly relevant to bureaucratic and administrative achievement these were; loyalty, work performance, responsibility, obedience, honesty, cooperative, initiative, and leadership. The *functional* career path in contrast used two major criteria that were relevant to scientific achievement they were, the main elements and the supporting elements. The main elements consisted of three factors; level of education, scientific publication, and technology acceleration. The supporting elements consisted of four factors; dissemination of science and technology, involvement in scientific activities, involvement in lecturing, and scientific acknowledgment (see Table 6.1 and 6.2). It could be said therefore, that the preferred behaviour of the researchers would be being involved in producing knowledge rather than in administrative activities as for the non-researchers.

The motivational element concerns the factors that are used by the control system to encourage members of an organisation to remain within the desired behaviour. It may be defined formally and/or informally through the organisational culture. The formal motivational element used by the units can be seen in the use of credit points obtained as a basis for promotion (see Table 6.3). The motivational element used in promotion may pay regard to the improvement of two aspects, formal improvement in official rank, which simultaneously improves the salary rate and the informal motivational component by the improvement in the scientific reputation of the researchers. The scientific reputation refers to an individual's satisfaction regarding his or her achievement in scientific acknowledgment of their work. The culture within the units encouraged the researchers to behave in certain ways to maintain their reputation as reflected by an informal meeting or discussion among the researchers, or during a scientific seminar.

The domination element is an ability to influence others in making decisions. In the context of a management control system, this element is presumed to be held by the subject who exercises control (Chua, et al., 1989). The ability to dominate others in making decisions would be used by the subjects of control to direct the objects being controlled toward a desired direction. However, the study by Abernethy & Stoelwinder (1991) indicated that in professional organisations the objects being controlled have more power to dominate the subjects. When an opposite situation from what is presumed in literature occurred, it will influence the choice of the control system.

The domination element was shown to be possessed by the researchers of the units examined, and the source of power to dominate others arises from excess information about a project's operation[86]. As the R&D function is not a repetitive operation, there would be no complete information available to define how an operation should be done. The Terms of Reference (Figure 8.1) may be the only document that presented the approximate plan of a project's operation. However, it should be kept in mind that the project deals with an uncertain environment and therefore, this plan would practically be subject to change. This condition meant that the subject of control would only hold the general description of the initial plan and be unable to figure out the project's operation relatively accurately. Therefore, the changes in detailed activities

[86] An interview with the head of bureau in Bappenas; DR Triono Sundoro, 19 January 1993.

could not be monitored. Such a situation was indicated through an interview with the personnel from the Planning Agency in 1993 and with the personnel from the Directorate of budget in 2004 in which they mentioned that they had incomplete knowledge about a project's operation[87].

On the other hand, the researchers that performed the R&D function became the only parties that possessed the most complete information about the operation. By possessing more information, the researchers would be able to influence the subject in making a decision. This situation was revealed in an interview with the researchers who understood that the external parties had a lack of knowledge about the task being proposed[88]**.** Therefore, the researchers perceived that to get the project approved the project goals should be connected to the National Development Plan and be within the area of the centre. In addition, the practice of creating slack to cover any costs cut or to assess performance in other preferred areas[89] would be more evidence of such a situation. Observation of a budget meeting also indicated such a situation. In this meeting, the personnel from the Planning Agency rejected the calculation of travelling cost, but the discussions had never been linked to the projects' goals.

The incomplete description of a project's goals made the decision space an important element in the control systems. The decision space refers to the degree of authority given to an individual in making a decision. Since a project's operation cannot be described precisely, the use of the decision space would be an effective way to limit a project's operation. The management control systems practiced limited a project decisions in three dimensions. Firstly, the directional dimension in which the project's goals were used to limit the area and direction of the R&D project. The use of this

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[87] An interview, DR Triono Sundoro, 19 January 1993, and with Drs Kisworo, 29 October 2004.
[88] Interview with the researcher from R&D project in Metal and Machinery Industry, 10 March 1993.

dimension was found in the selection process of the project goals. Secondly, the bureaucratic dimension referred to administrative norms to which the projects should comply. This dimension was used in the selection and the accountability process indicated by filling up standard forms and obtains approval from various parties. Thirdly, the financial dimension was to limit the project's financial decisions. The planning unit of the centre and the Directorate of Budget used this dimension.

It could be interpreted that the budget was used to limit the decision space of the project. It was used as an alternative means for the control system to decrease the risk of making a wrong decision in approving a project because of incomplete knowledge regarding the project's operation. By doing so, innovative behaviour would be maintained while the influence of the researchers toward the decisions would be protected.

When discussing the attributes of the actors being controlled, the study also proposed two other control elements that need to be considered in the choice of management control systems; the *implementation* of the control systems and the *control tools*. Both of which will be discussed in the following sub-section.

Implementation of control and the control tools

The *implementation* of the control systems refers to two components; the *time* or *stage* at which the control system is implemented and the *types* of control used. The *time* of the control to be exercised is categorised into input, process and output control. The *type of the control exercised consists* of two types, formal and informal. The informal control types in turn consists of surveillance and cultural control types. In turn, *control tools* refer to the dimension contained in the tools used by the control systems

[89] An interview with the project treasurers, 22 March 1993.

and the value represented by the tools. The study proposes that control tools have four dimensions: the directional, the bureaucratic, the scientific, and the financial dimension. There are three values represented by the tools: the external, the internal and the social values. The following part contains a discussion of the control systems exercised by the units in terms of the control types and tools used for the input, process and output control.

Input Control

The control systems practiced by the units studied show that input control was executed as part of the evaluation and selection process. The project evaluation and selection process applied to the units investigated were shown to use the formal and informal types of control system. The formal controls used the four dimensions of control tools: the directional, the bureaucratic, the scientific and the financial dimension. Various parties in selecting a project used the directional dimension. For the projects under the Ministry of Industry (the R&D Project for the Textile Industry and the R&D Project for the Metal, Machinery, and Electronic Industry), the head of the centre used a directional dimension to select the proposed projects' goals in relation to the goals of the centre. Then the directional dimension was applied by the Agency for R&D in Industry in relation to the tasks and functions of the ministry. At the end, the Planning Agency assessed the project in relation to the National Development Plan.

Although the selection process applied to R&D projects under the Indonesian Institute of Science was slightly different from those projects under the Ministry for Industry, the use of the control types and tools were found to be similar. The selection was started within the R&D Centre for Biology, which used the directional dimension to ensure that the projects' goals were within the function of the centre. Then, the proposal was sent to the head office that used the directional dimension to ensure that the projects' goals were within the tasks and functions of the institution. As a non-departmental institution, the proposal was assessed by the Ministry of State for Research and Technology to ensure that the projects were within the national direction of science and technology. Finally, the Planning Agency exercised the directional dimension and assessed all projects in relation to the national development plan.

The bureaucratic dimension was exercised during the review process to ensure that the project proposals complied with the existing administrative norms. The obedience to the administrative norms was illustrated by the filling up of the standard form to facilitate the monitoring of the project achievement. The bureaucratic dimension implemented by the planning unit of the Centre was to ensure that all required forms had been filled up correctly. In addition, as indicated during the budget meeting, the Directorate of Budget also used the bureaucratic dimension by requesting the supporting documents to be attached to the proposal.

The scientific dimension was used in at least two stages, firstly during the seminar which was required by the scientific panel and secondly by the Ministry of State for Research and Technology for the projects on behalf of the Indonesian Institute of Science.

The financial dimension was used internally by the planning division of the centre, and externally by the Directorate General of Budget, however they were found to have difficulty in linking the project goals with the financial aspect[90]. This difficulty then led the negotiation toward a condition where the budget was set prior to the project proposal. Though the priority rank of the proposal had been set internally, the budget meeting may reject or request revision of the proposal on the grounds of insufficient funds.

