FACTORS AFFECTING THE EFFICIENT PERFORMANCE OF
THE THAI STATE RAILWAY AUTHORITY:
A TIME-SERIES DATA ANALYSIS

DISSERTATION

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By

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The Thai State Railway Authority (RSR) is a public enterprise in Thailand. As an organization its performance is subject to the argument of contingency theorists that operating efficiency is dependent upon various factors both in the internal and external environments of the enterprise.

Most of the internal factors are those that organization theorists in the developed world have identified such as goals and objectives, resources, and organization structures. Meanwhile, external factors such as political, economic and social conditions of the society are regarded as indirect factors that have less importance than do the internal factors.

Scholars of the developing world have argued that political, social and economic conditions in the society are as important as internal factors. These factors may have a very significant influence on the enterprises and on the society as a whole. Consequently, public enterprises in developing countries always encounter the same problem of
operating inefficiency.

The RSR is selected as a case study because of its advantages over the other public enterprises in Thailand in terms of size of operation, length of service, and data availability. For the purpose of this project, data are collected from 1960 to 1984 for longitudinal analysis.

The methods of analysis are divided into two major sections: simple regression testing and multiple regression testing. The principal component technique is used in both testings to reduce variables to a smaller number for further analysis. The simple regression tests yielded mixed results, but the multiple regression tests resulted in significant relationships.

The three new factors derived from the factor analysis technique were labeled as "the organizational pressures," "the socio-political downturn," and "the public criticisms." They explained 84% of all the variance of operating efficiency. The other 16% was the effect of other factors including the management skills, which were excluded from this analysis.
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CHAPTER I

INTRODUCTION

This research project is a study of the various factors that have affected the efficient performance of the State Railway Authority of Thailand for the period from 1960 to 1984. It is a longitudinal analysis, implemented with regression and factor analysis techniques. The findings of this study should help clarify a number of factors that influence the efficient performance of the Royal State Railway (RSR) of Thailand. This study should also lead to a better understanding of the factors that may affect the performance of other public enterprises, both in Thailand and other developing countries.

Public Enterprises in Developing Countries: An Overview

Among the three economic sectors within developing nations--the government sector, the private sector, and the public enterprise sector--the last has been criticized most often. Public enterprises are proprietary operations of government or government-sponsored agencies. Although many types of public enterprise are able to serve their purposes, several of them have been criticized for such aspects as their slow operation, low efficiency, and operation at a
financial loss. Public enterprises receive so much criticism because their products or services, such as water and electricity supplies, telephone service, and transportation, are directly concerned with the daily lives of citizens. Therefore, the public is always sensitive to changes in these services or products.

Public enterprises are created in developing countries for various reasons, but they have one purpose in common: to be the instrument of the government to help fulfill or supplement the national plan, particularly in social and economic development. Developing nations expect that, if public enterprises have the flexibility to operate like businesses, they can stimulate national development more quickly and serve the public better than traditional governmental agencies.

In most developing countries, the first public enterprises emerged because of the need to improve the national infrastructure. When time and circumstances change, the original purpose is always changed. In Thailand, for example, the government first operated public enterprises in the area of public services, such as electricity supply, the state railway, and the telephone and telegraph service. Later on, more public enterprises were created for other purposes, including producing certain kinds of goods or services, supporting the government in
temporary or immediate needs, and preventing or limiting the influences of foreign traders. As government policy further changed to fulfill either public demands or the government's desires at the time, a large number of public enterprises were created for such reasons as producing industrial products, providing commercial goods to the public, and serving a particular sector of agricultural business.

In such cases, the policy towards public enterprises becomes so general that it can apply to almost any kind of public activity. Thus, a public enterprise may be established only to satisfy temporary needs and situations. The number of public enterprises can increase or decrease dramatically in a short time. Several Thai public enterprises, particularly the monopoly enterprises, operated at sound profit levels. At the same time, other enterprises, particularly the ones that compete with private enterprises in the market, operated at a loss. Some public enterprises have even been eliminated.

The results for the Thai enterprises are not different from those of other developing countries. The literature on public enterprises in developing countries shows that governments have tried to set policies that establish direction for the enterprises. From time to time, the government encounters problems that challenge its own policy, and the policy towards public enterprises
vacillates. Consequently, the enterprises operate not only on the basis of the original policy, but also according to several factors inside and outside the enterprise's organization.

Government officials are frequently selected to serve on the board of commissioners and to represent the ministry or agency that supervises those enterprises as a personal reward for loyalty to the government. In Thai public enterprises, for example, most of the members of the board of commissioners and top executives, such as governor or director-general, are composed of either active or retired civil servants and military officers. In some respects, then, the appointment of government officials in public enterprises serves a useful purpose in providing control and information. However, not all these appointees are selected on the basis of their experience and skills in the enterprise's business. Consequently, the performance of the enterprise is affected by decision-makers of mixed qualifications (Medhora, 1973, pp. 17-29; Phatak, 1969, pp. 348-349; I.B.R.D., 1959, pp. 90-91; Sherwood, 1971; Philip, in Ramanadham, 1984, p. 38; Skinner, 1957, p. 224; Scott, 1972, pp. 60-72; Riggs, 1966, pp. 309-310; Garner, in Ramanadham, 1984, pp. 25-26; Leazes, 1984, p. 77; Abdularhman, 1979, pp. 243-244, 306; International Legal Center, 1976, pp. 29-30; U.N., 1973, pp. 38-40).
Significance of the Study