The use of the financial dimension during the budget meeting was found to be rigid. The enforcement of a rigid control system in selecting the project may produce some unbeneficial consequences. The request for revisions to meet the available budget during the budget meeting then would influence the depth of the study and hence the quality of the research. It could also increase pressure, reduce creativity, and lead to dysfunctional behaviour as indicated by the researchers from the R&D Centre for Biology[91]. In addition, undesired behaviour was also found in the R&D Centre for Biology that inserted a certain degree of mark up on the budget, or shifted the budget to other research topics[92]. Therefore, it is suggested that the use of the financial dimension may only be appropriate under a situation where the funds are unlimited, and future events and consequences are predictable in a relatively accurate manner. In contrast, when those conditions cannot be met, the financial dimension alone would be an incomplete description of the desired ends, and therefore should be avoided. For this situation, other dimensions such as; the directional, the bureaucratic, and the scientific dimension should be added to counterbalance the financial dimension and should be maintained with the implementation of the control systems. By so doing, a complete and appropriate set of tools to represent the desired ends can be used effectively.

Informal control was indicated by social interaction among the scientists particularly during the seminar presentation. Informal control was found to use cultural control rather than surveillance control. This may be because of the non-routine task of the R&D function that makes the written norm required by surveillance control difficult to develop.

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[90] Indicated during the observation of the budget meeting with the Directorate General of Budget.
[91].Interview with researchers in R&D Centre for Biology, and with the personnel from Batan.
[92].Indicated from an interview with the project's treasurer of R&D project in Biological Resources.

The values that are represented by the control tools play an important role in controlling an organisation that deals with uncertainty. In a situation of high uncertainty, the control system may search for additional and independent information (Gordon and Narayanan, 1984) to ensure that the decision being made is relatively appropriate. As can be seen from project selection where each party involved used the directional dimension of the control tool that has different values of representation from one to another. The directional dimension used by the head of the centre can be said to use internal values in which were used with regard to the task and function of the centre. The directional dimension used by the external parties contained external values, which encompassed the tasks and functions of the ministry and/or the need for the industry sector of the country as indicated by the National Direction.

The bureaucratic dimension used by the control systems also contained different values of representation. The standard operating procedures that were developed by the centre to suit its conditions contain internal values of representation. In turn, all the standard forms used in the government sector and the procedure to deal with parties external to the centre contained external values. It could be said therefore, that the bureaucratic dimension contained internal and external values of representation.

The scientific dimension used by the control systems also contained different values of representation. The scientific dimension used by the panel, who were also the members of the centre during the seminar presentation, contained internal values. The internal values referred to perceived appropriate technological advances that should be possessed by the project proposals concerning the role of the centre. In addition, by using cultural control, the scientific dimension that was used internally, would also contain social values. A discussion among the researchers during the seminar presentation that involved criticisms and support toward a proposed concept can be used as an example to describe the existence of the social values. Similarly, the Ministry of State for Research and Technology applied the scientific dimension in selecting the proposals. However, it used external values to define the scientific boundary as that required to fulfil the needs of the nation.

The financial dimension applied during the project selection contained internal and external values. The amount of the proposed budget was set internally and contained the perceived appropriate amount of budget to be approved by the head of the unit. The use of the financial dimension by external parties such the Directorate General of Budget contained external values. Since the expected output of the project was difficult to value financially, the only values represented by this dimension were the availability of the government budget as a whole.

Process Control

Process control was executed throughout the project's duration. The use of control types in the process control was mostly of a formal nature, apart from the periodic seminar presentation that used cultural control, which was part of informal control. The implementation of formal control was facilitated by the provision of periodic progress reports (see Figure 7.7). The four dimensions of the control tools were also used in practice. The directional dimension was executed by the control systems to ensure that the project operated toward the achievement of the goals. The implementation of this dimension can be seen in the usage of Form B-1 as presented in Figure 7.7 particularly section III Activities Target and section IV Accomplishment Report. The use of the directional dimension was emphasised as a monitoring process rather than re-evaluating the appropriateness of the stated goals. There was no indication found to lead to an interpretation that there were changes to the goals that occurred during the project duration.

In turn, internal and external auditors[93] used the bureaucratic and financial dimensions as part of the process control to review the projects' compliance with the existing standard operating procedures. The use of these two dimensions was facilitated by the accounting report. The financial dimension was also exercised by the Directorate General of Budget to monitor the projects' financial progress and was facilitated by Form B-1 (see Figure 7.7). Regarding the scientific dimension, there were no formal reports indicated other than the regular seminar presentation conducted by the projects.

The value of representations of the four control tools implemented during process control was similar to those exercised by input control. The directional dimension used by the head of centre may contain internal values while external parties to the centre such as the Planning Agency may use external values consistent with the National Development Plan. The bureaucratic dimension that was inherent in the internal standard operating procedures of the centre contained internal values, while the standard operating procedures that applied to all government sectors contained external values of representation. Since the budget was developed by the projects then it could be said that the financial dimension would also contain internal as well as external values, which were used to ensure that the project was still within its financial boundary. The scientific dimension, which was implemented in the seminar twice a year along the project duration, contained social values to encourage the project's operation within a desired scientific range.

<u>Output Control</u>

Output control is executed at the end of the project's phase to examine the achievement of the operation, and from which corrective action can be carried out. This

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[93] Interview with the leader of the project that runs basic research (R&D project in Biological Resources).

study found that the implementation of output control used a formal control type which was facilitated by the Quarterly Report form (Figure 7.7), the List of Proposed Project Form (see figure 8.3), and accounting reports. It should be noted that, apart from the use of this form for the progress report, the quarterly report was also used as a final report to outline the achievement of each project at the end of the financial year. As can be seen in Figure 7.7, the essential elements of the report were formed in the three components: section II the Financial data, section III the Activities and target, and section IV the Accomplishment. The Financial data may only be used by the control function as a reference to ensure that the project operates within the financial boundary. It should be kept in mind that if the project could not spend the whole budget within the year, the budget of following year will be reduced to the total expenditure of the current year[94]. The rigid budget used by the units under study indicated that the systems were intolerant of the uncertainty dealt with by the R&D projects. Moreover, this system did not encourage the projects' personnel to be efficient in using the funds.

Section III is the Activities and Target and is used to describe project activities according to plan and present the actual progress quarterly. Both columns are filled quarterly with the percentage of the plan required to be completed and the actual progress from the total activity plan. However, there was no clear guidance on how the actual performance was defined. The manual book for the progress report only highlighted the fact that the percentage of actual progress in a quarter should be the same or higher than the previous quarter (the Planning Agency, 1988, p. 5). This situation could lead to an interpretation that the report was subjective and possibly far from accurate. In addition, it also indicates that by its nature the progress of a R&D

[94] Found from an observation on the budget meeting in the government sector.

activity is difficult to quantify, therefore, using a quantitative measurement to monitor the activity will be less effective.

Section IV is Accomplishment and contains a report of the achievement of four criteria; administration, physical target, financial target, and project's goals. The achievement of Administration and Goals was measured by the ability of the project to meet the schedule which was indicated by highlighting a 'Yes' or 'No' condition. For example, the administration target refers to the administrative tasks to administer and to make reports about the project operation within the schedule, while the physical and financial target must be indicated by a percentage. Although the criteria used to assess the project performance was spread along those four criteria, the most important criteria seem to emphasise the physical and financial targets as indicated by the requirement of those two targets to be quantified in relative terms.

Since the expected output of a R&D operation is knowledge, the physical target seems to be irrelevant. The reason to use the form may be that it is a standard form for all government projects and is designed to measure construction projects that are common to the government sector. The more appropriate target that should have been highlighted by the report was scientific achievement rather than physical (Sthal and Steger, 1977; Schainblatt, 1982; Weinberg, 1989; Menhard and Pederson, 1989). Unfortunately, there was no indication of the use of scientific achievement in the accountability report.

The financial target contained the financial dimension of control tools as well as the Development Budget report (see Figure 7.7 and 7.4), which was used by the Directorate of Budget to control the project by comparing the actual expenditure to the Cash Position on the Development Budget Report. Again, this process would be limited to the financial dimension without being connected to the focus of the project's achievement. Because of this difficulty, the use of this criterion would be ineffectual rather than just to ensure that the project operation remain within the budget.

Regarding control tools, it was found that the directional, financial and bureaucratic dimensions were used. Although it was subjective, the directional dimension was used by the accountability process as indicated by the report. The directional dimension that referred to the goals of the project contained internal values of representation. The financial dimension was also used as an output control in the project report and the development budget form. However, since the budget was developed by the project and approved by the Directorate of Budget, then it could be said that the financial dimension contained internal and external values of representation. Finally, the use of the bureaucratic dimension was also found in the project's report on administrative achievement. As the report referred to is a standard form for all government projects, it could be said that the value represented by this dimension was an external value. In addition, the role of the internal and the external auditor in measuring the compliance with the standard operating procedures was an indication of the use of the bureaucratic dimension. It is plausible that there were standard operating procedures set up specifically for the centre and it would contain an internal value of representation, while the general standard operating procedures that were to be applied to all government's institutions and contained external values of representation.

Although the three control implementation situations should be set in a package of management control systems, the emphasis on the role of those three types of implementation may vary. The study indicated that the expected output of the projects could not be described clearly or measured financially and accurately, and therefore, the quality of the desired end may mostly rely on direction rather than yardstick. Since the accomplishment of a project's goals was less verifiable, it could only be used to ensure that the project was still proceeding in the proper direction. Furthermore, when the desired ends could not be measured relatively accurately, the output control would not be able to perform a comparison process. Therefore, reliance on the use of such output control should be avoided.

The emphasis of the control function implemented by the units examined seems to be on input control. Although the expected output cannot be described clearly and measured financially before hand, the role of the dimension of the control tools may overcome the weak point to limit the decision space of the project under control. In turn, the role of process control would also play a significant role as a complementary control function to ensure that the project remains within the preferred behaviour. In turn, the role of output control may be limited to justifying that the project had been done, rather than to measure achievement.

The role of Accounting in Management Control Systems

Previous studies have indicated a significant role for accounting in control systems (Hopwood, 1973; Govindarajan, 1984; Otley, 1978; Brownell, 1982; Hirst, 1981). However, the uses of the different environmental characteristics of the units studied make the result vary (Chenhall, 2003). In addition, the previous studies focused the investigation on the role of accounting in output control where accounting was used as a yardstick for performance evaluation, and there were fewer investigations into input and process control.

In this study, accounting is treated as one of the control tools that may contribute to the management control system through the input, process and output controls. The purpose of input control is to define the input that should be appropriate to be used by the action. Therefore, the execution of input control by the units under investigation was on the project evaluation and selection process. It was indicated that with the evaluation and selection process the budget was used only as a boundary to limit the actors' decision space rather than a yardstick to measure their performance. This may be caused by lack of comprehensiveness of the accounting data used to represent the goals. Under a perfect situation, accounting data may represent the elements embodied in the goals relatively completely. For this circumstance, accounting may be appropriate to measure the performance and to limit the decision space financially. In contrast, under an imperfect situation, accounting data may be an incomplete description of goals, and therefore would be inaccurate to measure performance, and would only be able to limit the project’s financial boundary.

The purpose of process control is to ensure that the tasks are performed, and they are performed in accordance with the committed norms. Therefore, process control in this study was executed during the project duration. As part of process control, accounting may have three contributions to the management control system. First, accounting data provides criteria to define good performance that can be used by process control to ensure that an action has been done toward the achievement of those criteria. This control function may be used to base a decision for a reward and corrective action. Second, accounting data defines a boundary that will facilitate process control in monitoring the action to ensure that it remains within the limits. Third, the accounting system provides an internal control mechanism that reduces the chance to enhance individual benefit, and to encourage the system to produce valid and reliable accounting information on which to base a decision. However, the quality of the internal control mechanism relies upon how the accounting tasks are distributed among individuals within the organisation. The reliability of accounting information is influenced by a separation of at least three tasks:

1. Maintaining assets and cash payment
2. Justifying transactions
3. Preparation of reports.

The data presented in previous chapters indicated that accounting data was less effective as means of assessing achievement. Moreover, the accounting information that was produced during the project duration gave no indication that it was to be used for future reference rather it was used as a justification that the funds had been used. Though the accounting data was used to monitor the project, it had no clear relationship with the expected scientific output. Therefore, the accounting data was used only to define a boundary and the process control system encouraged the project to remain within this financial boundary.

A project's treasurer is required to administer each government project. The project's treasurer was at least responsible for four tasks; to receive the funds, to maintain the funds, to administer the project's financial transactions, and to prepare the financial report (Yujana, 1992, pp. 140-144). In this situation, there was no separation of those three critical tasks, in which the treasurer performed the task of maintaining money, performing cash payments and receipts, as well as maintaining the accounting record. Therefore, the internal control situation on the unit examined was found to be ineffective.

The purpose of output control is to ensure that the goals have been achieved by the action. The information produced by the accounting system contributes to the output control to measure performance and as a basis for corrective action. However, the units examined by this study were found to use the accounting data only to justify the funds that had been consumed. There was no indication found on the use of accounting data for performance evaluation among the units, as well as no financial criterion was used to measure the performance of individual scientists. This finding leads to the interpretation that when the output R&D activities cannot be measured financially in the short term, there is only a little role for accounting in output control.

Apart from a non-profit orientation of the government sector, the nature of the R&D organisation may also influence the inappropriateness of accounting data for output control. Two major factors that characterised the nature of the R&D operation can be proposed as a cause of the inappropriateness of accounting data for output control. First, this may be because there is a long time horizon between the execution of the project and the expected financial benefit. Before the output from a R&D operation, particularly in basic and applied research, can be constructed as a financial benefit, it should go through a product development process. For the product development, the time lag between the execution of this activity and the financial benefit received may take four to six years (Ravenscraft & Scherer, 1982). Therefore, the long time horizon between the execution of basic and applied research and the occurrence of financial benefit will influence the inappropriateness of accounting data for output control for the short term. Second, a key factor for the execution of output control is a product that resulted from the project. However, the product of basic and applied research contains a large portion of scientific output that is difficult to measure financially. This condition may influence the inappropriateness of accounting data to be used as part of output control in the short term. Therefore, it could be said that for the units that run basic and applied research the role of accounting data as part of the output control would be less significant as a measure of performance, rather it is used to draw the financial boundaries.

Summary

The government sector in Indonesia still holds on to the administrative systems introduced during the colonial era that used a centralised control mode and created bureaucratic elite in Indonesia. This was indicated by the practice of the management control systems for the projects of the units under investigation that showed the role of the Planning Agency and the Directorate of Budget in selecting and controlling the projects. Although efforts had been made to improve the systems, there was not much change however, and the systems were still based on the centralisation of power mode. Some efforts had made recently through a trial of using a double entry accounting system and unifying the budget as well as making the systems less centralised by an introduction of regional autonomy. However, there were no changes in detailed standard operating procedures that would affect the management control systems; rather there was only an improvement in accounting technicality. Therefore, it can be said that the existing management control systems applied by the units under study is a very archaic system where the reasoning of the management control systems has undergone no change since the Dutch period.