Public enterprises in developing countries are not trivial inventions, but major institutions centrally positioned in society. They have become important components of the government's administrative and policy-setting process since they were established. The importance of public enterprises has been recognized among scholars, who have tended to concentrate on how to improve the enterprises by increasing profitability, efficiency, effectiveness, or accountability (Abdulrahman, 1979; Bhatia, 1983; Basu, 1976; Botchevy, 1973; El-Namaki, 1979; Fernandes, 1979; Fernandez, 1976; Frank, 1971; Gantt and Dutto, 1968; Garner, 1984; Ghai, 1984; Gupta, 1968; Hanson, 1965; Hauck-Walsh, 1980; Jones, 1975; Le, 1979; Likierman, 1984; Mahmud, 1977; McAuslan, 1979; Nove, 1973; Opoku-Afriyie, 1982; Philip, 1984; Prakash, 1963; Raj, 1977; Ramanadham, 1984a, 1984b; Robinson, 1973; Seidman, 1983; Saddique, 1975; Sheahan, 1976; Shepherd, 1976; Wu, 1967; Yoshitake, 1973).

International organizations have also recognized the importance of public enterprises in developing nations (International Legal Center, 1976; United Nations, 1973 and 1974). Thus, the concept of public enterprise is particularly important and deserves serious further study.

The role of public enterprises in developed countries such as the United States is not as significant because they
are on the periphery of the economic system, but in developing countries, public enterprises play a prominent and crucial role in national affairs. Among developing countries most governments are managing or expanding public enterprises on various scales with the intention of promoting and accelerating national development. Public enterprises are looked upon as the main policy and program instrument by which many political, economic, and social objectives may be attained.

At the same time, developing countries have learned that public enterprises are not easy to administer or manage. Their establishment does not automatically ensure the attainment of public policy objectives. From time to time, public enterprises become instruments of particular cliques operating against the public interest that they are created to serve. By the same token, when the enterprises fail to meet expectations, they become sources of embarrassment and failure.

Another major problem is that, while public enterprises have been created to pursue national development goals in the social, political, and economic arenas, these arenas in turn influence the performance of the enterprises and are the major environmental influences upon them. The degree of influence depends upon time, circumstance, and the nature of the enterprise.
Public enterprises are the major institutions in developing nations, with investments constituting a significant share of the national budget. Thailand, for instance, is a good example. In 1985, Thailand operated over sixty public enterprises under the supervision and control of seven ministries and agencies (Loohawenchit, 1984, pp. 11-12). According to Hongsanun, up to 1985, the Thai government had invested a total of 274 billion (Thai) Baht (approximately $11 billion) for all public enterprises. Also, the public enterprise sector, in 1985, employed 252,000 people. In 1983-1984, for example, while the national budget was only 192 billion Baht ($7.38 billion), all public enterprises invested 399 billion Baht ($15.35 billion) or 208% of the national budget. The total foreign debt of all public enterprises in 1984 was 86 billion Baht ($3.3 billion) or 60% of the government's total debt amount, and the domestic debt in 1984 was 15 billion Baht ($0.57 billion) (Hongsanun, 1985, p. 1; Bureau of Budget, 1983-84).

The economic significance of public enterprises in Thailand makes the Thai government very sensitive to their activities. Their effect on political, social, and economic conditions is no less significant than that of private and other public sectors. Thus, it is important to know how sensitive the public enterprises are to the changing of political, social, and economic conditions. If these
environmental conditions really have an effect on the enterprises, when the effects occur and how powerful they are are subjects that must be examined.

Since public enterprises are such an important instrument to a developing nation, the study of factors affecting the performance of the enterprises will be instrumental in understanding the problems that arise. Moreover, the results of this study may help governments of developing countries recognize the factors affecting public enterprises before they are created. It would also benefit national planners to realize that running public enterprises is not an easy task.

For the purpose of this study, the Royal State Railway (RSR) of Thailand was selected as a sample public enterprise. It is expected that this case study will be significant in a practical way since the RSR is the largest public enterprise in terms of personnel employed. It is one of the oldest public enterprises, created in 1951, second only to the Government Savings Bank. Its employees are also represented by most of the major labor unions in Thailand. Because of its long period of operation, the RSR has experienced the most interaction between the enterprise's performance and political, economic, social, and organizational changes.
The General Method of Study

Research employing statistical methods always has at least one of two fundamental types of data sets: (1) cross-sectional, in which the researcher has collected observations on a set of variables at a given time across many nations, states, counties, cities, or other units of analysis, or (2) time-series, in which one has collected a set of observations on some variables for the same unit of analysis over a period of time. For either type of data, however, the regression technique can be applied to the analysis.

This study applies the regression technique to the time-series design for the following reasons:

(1) Public enterprises have different goals from one another. It is not appropriate to pool the enterprises in a cross-sectional design as the subject of the same study.