The units examined dealt with an uncertain environment. This uncertainty arose from internal and external elements of the environment. The internal environment refers to the nature of performing the tasks and uncertainty about the expected output and the external environment refers to uncertainty regarding the decision made by the external parties to approve the proposal. This environmental uncertainty was also indicated to influence the setting of the organisational structure of the units. The R&D centres investigated were found to use an organic structure based on disciplines. The organic structure has three advantages; one, providing flexibility for the R&D unit allowing it to adapt to a rapid change situation, two, the creation of an informal and friendly climate within the unit, and three, supporting the existence of cultural control.

It was indicated that the goals of the R&D projects were derived from and directed to achieve the system goals rather than the operational goals. The goals of the projects under two centres were characterised by a directional dimension and the project's operation as a learning process. This characteristic will prevent the control system from using the desired ends as a yardstick to measure the performance quantitatively. It may only be used to define new goals in which the preferable planning system would be directional planning rather than planning toward goals.

The elements of actors were indicated to be important in controlling the R&D organisation in which the researchers were considered different from non-researchers. The ideal behaviour of a researcher was related to innovative behaviour to create new knowledge. Therefore, the performance of the researchers was preferably measured by the scientific dimension rather than the bureaucratic dimension as for non-researchers. The motivational element to encourage the researchers to remain within the desired behaviour was financial reward, which resulted from promotion in official rank, as well improvement in scientific reputation. The domination of the researchers toward the controlling parties was exercised by the researchers where the power to dominate others resulted from excess information about the project's operation. The controlling parties in turn, attempted to reduce this domination by enforcing directional, bureaucratic and financial dimensions to limit the decision space of the researchers.

The implementation of input control used formal and informal control types, and used the four dimensions of control tools in practice. The execution of formal control types through the selection of the project goals was shown to use a directional dimension. Formal control types were also used through standard operating procedures, which used bureaucratic and financial dimensions. In addition, the Ministry of State for Research and Technology also extended the scientific dimension formally to a project from a non-departmental institution. In turn, the informal control type was executed through the culture of the organisation during the seminar presentation. There was no surveillance control found to occur in controlling the researchers.

The control tools exercised during input control were found to have the three values of representation. The directional and financial dimensions of the control tools used the external and internal values of representation. In addition, the scientific dimension executed by the Ministry of State for Research and Technology used only external values of representation. In turn, the cultural control exercised informally during the seminar presentation contained social values of representation.

Regarding process control, four of the dimensions of control tools were used in the process. The directional, bureaucratic and financial dimensions were applied formally by various parties such as internal and external auditors, the Planning Agency, and the Directorate of Budget. However, since a R&D operation is a non-repetitive activity and difficult to connect to the financial aspect, the use of those control dimensions was limited to maintain the project within the boundary rather than to measure the achievement. The scientific dimension however, was executed informally trough regular seminar presentations by the R&D project for Biotechnology. Furthermore, the directional and bureaucratic dimensions used by external parties can be said to contain external values of representation, whereas the financial dimension by using the budget as comparison can be said to contain internal values of representation. Finally, the scientific dimension used during the internal seminar within the centre would contain social values.

The implementation of output control in the units under investigation was done through a formal control type. The accomplishment report indicated that four criteria were used to assess the performance, they were; administration, projects' goals, physical target, and financial target. The administration target was interpreted to contain the bureaucratic dimension, while the projects' goals would be directional dimension. The use of physical targets was interpreted as less relevant because most of the scientific findings would not be presented physically. The financial target was interpreted as part of the financial dimension in which it would be represented by the budget that contained internal values of representation. The use of the scientific dimension was not found in the output control. As the R&D operation is a non-repetitive task, and is difficult to connect to financial value, the use of those dimensions in the control tools should be kept in balance.

As part of the input control, the accounting data may contribute to the management control systems in four areas;

1. to define a financial boundary,
2. to define criteria for performance measurement,
3. to provide data for future reference, and
4. to reduce fraud and data manipulation.

During the input control, the accounting data for control purposes was used by all units to define a financial boundary to the projects' operation. With the process control, the accounting data was to monitor whether the projects remained within the limit, rather than to measure the achievement. Throughout the implementation of output control, the accounting data was not used to measure the performance, nor as a future reference, rather only to limit the financial boundary. Therefore, it could be said that accounting has only a little role in controlling an R&D operation particularly in basic and applied research.

Overall, the management control systems practiced by the units under investigation seem to be ineffective. It is suggested that the emphasis of the management control system during the three critical points of control execution should be placed on the input control, while process control would be used as a second layer to ensure that the project operated within the boundary. When the operation is risky and requires a significant amount of money to be consumed, the control function is best to be emphasised in the first place. It should be kept in mind that when the output and the action to perform the tasks cannot be taken for granted, the output control would be less significant. Nevertheless, the output control should be able to reveal the output of a R&D operation by using scientific dimensions rather than financial.

The next chapter is a concluding chapter that presents final remarks on the practice of management control systems, the historical influence, how the control elements are used, and the reason for using the control elements. In addition, the next chapter also presents the implications of the study and limitations of the study as well as suggestions for further research.

CHAPTER TEN

The Conclusion

Introduction

The literature shows that R&D activity is a learning process and the R&D unit operates in a relatively uncertain and rapidly changing environment. This makes the goals of R&D activities difficult to measure financially. The R&D organisation requires an innovative or creative work climate and the employees are predominantly professionals, which influences their behavioural characteristics. The uncertain and dynamic environment dealt with by a R&D organisation ensures that clear goals are defined through an action process. In such a situation the system will be unable to develop in advance, a relatively accurate standard, particularly using monetary measurement for the control function. In addition, the employees' characteristics such as impatience with routine, disdain of regulations dislike of bureaucracies and abhorrence of administrators would require neither a very tight nor a loose control model. Otherwise, the employees' innovative capabilities may be reduced.

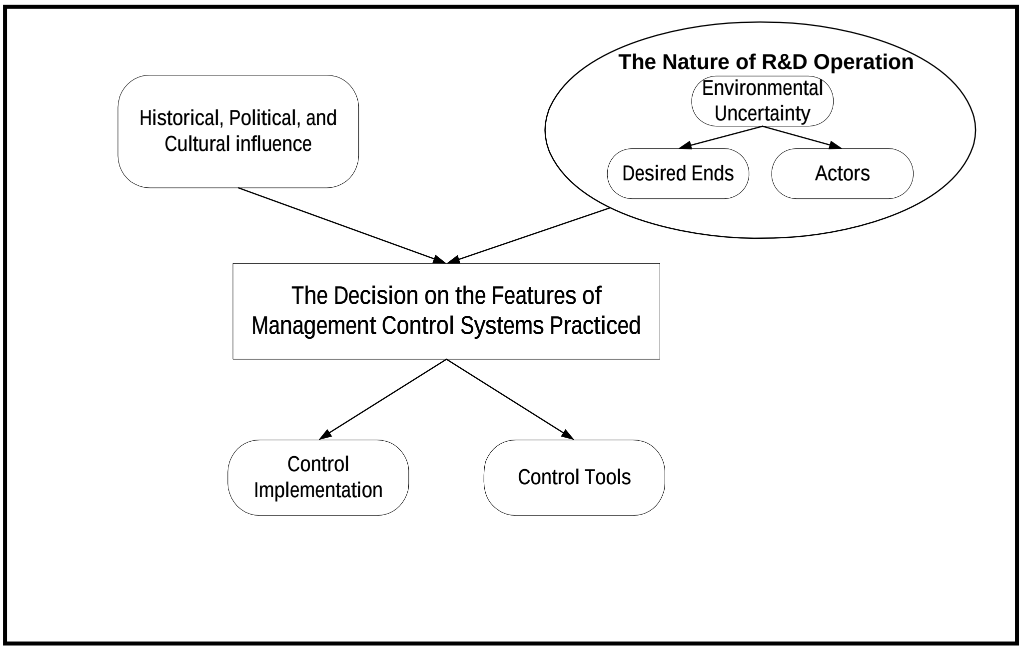
This study is built on the thrust of those characteristics of R&D organisations and used a case study research strategy to conduct an investigation into how management control systems were applied in public sector R&D organisations in Indonesia and why such practices were chosen. The study developed a framework that consisted of four core elements of a management control system that need to be considered in setting the control function. Despite the historical and environmental uncertainty, the framework was used to explain how and why such practice was implemented. The study does not intend to generalise the finding, rather it intends to contribute to the body of knowledge and practice, showing the consideration of the four core elements in setting the management control system. The study is limited to public sector research organisations in Indonesia and is concerned with the period 1993/2004.

The chapter consists of four sections. Firstly, the section begins with a discussion of the practice of management control systems in Indonesia and includes a discussion of the historical influences on the current practice. Then follows a discussion of the use of the management control elements, and closes with a discussion of the reason for the use of the control elements. The second section contains a discussion of the implications of the study and is followed by the third section that presents the limitations of the study and suggestions for further study. Finally, the chapter ends with a summary.

The Practice of management Control Systems

The management control system that is applied in public sector R&D organisations in Indonesia is a very archaic system and is tightly centralised by the central government in Jakarta. This is evidenced by the fact that project approvals can only be made by the central office in Jakarta. The approval process includes the role of the Planning Agency, the Minister of State for Research and Technology, the Agency for R&D in Industry, and the Directorate of Budget. The implementation of this practice of management control in the public sector in Indonesia has been influenced by many factors including the historical, political and cultural background of Indonesia, and the nature of the R&D activity itself that consists of the environmental uncertainty, the characteristic of desired ends, and the actors. This finding then will refine the interaction among the four control elements proposed by the study, by placing those factors above as influencing factors to the choice of the feature of the management control systems practiced. The interaction is presented in figure 10.1.

Figure 10-1: Factors Influencing Management Control Systems Practiced



Two major factors influenced the choice of the features of the management control systems, they are; Historical, political, and cultural factors and the nature of the R&D operation. The Historical, political, and cultural factors influenced the centralisation of the management control systems practiced to the central office in Jakarta. The nature of R&D operations that deal with uncertainty affects the choice of the desired ends and leads to the different treatment of the actors in R&D activities, which then, affects the choice of the features of the management control systems practiced. The features of the control systems are related to two main elements; control implementation and control tools. Further discussion of those two factors and the use of the features of the control systems applied will be presented below.

The historical, Political and Cultural influence

Historical evidence indicates that Indonesia has in the past been influenced by many countries. But the period when the Dutch including the Dutch East India Company (VOC), occupied Indonesia was the most significant. The Dutch were in Indonesia for about 350 years and established administrative systems that were centralised in Batavia, which is now it is called Jakarta, the capital city of the country. In order to centralise their power, the Dutch created an indigenous bureaucratic elite called the “Pangreh Praja” (meaning the rule of realm) as the colonial agent to deal with the local society. This group consisted of Javanese aristocrats who had family relationships with the former kingdoms of Java. The Dutch placed them in the bottom line of civil servants.

Near the end of the colonial era, the Dutch introduced a western education system. However, only limited indigenous Indonesians were allowed to enrol in these schools and these mostly came from the families of the bureaucratic elite and the Chinese group. Again, this course of action centralised the administrative function within this group. Apart from the Dutch government, there were at least four major groups involved in Indonesia during the Dutch era. They were the Javanese aristocrat group who were mostly civil servants who were involved with the administrative function of the government, the Chinese group who controlled the economy, the Javanese intellectual group who mostly came from the families of the aristocrats, and the Islamic group.

After the Dutch era, the Japanese came to occupy the country for about three and a half years. The Japanese attempted to eliminate the western influence, including its administrative systems. Unfortunately, within a very short period the intention could not be achieved. Rather, the Japanese had to rely upon the existing administratively skilled labourers who were again members of the aristocrat group. In 1945, Indonesia obtained its independence and was led by Soekarno. Again, Soekarno had no choice but to keep the existing group in charge of the administrative function and use the Dutch administrative systems to rule the country. At the beginning of independence, the country was full of riots, had limited funds, and a high inflation rate, which meant that Soekarno had no chance to develop the administrative system during his leadership.

During the era of the New Order, Soeharto who has a strong Javanese background had a big chance to improve the administrative systems. Although there were some developments made in policy and regulation which affected the standard operating procedures, using military power, even through parliament, he remained centralised the control over bureaucracy (King, 1988). The use of the Dutch's accounting system through the ICW (which is the Dutch administrative policy) is another evidence of the preference of centralised control over bureaucracy. During the era of New Order, the change on the administrative system since the colonial era was only to translate the Dutch's administrative policy into Indonesia. Furthermore, this practice of the centralisation of power using administrative systems was indicated by the fact that all of the groups investigated were controlled from their central office in Jakarta. Thus, the management control system practiced is based on a very archaic system the basis of which has undergone no change since the time of the Dutch who centralised power into central government.

Habibie was the next leader after Soeharto and he again activated the decentralisation policy. However, he only stayed in power for 17 months and did not have enough time to make further improvement. Similarly, Abdurrahman Wahid who came into power for less than two years had no chance to make further improvement. Megawati came to power to replace Abdurrahman Wahid and stayed for nearly three years. She made two important changes to the administrative function by changing the accounting system from single entry to the double entry system and changing the budgeting system from the routine and development budget system to the unifying budgeting system. However, the changes were only technical in nature, without affecting the core problems of the centralisation of the control system. Although the new president made policies regarding autonomy, the central office in Jakarta, where all cabinet members are situated would like to hold the status quo in controlling all regions by assuming that the regions are not yet ready to operate without being directed by central office.

Considering the diversity of ethnicity and religion as well as the huge number of islands in Indonesia, the system should consider the balance of power. The power to approve a project proposed from a province may be given to the provincial level, which is headed by a governor, rather than the central offices in Jakarta. In addition, centralisation of power on a specific ethnic group may also need to change. Rather than using an ethnic basis as had been experienced through the Pangreh Praja which lead to nepotism, a level of competence would be a better basis to use in appointing a person to a particular official rank of the civil service.

The Organisational Environment

The units under investigation were found to deal with environmental uncertainty that is summarised in Table 10.1.

Table 10.1: Types of uncertainty deal with by the units

The Units being controlled	Types of Uncertainty
The R&D Centre for Biology	1. Scientific requirements, 2. Action of external parties (the Ministry of State for Research and Technology, the Planning Agency and the Directorate of Budget)
The R&D Centre for Textile Industry	1. Scientific requirements, 2. Requirement and/or users' needs, 3. Action of external parties (the Planning Agency and the Directorate of Budget)
The R&D Centre for Metal, Machinery and Electronic Industry	1. Scientific requirements 2. Requirement and/or users' needs 3. Action of external parties (the Planning Agency and the Directorate of Budget
The Units that performed the control	**Types of Uncertainty**
The Planning Agency	1. Knowledge contributed by the output, 2. Transformation process, 3. Amount of budget to finance the project, 4. The linkage of expected output with the national development plan
The Directorate of Budget	1. Understanding regarding the output characteristics 2. Transformation process, 3. Amount of budget to finance the project.

The R&D Centre for Biology which operated more on basic research were found to deal uncertainty arose from two sources; the scientific requirements and the action of external parties. Since the R&D Centre for Biology was a non-departmental institution, the Ministry of State for Research and Technology must also assess its project proposal. Therefore, the action of external parties is related to the Ministry of State for Research and Technology, the Planning Agency and the Directorate of Budget. The R&D for Textile Industry and the R&D Centre for Metal, Machinery and Electronic operated on applied research and were departmental institutions that did not need assessment by the Ministry of State for Research and Technology. These units dealt with uncertainty that arose from three sources; the scientific requirements, the requirement and/or users' needs, and the action of external parties of the Planning Agency and the Directorate of Budget.