(2) Public enterprises, particularly in Thailand, have different histories. Several of them have had very short lives, and the number of enterprises fluctuates at any given time. Essentially, almost all of the other enterprises playing significant roles in Thailand are relatively new. Time-series analysis is most effective for the enterprises that have had a long period of operation; it cannot be usefully applied to study newer enterprises. Cross-sectional analyses including both old and new enterprises would be
problematic.

As a result, this study concentrates on longitudinal research. The RSR was selected because it is the most appropriate agency in terms of data available and its long period of operation.

In cases in which an independent variable was represented by a cluster of several sub-variables, the factor analysis technique was applied to discover the highest correlating sub-variable. That is, principal components analysis was applied to identify the single indicator that would represent the cluster of variables in the regression analysis.

Scope of the Study

Usually, the corporate form of organization is adopted in cases in which a government is managing an economic enterprise, and there is a perceived need to confer a considerable amount of flexibility or autonomy on the enterprise's managers and executives (Tierney, 1984, p. 75). Thus, the term "public enterprise" is understood to signify an economic activity in which the majority of ownership or managerial control is vested in the government or other public agencies, but one which has a corporate structure. Public enterprises are usually created, owned, and/or controlled by virtue of some kind of public act. At the same
time, their products are intended to be marketable and their activities made viable through sales activity on the basis of price-cost relationships.

Most public enterprises, although capable of being run for the private purpose of earning a profit, consider the purpose of the public interest to some degree. As Aharoni points out, public enterprises in any nation share two common characteristics:

(1) Being publicly owned, they are expected to pursue various activities in the public interest and at the same time achieve economic goals and generate cash flows in excess of their cash outflows; (2) they have to reconcile to a changing environment with the need to assure public accountability and consistency with social goals which, in many cases, are not prescribed at all (1981, p. 1341).

Thus, in essence, most public enterprises have a dual purpose. On the one hand, they have to pursue the promotion of economic growth and financial aims, such as generating a surplus and earning foreign exchange. On the other hand, there are usually other, what might be called social, aims.

From this traditional viewpoint, the purposes and goals of public enterprise can be summarized as follows:

(1) The performance of public enterprise is basically based on economic activity to some degree.

(2) The operation of public enterprise is also expected to fulfill the public need to some degree, depending on the goal of each enterprise.
(3) Thus, public enterprises can be seen on a continuum where the profit-making-goal enterprises are at one end, the social-responsibility-goal enterprises are at the other end, and other kinds of enterprises fall between them, depending on the degree of profit-making emphasis or social-responsibility emphasis.

(4) Public enterprises have to address both business and public concerns.

(5) Consequently, the factors affecting the performance of public enterprise are numerous, ranging from the intrinsic variables of the organization, such as managerial skills and organizational characteristics to the extrinsic variables of the organization, such as political, social, and economic conditions. These variables are hypothesized to be critical to the enterprise's performance.

Several studies of an organization's performance in profitability, effectiveness, or efficiency have agreed upon the critical role of the above intrinsic and extrinsic variables (Van Meter and Van Horn, 1975; Carlisle, 1982; Tierney, 1984). Among these studies, the framework proposed by Van Meter and Van Horn in 1975 is the most interesting one. Thus, the framework of this study is derived from their conceptual framework on the policy implementation process.
The Foundation of the Scope of the Study

Van Meter and Van Horn's 1975 study explores how policy decisions are transformed into public services. Van Meter and Van Horn defined policy implementation as "those actions by public and private individuals (or groups) that are directed toward objectives set forth in prior policy decisions" (1975, p. 447). Like Pressman and Wildavsky (1973), they pictured implementation as an undirectional process, but one mandated by prior policy decisions. Yet their study concentrated on the role of organization structure and emphasized human and psychological factors that influence the behavior of the implementors. From this analysis, they developed a model of the policy-implementation process based on six clusters of variables that shape the linkages between policy and performance:

1. standards and objectives
2. resources
3. interorganizational communication and enforcement activities
4. characteristics of the policy implementation agency
5. economic, social, and political conditions
6. the disposition of implementors (pp. 462-474).

Van Meter and Van Horn's analysis highlighted and explored some of the personal and psychological complexities that influence the actors in the implementation arena. This
analysis emphasized the personal, political, and organizational forces at work within the implementation arena itself as a key object of study.

Some other scholars such as McLaughlin (1976), Bardach (1977), Rein and Rabinovitz (1978), and Nakamura and Smallwood (1980) revealed a consistent and progressive shift away from the classical hierarchical model. Nakamura and Smallwood, for example, viewed the process "as a fluid and reciprocal series of interrelationships between different group of actors rather than a straight line classical hierarchy that points directly from the top to the bottom" (p. 19).

Among these viewpoints, the model of study proposed by Van Meter and Van Horn is the most interesting one because they pay attention to factors from several disciplines that possibly affect the performance of the organization. The components of the model that Van Meter and Van Horn used differed little from other adaptations of political system models first introduced by Easton (1965). The components of their model are as follows:

(1) an environment that both stimulates government officials and receives the product of their work

(2) demands and resources that carry stimuli from the environment to policy makers
Van Meter and Van Horn point out that the implementation phase does not commence until goals and objectives have been established or identified by prior policy decisions. It takes place only after legislation has been passed and funds committed (or after a judicial ruling and accompanying decree). Therefore, students of implementation must first examine those factors that contribute to the realization or nonrealization of policy objectives (p. 448).