The personnel from the Planning Agency and the Directorate of Budget who has a least experience in conducting a R&D project experienced with uncertainty on how to conduct the research, the benefit bring about the expected out put, amount of budget to be allocated, and the linkage of the out put with the national development plan.

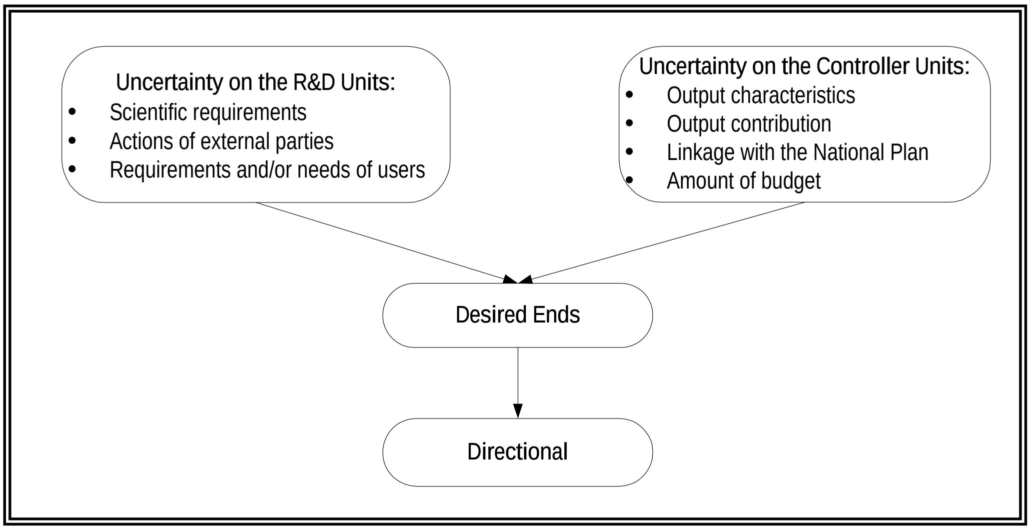
The Use of Management Control Elements

Apart from historical influence and the environmental uncertainty, the management control systems applied to R&D projects in the government sector in Indonesia were found to use four control elements in the different stages of control implementation and these will be summarised below.

Desired Ends

The elements of Desired Ends as indicated by the R&D projects' goals were found to have more qualitative characteristics. The projects' goals were stated in relation to the National Development Plan, within the role of the Ministry or Institution, and within the desired scientific boundary. This choice of goals setting is influenced by environmental uncertainty as the nature of the R&D activities, which is presented in figure 10.2.

Figure 10.2: The influence of environmental uncertainty on goals setting

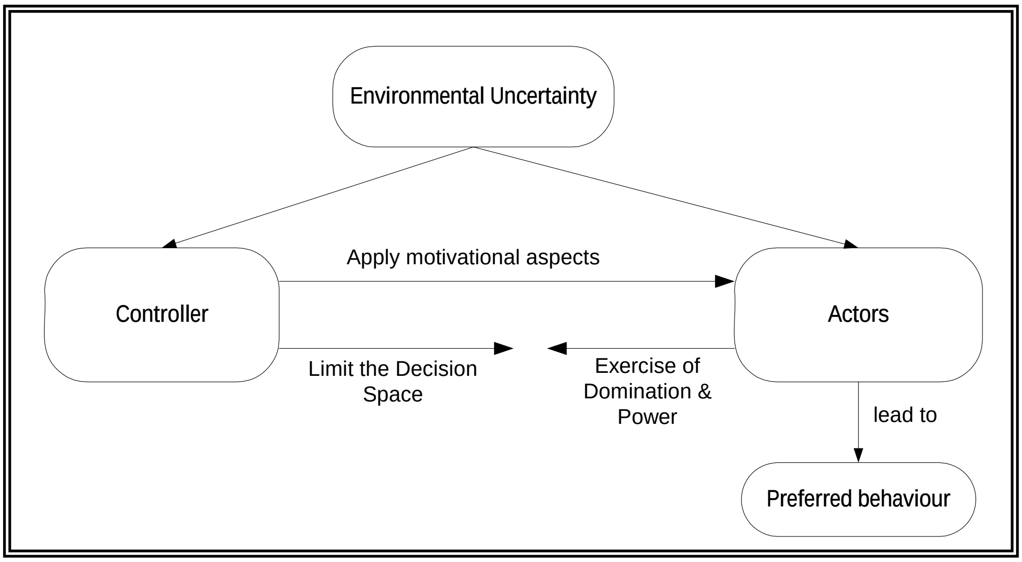


The environmental uncertainty dealt with by the controller and controllee created low level of predictability of the output, which then lead to the choice of the goals setting that were characterised by direction. Regarding the two sub-elements of the desired end proposed by the study, the finding is corresponding with the suggestion that under the environmental uncertainty the emphasis would be on the direction rather than yardstick.

Actors

The study proposed that Actors consists of five elements; behavioural, motivational, domination, power and decision space. The study found that the research personnel were treated differently compared to non-research personnel, which make a refinement from the originally proposed by the study. The use of these five elements is constructed in figure 10.3.

Figure 10.3: The use of the components of Actors



The use of a functional career path for the scientists indicated that the preferred behaviour would be to produce knowledge rather than concentrate on administrative matters as in the use of a structural career path. Although the output of the project was not directly related to the achievement of an individual researcher however, the researcher could use the output of the project to publish a paper as a scientific achievement. This would allow the scientist to obtain credit points on which to base a promotion as well as an improvement in the scientific reputation.

The purpose of using behaviour and publication of scientific papers as a base for promotion is in line with one sub-criterion in selecting a project proposed by Twiss (1992) as the attitude to innovation. The domination (Chua et al, 1989) of the researchers over the controller was found to be exercised during the budget meeting. The source of power to dominate others was indicated from the excess knowledge about the project's operation. This finding is in line with the study of Dillard and Burris (1993). The intention to dominate the controller may be affected by the uncertainty dealt with by the controller, which was known by the researcher.

Since the controller experienced with uncertainty then, the controller was found to use the goals (by the Planning Agency) and the budget (by the Directorate of Budget) as to limit the decision space of the project. The purpose of using decision space is to decrease the risk of making decision and to reduce domination of the researcher.

Control Implementation and Control Tools

Various internal and external units executed the management control systems for R&D projects in the government sector in Indonesia. The internal units were the Planning division of the centre, the Head of the R&D centre and the scientific group. The external units were; the National Planning Agency, the Directorate of Budget, the Ministry of State for Research and Technology, the Directorate of Budget, the Agency for R&D in Industry, the Financial and Supervisory Agency, and the Internal Audit unit. These institutions were involved in the different stages of control implementation, from input to process and to output control that will be discussed below.

<u>Input Control</u>

Internal and external units executed input control during the project selection process in which the features of the management control systems applied by the units under study is summarised in table 10.2 below.

Table 10.2: The Feature of the Management Control Systems applied to Input Control

Units that perform the control	Features of the management control systems			
Internal	Types	Tools	Dimension	Value
Scientist during Seminar	Informal	Culture	Scientific	Internal and Social
The Management of the Centre	Formal Formal Formal	Goals Budget SOPs	Directional Financial Bureaucratic	Internal Internal Internal
External				
The Agency for R&D in Industry	Formal	Goals	Directional	External
The Ministry of State for Research & Technology	Formal	Goals	Direction Scientific	External Social
The Planning Agency	Formal	Goals	Directional	External
The Directorate of Budget	Formal Formal	SOPs Budget	Bureaucratic Financial	External External

The control types used during the input control were mostly formal control, except the one that used by scientists during the seminar presentation. In turn, the control tools used were goals, budget, SOPs (Standard Operating Procedures), and culture. Those tools contained the four dimensions; directional, financial, bureaucratic, and scientific. Unless the scientific dimension that contained social values, the dimension of control tools used by internal units mostly contained internal value of representation that was developed with regard to the condition of the R&D centres. Furthermore, the dimensions of control tools applied by the external units were found to contain external values of representation.

Having experiences in conducting a R&D project, the scientist would be able to emphasise the selection to ensure that the expected output would bring a scientific contribution. In turn, the management of the R&D Centre (the planning unit and the head of the centre) would focus the control tools on the goals of the centre, SOPs, and the budget. The input control performed by the management was to ensure that the project operates in line with the goals and within the function of the centre. The use of SOPs that contained bureaucratic dimension was to ensure that the project complied with the existing regulation. The purposes of using budget with its financial dimension were to limit the financial decision of the project as well as to ensure that the total budget of the centre was not over the budget ceiling.

In the similar vein, the external units that dealt with uncertainty emphasised their control tools on the goals, SOPs, and budget. The Agency for R&D in Industry was to ensure that the project's operation was in line with the objectives and functions of the Ministry for Industry. The Ministry of State for Research and Technology used the control tools to ensure that the output would be scientifically appropriate and relevant to the National Direction of Science and Technology. The role of the National Planning

Agency was to coordinate, monitor and evaluate the R&D projects in relation to the National Development Plan. Therefore, the control tool used by the agency was to ensure that the project's operation was in line with the National Development Plan. Finally, the Directorate of Budget who also experienced with uncertainty would emphasise its control on the SOPs and the budget. The use of SOPs was to ensure that project had complied with the existing rules and regulation. In turn, the use of budget was to limit the project's financial decision as an alternative means for the control system to decrease the risk of making a wrong decision in approving a project.

Process control

There were various internal and external units involved in process control. They were; the management of the centre (Planning unit and head of the centre), the scientist group, the internal audit unit (Inspektorat Jenderal), the Agency for R&D in Industry, the external auditors (the Audit Board and the Financial and Development Supervisory Agency/BPKP and the Indonesian Audit Board/BPK), the Planning Agency and the Directorate of Budget. The feature of management control systems applied by those units during the process control is summarised in table 10.3.

Table 10.3: The Feature of the Management Control Systems applied to Process Control

Units that perform the control	Features of the management control systems				
Internal	Types	Media	Tools	Dimension	Value
Scientist during Seminar	Informal	Seminar	Culture	Scientific	Internal & Social
Internal Auditors	Formal Formal	Accounting record Performance report	SOPs Spending	Bureaucratic & Financial	Internal Internal
The Management of the Centre	Formal Formal	Performance report Performance report	Goals Spending	Directional Financial	Internal Internal
External					
The Agency for R&D in Industry	Formal	Performance report	Goals	Directional	External
The Planning Agency	Formal	Performance report	Goals	Directional	External
The Directorate of Budget	Formal	Performance report	Spending	Financial	External
External Auditors	Formal Formal	Accounting record Performance report	SOPs Spending	Bureaucratic & Financial	External External

The scientist group implemented informal control through regular seminar presentations twice a year by using a scientific dimension through culture, which contained internal and social values of representation to encourage the project's operation within a desired scientific range. The internal auditors regularly performed an audit, while the external auditors performed an audit once a year. Both auditors used a formal type of control with regard to standard operating procedures including the accounting records to measure compliance, and the performance report (Form B-1) that presented budget spending as financial criteria to measure efficiency. Regarding the control tools, the auditors used bureaucratic and financial dimensions, which contain internal values for internal auditors, and external values of representation for external auditors.

In the case of R&D project under the Ministry of Industry, the Agency for R&D in Industry was also involved in process control. The performance report (Form B-1) was used by the Agency to monitor and ensure that the project progress was remaining toward the goals of the Ministry of Industry. This agency used the goals with the directional dimension and contained external value to control the project.

The Planning Agency and the Directorate of Budget are also involved in monitoring R&D projects as indicated by the requirement to send a copy of the performance report (Form B-1) to these units. The Planning Agency may use the goals achievement to ensure the direction of the project remained toward the National Development Plan. In turn, the Directorate of budget may focus on budget spending presented in the performance report, and therefore emphasised the tools on the financial dimension with its external values of representation.

<u>Output Control</u>

The implementation of the management control system for output control is similar to that of process control unless the role of the scientist group was not present. The external institutions involved and the report (Form B-1) used are also similar to that of process control. Internal and external auditors, the Planning Agency and the Directorate of Budget implemented formal control, while the dimension of the control tools used involved bureaucratic and financial dimensions which contain internal and external values of representation. Since the projects were about R&D activities, it was expected that a scientific dimension would be used as an output control to measure the achievement of the R&D projects (Stahl and Steger, 1977; Schainblatt, 1982; Weinberg, 1989). However, no such use was made of the scientific dimension to measure the final performance of the project. An alternative explanation for this practice may be relevant to one of the purposes of management control systems to direct the actors toward a preferred behaviour (Flamholtz, 1983; Birnberg and Snodgrass, 1988). Since the R&D projects were involved with basic and applied research, the individual researcher may be encouraged to use the finding of the project for written work in a scientific publication and/or oral presentation (Place, 1977) and to assist his or her promotion as indicated by the functional career path.

The implementation of the control systems through input, process and output control confirm Amigoni’s proposition (1978) regarding the turbulent environment with a high degree of discontinuity that influences the choice of control features to be more future oriented, and required a combination of control tools other than that provided by the financial dimension. The situation of the R&D operations examined that were characterised by non-repetitive tasks required a combination of control tools of directional, scientific, bureucratic, and financial dimensions.

The reason for using the Control Elements

The reason to implement the control systems as such may also be influenced by the nature of the R&D activity itself as a learning process, a non-repetitive task, with the difficulty of determining output quantitatively and financially in advance. Such a situation may create uncertainty among the parties involved in controlling the state of affairs. The study indicated that the researchers on the R&D projects examined dealt with uncertainty, which included task uncertainty and the uncertainty about the action of the dominant parties that were assigned to approve or reject the proposal. In turn, the controller group had limited information about the performance of the task and were unable to measure the desired end quantitatively and financially.

This situation led the controller group to apply the control system formally in selecting the proposal by comparing the project’s desired end to the desired direction such as the objectives of the centre, the objectives of the ministry, the National Direction for Research and Technology and the National Development Plan. In addition, the control systems were also applied to ensure that the project’s goals were within or remain within the objectives of the related ministry or institution. This aim was facilitated by the use of a bureaucratic dimension of the control tools as expressed by the use of the proposal form or accountability report that had to be approved and signed by a related head of the units. This finding is parallel with Twiss (1992, p. 131) who suggested that “corporate objectives, strategy, policies and values” as one of the important criteria in selecting a R&D project.

Another aspect of the R&D organisation was that the majority of employees were scientists, were clearly treated differently to non-scientists. This circumstance brought about the use of the scientific dimension of control tools. The scientific dimension was applied informally by the group of scientists during the regular seminar, and was applied formally by the Ministry of State for Research and Technology in the case of non-departmental institutions. The use of the scientific dimension of the control tools should have played a significant role as a supplemental component in the absence of quantitative and monetary measurement. The use of the scientific dimension of the control tool was not found during the output control. The accountability report (Form B-1, see Figure 7.7) which facilitated process and output control, was shown to have an estimated of a physical target measure but this can be easily manipulated by the project. It can be filled with the quantity of research outputs such as the number of research reports accomplished, which may not be a significant measure of scientific achievement. Given this situation, the use of this form for control purposes emphasises the financial dimension.