Van Meter and Van Horn study several disciplines, including sociology, public administration, social psychology, and political science, for their research. The theoretical framework they proposed is developed from three bodies of literature: organization theory and, more specifically, the work in the general area of organizational
change (innovation) and control; the impact of public policy, particularly judicial decisions; and selected studies of intergovernmental relations (p. 453).

Finally, Van Meter and Van Horn identified six clusters of variables that more or less affect the delivery of public services. They argued that these factors are not static but dynamic. Thus, there are some linkages among these factors. This model, according to the authors, has noteworthy features. It delineates six factors that shape the linkages between policy and performance of the public programs and specify the relationships among the independent variables (p. 462).

Clearly, the public program organization and the public enterprise organization share a common characteristic, as both are government-sponsored organizations. With the exception of the disposition of implementors, the conceptual framework proposed by Van Meter and Van Horn can be applied directly to the study of the factors that affect the performance of public enterprises. Thus, if realistic and informed expectations about the government-sponsored program can be established, this conceptual framework should apply to the government-sponsored enterprise as well.
Limitation of the Study

A research design must be feasible in order to meet the goals of the study, and this area of research is no exception. Thus, the scope of the study is limited in some aspects as follows:

(1) It is not practical to embark on full-scale research on the performance of the public enterprise from all perspectives. This study omits the variable of management skills. It is acknowledged that management skills, which include accounting, marketing, finance, production, and personnel administration, are vital to the success of the enterprise. Time and budgetary constraints necessitate that determining their importance be left for another study. Only the labor relations aspect of management will be included.

(2) There is no standard methodology for the measurement of performance. Rather, a variety of approaches exists. For the purpose of this study, the dependent variable was limited to the efficiency of the enterprise's performance. Other variables suitable to test an organization's performance include profitability, effectiveness, and accountability. However, conventionally, profitability is most suitable for profit-making enterprises such as ordinary private enterprises, and accountability is most suitable to evaluate the performance of public program agencies.
Effectiveness and efficiency are the two indicators that most organization students in developing areas recognize as useful tools in measuring any kind of organization (Abdulrahman, 1979; Bos, 1981; Ramanadham, 1984a, 1984b; Bhatia, 1983; Raj, 1977; Shepherd, 1976; and United Nations, 1973). Even in the western world, such as in the United States, the study of England disclosed that among American managers, efficiency is viewed as of primary importance along with productivity and profitability (England, 1967, pp. 107-118). Thus, efficiency and effectiveness are good candidates for testing the performance of a public enterprise.

(3) Another limitation is that, as mentioned earlier, this study will focus on only one public enterprise: the Royal State Railway. The unit of analysis will be yearly performance from 1960 to 1984. While a cross-sectional study would yield data on more organizations, there is a problem in data gathering because not all public enterprises in Thailand collect the same kind of data. Moreover, different enterprises apply different tools for data collecting and recording. Thus, not all data are on the same standard. As a result, there is no other option but time-series analysis.
The Thesis of the Study

The results of the research explore the question of whether a relationship exists between the efficient performance of the RSR and the six clusters of independent variables: organizational goals and objectives, the enterprise's resources, organization structure and control activities, political conditions, economic conditions, and social and industrial relations conditions. Thus, the thesis of this study is that the degree of efficiency of the RSR varies and is associated with changes in those identified independent variables. In other words, this study reports the results of a test of the validity of contingency theory, which states that organizational performance depends upon congruence or consistency between particular mixes of external environmental variables and internal organizational characteristics.

This study assumes that more than one factor affects the efficiency of public enterprises in developing countries, regardless of the reasons why those enterprises were established. Some of these factors are clustered as groups of control variables or independent variables. The hypotheses of the study will be stated as follows:

1. The clearer the goals and/or objectives, the less confused is the operation, and thus the more efficient is the enterprise's performance.
2. The more operating resources the enterprise has, the more efficient is its performance.

3. The more old equipment is utilized, the less efficient is the enterprise's performance.

4. The more rigid control over employees, the more efficient is the enterprise's performance.

5. The older the enterprise's organization, the more formalized is its behavior, and thus the more efficient is its performance.

6. The larger the size of the enterprise's organization, the more formalized is its behavior, and thus the more efficient is its performance.

7. The smaller the size of the administrative component, the more efficient is the enterprise's performance.

8. The larger the size of the executive board, the more efficient is the enterprise's performance.

9. The more armed forces officers appointed to the decision-making positions, the less efficient is the enterprise's performance.

10. The longer board members serve, the more efficient is the enterprise's performance.

11. The greater the number of members of the board who hold more than one position, the less efficient is the enterprise's performance.
12. The more accountable public enterprises are to the public, the more efficient is the enterprise's performance.