During the process and output control the auditors emphasised heavily the use of the bureaucratic and financial dimensions of control tools. The reason for this may be caused by a limited knowledge of the scientific achievement of the project. Similarly, the Planning Agency emphasised its monitoring system through the directional dimension of control tools, and the Directorate of Budget used the financial dimension because they have more understanding of financial matters. It could be said therefore, that the choice of the use of a control dimension practiced by a controller group was to favour that which the controller had more knowledge of rather than that which the system needed to be emphasised.

Implication of the study

This study contributes to the body of knowledge particularly in the area of the practice of management control systems. The contribution that this study makes to the body of knowledge is the idea of using four control elements that need to be considered simultaneously in designing a management control system particularly for a R&D organisation. The four elements are Desired Ends, Actors, Control Implementation, and Control Tools. The study identifies the characteristic of desired ends, considers different types of employees, describes the different stages and types of control implementation, and provides a classification of control tools as well as the values represented by the control tools.

The study proposes two components of Desired Ends; Direction and Yard Stick where the relative dominance of each component that exists within a situation will affect the practice of control implementation and the choice of control tools. In addition, the element of Actors is also suggested by the study to have an implication for the practice of control implementation and choice of control tools. Five components of the Actors were considered by the study: and they are; Behavioural, Motivational, Domination, Power, and Decision Space.

Apart from those two elements, the study also identified two major components of Control Implementation; they are the time to apply the control, and the types of control used. The time of implementation is broken down into three stages; input, process and output control. In turn, the type of control systems consists of two major types; formal and informal control types.

The study also identified two important components of Control Tools, they are; Dimension and Value of Representation. The study suggested four dimensions of control tools viz; Directional, Bureaucratic, Scientific and Financial dimensions. These dimensions may contain different values of representation and the study proposes three values namely internal, external, and social values. The importance of value of representation is related to the awareness of something that may be correct to one person but may be incorrect to another. Since the control system followed a systemic approach and applied those four elements simultaneously, the shared values that are accepted by each party involved must be considered and be used to measure the performance.

Although there is no intention of the study to generalise the finding, the study brings a contribution on the fact of how and why the elements of the management control system are applied in practice by selected units of an organisation. By identifying the elements of the control system in more detail, and demonstrating how and why they were used simultaneously in practice, the study brings about a contribution to enrich the concept of management control systems. The use of those elements and its components respectively may be applied differently in different situations dealt with by an organisation.

The study investigated the practice of management control systems in three R&D Projects in the government sector in Indonesia. The study indicates that the management control systems practiced were influenced by the country’s historical, political and cultural background by using a centralised control system. Since the country contains more than 500 major ethnic groups and widespread over 17,508 islands, a certain degree of centralisation that leads to standardisation of the administrative system may be an advantage in such a diverse country. However, the use of such a tight control system where all the decisions were made by the central offices in Jakarta seems to be inappropriate. Decentralisation of a certain degree of the control system among the hierarchy, areas, and ethnic groups may be more beneficial for the country’s development. Since the control system is centralised, the span of control may be too long, and decision making process to deal with the changing environment may be too slow to respond as required by such a situation.

The practice to differentiate departmental and non-departmental institutions in selecting a R&D project may use different values of representation of the scientific dimension of control tools in assessing the proposal. R&D project under a departmental institution which was selected by a group of scientists within the unit used internal and social values, while a non-departmental institution that was scientifically assessed by the Ministry of Research and Technology used a social and external value of representation. It is suggested therefore, to develop uniform procedures in selecting R&D projects which use the same values, whether internal or external for the scientific dimension of control tools. In addition, as the R&D core output is knowledge, the use of the scientific dimension of control tools should be part of the formal control types that need to be implemented throughout input, process and output control. By so doing, the assessment of what had been achieved, and what and how to measure it will be on line.

The nature of the R&D activity may also be linked to the inappropriateness of the centralised control system. The R&D activity is a learning process; it deals with uncertainty, and is difficult to measure quantitatively and monetarily. In addition, as a learning process, the R&D activity needs a situation that supports creativity, which the centralised control system cannot provide. The rigid control systems that emphasise the bureaucratic and financial dimensions of control tools and ignore the scientific dimension would jeopardise innovative behaviour, and finally create dysfunctional behaviour. Therefore, it is suggested that the use of various dimensions must be maintained, however they must be put in balance in respect of the achievements.

The use of the directional dimension of the control tools applied may be interpreted as an alternative in the absence of quantitative and financial measurement of the goals. In such a situation, the role of the financial dimension of control tools as reflected by the use of the budget may play a role limited to a boundary system rather than determine what is achieved and not achieved. If that is the case then, it could be said that the scientific dimension of control tools should be used as a core tool to measure the achievement, while others as directional, bureaucratic and financial dimension are used to limit the decision space of the actors being controlled.

It is suggested therefore that a measure of the performance of a R&D activity may be developed by using and balancing all the dimensions of the control tools in such a way as to ensure and appreciate the effort being done by the project. Applying percentages to each dimension in terms of their importance may be a good practice. However, it should be noted that the use of the dimensions and the weight of each dimension in order of importance must be communicated to all parties, rather than blindly imposed by the controller group. When the assessment criteria and the value represented by the criteria are accepted by all parties, the conflict may rarely occur, and the innovative behaviour may be fruitful.

Limitation and Suggestion for Further Study

Although a lot of effort, awareness and time have been put into the undertaking of this study, there are still limitations. Some of the limitations identified will be presented and a need for further study will be suggested. The study was to investigate the how and why of management control systems applied to R&D organisations. The study used the framework of the four elements of management control system applied by three government institutions to three R&D projects in Indonesia.

As the study was concerned with the government sector, its findings are limited to the government sector particularly in the context of Indonesia. The study was also limited to only three R&D projects under two government institutions in Indonesia, which may not represent the practice of the government sector in another country. In addition, the R&D projects investigated by study limited their activities to basic and applied research, which may be different to product development. As the core samples are taken from different government bodies, the continued process from the basic research up to product development could not be investigated. A further study is required to investigate a continuum process of the three R&D functions that are conducted within a single organization. By doing so the differences in the practice of management control systems among those three R&D functions would be able to reflect a more complete practice of control.

The use of the four elements of the control systems were only investigated at those sample sites, while further study is suggested to use the framework to investigate their usage in different types of organisation. A further study to investigate the use of those elements may be undertaken in the private sector, and/or in different organisational settings. By so doing the further study may find different emphases of control implementation as well as additional or different control tools used by other organisations.

Finally, it should be acknowledged that the study uses a descriptive case study research strategy from which the finding cannot be generalised. Therefore, it suggested for further studies to undertake a similar approach by using similar framework but to investigate different organisational settings. By so doing the enrichment of the body of knowledge in the area of management control systems practiced by different organisations can be added to the inventory of such practices. In addition, an exploratory case study may also be suggested to investigate the use of those control elements in practice.

Summary

The practice of management control systems in Indonesia was found to be an archaic and centralised system. Such practice may be influenced by several factors including historical, political, and cultural as well as the nature of the R&D activities. Centralisation of control was found to be placed in the central government offices in Jakarta. Since the characteristic of the country is unique, and the situation dealt with by R&D organisation is uncertain, it is suggested that the control systems be less centralised, and move toward being more decentralised. The study also found the use of the four control elements applied by different controller groups and in different stages of control implementation. However, there is a need to balance the use of those elements.

This study uses descriptive case study research which makes its findings limited to the three R&D projects in the government sector in Indonesia. Therefore, the study suggested further study in different organisational settings, as well as to undertake explanatory case study research to investigate the existence of the four elements of management control systems in other settings.

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