13. The more frequent political changes in the nation, the less efficient is the enterprise's performance.

14. The greater its market competition, the more efficient is the enterprise's performance.

15. The better national economic conditions, the more efficient is the public enterprise's performance.

16. The higher government expenditures on behalf of the public, the more efficient is the enterprise's performance.

17. The more highly educated the population, the more efficient is the public enterprise's performance.

18. The more active labor movements are, the more efficient is the enterprise's performance.

19. The better rewarded employees are, the more efficient is the public enterprise's performance.

20. The more frequently labor-management frictions occur, the less efficient is the enterprise's performance.

Thus, the basic elements of this study are as follows:

(1) The factors that affect the enterprise's performance are called independent variables and are categorized into six groups. The first three groups represent organizational characteristics, which are also considered internal environmental factors. These organizational characteristics are goals and objectives, resources of the enterprise,
organization structure and control activities. The external environmental variables compose the next three groups: political factors, economic factors, and social and industrial relations factors. The performance of the public enterprise is the dependent variable, represented by the efficiency indicator.

(2) The relationships between the individual independent variable and dependent variable may be either direct or indirect. The relationships can be tested through simple regression analysis.

(3) However, more than one independent variable can simultaneously influence the dependent variable, partially affecting the performance of the public enterprise. One can use a data reduction technique to reduce the number of independent variables, and these can be used in the regression equation. A regression equation that has more than one independent variable is called the multiple regression equation. It is used for the analysis of many independent variables, when they affect one dependent variable, as in this study.
The Operationalization of the Dependent Variable

One of the major obstacles to the synthesis of research on organizational efficiency is the lack of agreement on what constitutes "efficiency." The different ways of measuring efficiency arise from an unclear understanding of the concept or from an inability to operationalize it. Moreover, the term "efficiency" from time to time is used interchangably with other concepts such as "effectiveness," "productivity" and "profitability." Thus, it is imperative that this research study provide clear-cut definitions of these four synonyms.

1. "Profitability" refers to the ability to generate an excess of money income from inputs over the money costs of inputs for a specific time period (Shand and Battersby, 1975, pp. 25-38). For the purpose of this research project "profitability" is restricted to the commercial purpose of private enterprise.

2. "Productivity" refers to the relationship of output to an input such as labor or capital in terms of unit cost (Wu, 1973, p.288). In other words, it takes into consideration, not only input-output ratio, but also the "real service as of a single input factor to output" (Fosler, 1978, p. 25; Downs and Larkey, 1986, p.8). Productivity measurement is usually used to compare productivity changes over time in both public and private sectors.
3. "Effectiveness," for the purpose of this research study, refers to the extent to which the organization accomplishes its goals or the degree of goal-achievement (Price, 1968, p. 3; Georgoulous and Tannabau, 1969, pp. 80-88). In other words, it is a ratio measure relating observed (actual) output to the planned (or goal) output for some time period (Downs and Larkey, 1986, p. 7).

4. "Efficiency" refers to the ratio of the units produced or obtained to resources or costs required to obtain or produced those units (Pennings and Goodman, 1981, p. 102). "Efficiency" and "effectiveness" are closely related and can be treated as complementary (Pennings and Goodman, 1981, pp. 146-184).

In relation to the operations of an enterprise, the term "efficiency" means different things to different people. Theoretically, organizational efficiency refers to the degree of return on investment, where return is defined by organizational goals (Becker and Neuhauser, 1975, p. 46). For the purpose of this study, efficiency refers to the ratio of output to all inputs in an aggregate form (a weighted aggregate in terms of money costs). The ratio can change not only the output dimension but also the input dimension. In other words, any public enterprise can be considered efficient if it can convert inputs with the least amount of organizational effort, meaning fewer people, less
equipment, or lower expenditures when compared to the ratio of the previous year. Scholars who have measured efficiency in this fashion are Farmer and Richman (1965), Hage (1965), Blau et al. (1966), Feldstein (1967), Ingbar and Taylor (1968), Hefty (1969), and Becker and Neuhauser (1975).

The efficiency of the railroad can be represented as follows:

\[
\text{output} = \text{total revenue from freight and passenger service charges}
\]

\[
\text{input} = \text{labor + equipment + fuel + materials money cost}
\]

Outputs are money costs of goods or services produced from inputs; inputs include human, material, and other resources used to produce goods or services.

The Operationalization of Independent Variables:

Internal Factors

Internal variables or organizational characteristics consist of goals and/or objectives, resources, and organizational structure of the public enterprise.

Goals and Objectives

One of the factors that determine the performance of an organization is its goals and objectives (Van Meter and Van Horn, 1975, pp. 462-465). Goals and objectives of public enterprise are expected to be clearer and more
straightforward than those of traditional governmental agencies because of the necessity to operate like private business. As Tierney pointed out, "Public enterprises whose goals are multiple and contradictory can be expected to do a poorer job of meeting public expectations than the enterprises whose goals are less diffused" (Tierney, 1984, p. 90). In most cases it is difficult to identify goals because of their breadth and complexity. The difficulty may also be a consequence of ambiguities and contradictions in the phrasing of standards and objectives.

Hypothesis: The clearer goals and/or objectives, the less confused is the operation, thus the more efficient is the enterprise's performance.

Variables for Operationalizing Goals and Objectives:

1. total objectives (TOTOB)
2. ratio of objectives stated in quantitative terms to all objectives (QUANTOB)
3. ratio of quantitative to qualitative objectives (QUANQUAL)
4. ratio of total objectives to total goals (OBGOAL)
5. ratio of unverifiable goals to total goals (RAUNVERG).
Resources

Resources are important to efficient organization. Becker and Neuhauser argued in their book, *The Efficient Organization*, that resources (people and things) and procedures (ways of doing things by, to, and with resources) are the major components of the proposed "Entrepreneurial Theory." As they stated,

The owner sets the goal and attempts to achieve it by storing in specific form a higher or lower proportion of the organization's resources . . . The Owner's ability efficiently to combine the appropriate resources and procedures, to cope with the limitation imposed upon him by the environment, depends on his ability to specify procedures to increase potential visibility of consequences so as to increase his actual visibility of consequences, his awareness of what is going on (Becker and Neuhauser, 1975, pp. 85-86).

The importance of resources is also supported by Van Meter and Van Horn. According to Van Meter and Van Horn, policy formulators usually furnish more than the standards and objectives against which to judge performance. They also make available resources that facilitate the administration of the organization (p. 465). These resources include both material and human resources. Usually, the material resources of a public enterprise are the money value of all assets belonging to the enterprise after debt deduction. Old, aged resources can be a subject of value-change and affect the enterprise's performance as well. Human resources are the personnel working for the enterprise.
Hypothesis: The more operating resources the enterprise has, the more efficient is its performance.

Variables for Operationalizing Resources:

1. total budget appropriation for RSR (RSRBUDGEX)
2. number of officers in RSR (OFFICER)
3. current assets of RSR (CURASSEX)
4. budget for administration (ADMINX)
5. number of steam locomotives in service (STEAMS)
6. number of diesel locomotives in service (DIESELS)
7. number of railcars in service (RAILCARS)
8. number of passenger cars in service (SPASSCAR)
9. number of freight cars in service (SFREIGHT)
10. total railroad vehicles in service (SRAIL)
11. budget for railway renovation (RENOVATX)
12. budget for survey and building new lines (SURVEYX).

Hypothesis: The more old equipment is utilized, the less efficient is the enterprise's performance.

Variables for Operationalizing Age of Major Equipments:

1. average age of steam locomotives (SAVERAGE)
2. average age of diesel locomotives (DAVERAGE)
3. average age of railcars (RAVERAGE)
4. ratio of railroad vehicles age under 10 to 11-20 years (RA10TO20)
5. ratio of railroad vehicles age under 10 to over 10 years (RA10TOOV)
6. ratio of railroad vehicles age 11-20 to over 20 years (RA11TOOV).

Organization Structure

Van Meter and Van Horn argue that effective performance requires that standards and objectives be understood by those individuals responsible for their achievement (pp. 465-466). These standards are understood as either roles of rules (Merton, 1940) or as bureaucratic techniques (Gouldner, 1954). Merton explains Weber's theory of bureaucracy, and summarizes the pertinent components of roles of rules in the bureaucratic organization according to Weber as follows:

The assignment of roles occurs on the basis of technical qualifications which are ascertained through formalized, impersonal procedures (e.g., examinations). Within the structure of hierarchically arranged authority, the activities of trained, salaried experts are governed by general, abstract, and clearly defined rules which preclude the necessity for the issuance of specific instructions for each specific case. . . . The pure type of Bureaucratic official is appointed . . . (Merton, 1957, p.49).

Merton, however, argues that rules and procedures may be offset by unintended consequences (Merton, 1940, pp. 560-568). Also, Gouldner supports the thesis that bureaucratic technique or role rules can produce their own reactions (Gouldner, 1954). Subsequently, the degree of bureaucratization in the organization's internal structure can determine the feasibility of achieving specific goals.
Thus, the varying degrees of bureaucratization affect such performance characteristics as participants' behavior, effectiveness of goal setting, efficiency of performance, and relations with the external environment.

At this point, the Weberian ideal of bureaucracy can be applied to measure the performance of the enterprise. In brief, the Weberian ideal of bureaucracy exists when the superior exercises executive control over and coordinates the activities of the subordinates and tools necessary to achieve the goals of the organization. As Weber stated, one characteristic of monocratic bureaucracies is that "they are organized in a clearly defined hierarchy of offices" (Weber, 1947, p. 333). Then he further argues that "this form of organization is ... capable of attaining the highest degree of efficiency and is ... the most rational known means of carrying out imperative control over human beings" (Weber, 1947, p. 337).

This monocratic bureaucracy of the organization is recognized as the use of rules and regulations specified by hierarchical superiors for subordinates and sanctioned by the authority office. It is also supported by Fayol who stated that "the soundness and good working order of the body corporate depend on a certain number of principles, laws, and rules" (Fayol, 1949, p. 19).
Thus, two conditions necessary for the emergence of an efficient organizational form are a high proportion of specified procedures and hierarchy of supervision. These conditions can be taken to mean that, among other things, bureaucracy is a control mechanism to insure coordination and organizational efficiency.

In addition to rules and control mechanisms, the structure of organizations is also under the influence of three more factors—age, size and administrative component—since the older the enterprise, the more formalized it is (Downs, 1967, p. 18), the larger the size of the organization, the more it needs rules and regulations to control its operation (Child, 1974, pp. 2-18), and the greater its scale of operations, the more economies of scale should allow it to decrease the proportion of personnel allocated to indirect activities, increasing efficiency (Jackson and Morgan, 1978, p. 213). As an organization increases in age and size, an increasing number of rules and procedures in the bureaucratic organization will lead to more efficient performance.

Hypothesis: The more rigid control over employees, the more efficient is the enterprise's performance.

Variables for Operationalizing Control Activities:

1. number of rules and regulations in RSR (RULES)
2. number of rules changes in RSR (RULECHAN)
3. decentralization change (DECENT).

**Hypothesis:** The older the enterprise's organization, the more formalized is its behavior, and thus the more efficient is its performance.

**Variable for Operationalizing Organizational Age:**

1. age of organization in years (YEAR).

**Hypothesis:** The larger the size of the enterprise's organization, the more formalized is its behavior, and thus the more efficient is its performance.

**Variables for Operationalizing Organizational Size:** A variety of size variables are used in this research project as follows:

1. total assets of RSR (ASSETX)
2. length of track (TRACK)
3. number of employees in RSR (TOTALEMP)
4. total route in kilometers (TOTROUTE)
5. freight traffic on railways (FREIGHT)
6. passenger traffic on railways (TOTALPAS)
7. number of permanent employees (PERMEMP)
8. number of temporary employees (TEMPEMP)
9. number of officers (OFFICER)
10. number of permanent laborers (PERMLA)
11. maintenance costs (MAINCOSX)
12. accrued depreciation (ACCRUDEX)
13. pension and welfare reserve (RESERVEX)
14. amount of gross pay (GROSSPAK)
15. special funds (SPECFUNX)
16. tonnage transported (TRANSPO)
17. passenger kilometers (PASCON)
18. ratio of temporary to permanent employees (TEMPPERM)
19. ratio of passengers to workers (PAPRODUCT)
20. ratio of freight to workers (FRPRODUC)
21. repayment of loans by RSR (REPAYX)
22. investment programs of RSR (INVESTPX)
23. number of steam locomotives on books (STEAMB)
24. number of diesel locomotives on books (DIESELB)
25. number of railcars on books (RAILCARB)
26. number of passenger cars on books (BPASSCAR)
27. number of freight cars on books (BFREIGHT)
28. ratio of total revenue to workers (RAPRODUX)
29. total railroad vehicles on books (RAL).
result, this analysis has no other options but using temporary and permanent employee's variables. It is expected that the changes in the number of temporary employees may result in significant changes for the RSR's performance.

Variables 23 to 27 and 29 are different from those used in the resources hypothesis, even though they represent the same rolling stock used in the railroad business, because not all vehicles are used in the service. "On books" means all railroad vehicles including those out of services, but still having value in an accounting sense. "In service" means the vehicle is actually used in the operation. Thus the on-books vehicles are suitable for measuring size, while the in-service vehicles are suitable for measuring the operation's resources.

Hypothesis: The smaller the size of the administrative component, the more efficient is the enterprise's performance.

Variables for Operationalizing Administrative Size:

1. number of officers (OFFICER)
2. ratio of officers to permanent laborers (OFFPERM)
3. ratio of officers to all laborers (OFFALLLA)
4. ratio of officers to operating revenue (OFFREV).
The Operationalization of the Independent Variables:

External Factors

The effect of social, economic, and political conditions on public policy has been the focus of much attention during the past decades. Students of comparative state politics and public policy have been particularly interested in identifying the influence of these environmental variables on policy decisions (Sharkansky, 1967; Sharkansky and Hofferbert, 1969; Cnudde and McCrone, 1969; Dye, 1966; Hofferbert, 1964). By the same token, the performance of a public enterprise is under the influence of economic, social, and political conditions. Although the effect of these factors is rarely direct and obvious, they may profoundly affect the enterprise's performance. Thus, it is necessary to examine the influences of these three factors.

Van Meter and Van Horn proposed six questions regarding the economic, social, and political environment affecting the organization (1975, p. 472). These six questions are stated as follows:

1. Are the economic resources available within the enterprise sufficient to support successful implementation?

2. To what extent (and how) will prevailing economic and social conditions be affected by the implementation of the policy of the enterprise in question?
(3) What is the nature of public opinion and how salient is the related policy issue?

(4) Do elites favor or oppose the performance of the enterprise?

(5) Is there partisan opposition or support for the performance?

(6) To what extent are private interest groups mobilized in support of or opposition to the performance?

The above six questions proposed by Van Meter and Van Horn recognize the importance of external environmental factors and provide a framework for this study, although the points that Van Meter and Van Horn argued are not all suitable for evaluating the external factors that may affect the performance of the Thai state railway. This study argues that the external factors comprise the following political, economic and social conditions.

Political Conditions

Among all external conditions that affect the performance of public enterprises in developing countries, politics is a key factor. Political issues widely spread over public organizations since all interest groups, clients, professional associations and suborganizations vie for influence in organizational decision-making and make up the institutional environment of the organization (Seidman,
1980, ch.6). Also, when political change is violent, abrupt, and disruptive, public organizations are often placed at a serious disadvantage in terms of productivity. As Farmer and Richman (1965) pointed out, "Countries wracked by frequent and violent revolutions, rapid changes of governments and policy, and similarly disruptive forces seldom are noted for their progressive, efficient, productive enterprise" (p. 264).

The proper organization of any enterprise involves long-term arrangements with labor, suppliers, customers, and governments. Any factor that tends to disrupt such arrangements typically leads to low-efficiency performance since long-term planning is difficult or impossible in such circumstances. Thus, politics, both inside and outside the enterprise, is vital to the performance of domestic enterprises.

In public enterprises, in particular, politics can play a key role for at least two reasons: First, politics becomes involved in public enterprise because public enterprise would not emerge without policy. Second, the role of politics in public enterprise is always critical because public enterprises are the major instruments of the government to accomplish national development goals. However, the degree of political involvement varies, depending on several factors. As Tierney points out,
In the United States, for example, it is likely that no government corporations exist whose actual operations reflect the full measure of political isolation and managerial autonomy portrayed in either the theoretical literature or the rhetoric accompanying the organizations' creation. Rather, there is a spectrum or continuum along which these organizations fall (Tierney, 1984, p. 85).

Thus, political changes ultimately affect the public enterprises' performance.

Politics is not limited to the external political environment. Political issues always surround appointments to decision-making positions in public enterprises and affect the enterprises' performance. In Thailand, in particular, the controversy over the appointment of the board's members is narrowed down to the issue of 'who performs better,' between the armed forces officers and the civil service officers, when selected to serve as the board of commissioners. Especially, it is argued that, besides the effect of political changes on the nation, the size of the selected executive board may affect the organization's performance; the background of board members may have an effect on the enterprise's performance; a very high rate of turnover of board members may affect organizational operation; the number of board members who hold more than one position concurrently in different organizations may affect the performance's creditability; and non-accountability of public enterprises to the public may
hamper the enterprises' performance. As a result, background of the board members, size of the board, short-term services, concurrent positions, public accountability, and political changes in the nation become issues of controversy.

**Hypothesis:** The larger the size of the executive board, the more efficient is the enterprise's performance.

**Variable for Operationalizing Size of the Executive Board:**
1. number of board members (BOARD).

**Hypothesis:** The more armed forces officers appointed to decision-making positions, the less efficient is the enterprise's performance.

**Variables for Operationalizing Background of the Board Member:**
1. career background of the chairperson of the board as either civil servant, or armed forces officer (CHAIR)
2. career background of the governors of RSR as either civil servants, or armed forces officers (GOVERNOR)
3. number of armed forces officers on the board (ARMEDOFF)
4. number of civil servants on the board (CIVILSER)
5. ratio of armed forces officers to the board (ARMEDBOD)
6. ratio of civil servants to the board (CIVILBOD)
7. ratio of armed forces officers to civil servants in
the board (ARMCIVIL).

In the past, according to the law, only government officials from government agencies could serve on the board of commissioners. Neither politicians nor business people were allowed to serve. The current law allows business people to be appointed in the decision-making positions, such as the governor or director-general of the enterprise. However, the majority of the board members are still government officials. Thus, the board members may be either civil servants or armed forces officers. The armed forces officers are those military officers in the army, navy, air forces, as well as the police officers.

Hypothesis: The longer board members serve, the more efficient is the enterprise's performance.

Variables for Operationalizing Length of Tenure:

1. average tenure of board members in months (TENURE).

Hypothesis: The greater the number of members of the board who hold more than one position, the less efficient is the enterprises' performance.

Variables for Operationalizing Concurrent Positions:

1. ratio of board members who concurrently hold more than one position to those who hold only one position (CONCUR).

Hypothesis: The less accountable public enterprises are to the public, the less efficient is the enterprise's
performance.

Variables for Operationalizing Public Accountability:

1. budget appropriation for public enterprises (APPROPX)
2. legislative oversights of public enterprises in each year (LEGISLAT) (measured by number of hearings and investigations)
3. government-labor relations (GOVLA) (measured by the number of times in which the government dealt with the labor unions each year).

The legislative oversights and the government-labor relations variables are composed from a tally of the records collected by Hongsanun and Dilokvidhyarat and published by the Social Science Association of the Thailand Press in 1986 and 1985. Legislative oversights are recorded yearly according to the number of hearings on and investigations of the public enterprises by the legislators. Government-labor relations are recorded yearly through the number of events involving government dealing with the labor unions.

Hypothesis: The more frequent political changes in the nation, the less efficient is the enterprise's performance.

Variables for Operationalizing Political Conditions:

1. governmental change and national election (GOVCHANG)
2. political protest (POLITEST)
3. state coercive behavior (STATECOE).
Data for testing this hypothesis are derived from Taylor and Jodice's *World Handbook of Political and Social Indicators* from 1960 to 1977 and from the *New York Times Index* 1978 to 1984, following Taylor and Jodice's format of collection. The governmental change and national election (GOVCHANG) variable is a composite of six sub-variables: national election, unsuccessful regular executive transfers, unsuccessful irregular executive transfers, executive adjustments and regular executive transfers. The political protest (POLITEST) variable is a composite of seven sub-variables: protest demonstrations, regime support demonstration, political strikes, riots, armed attacks, assassinations and death from political violence. The state coercive behavior (STATECOE) variable is a composite of three sub-variables: imposition of sanctions, relaxation of sanctions and political executions. The collapse of these sub-variables into three composite variables is the result of too many zero events in each sub-variable.

**Economic Conditions**

Economic conditions can influence the performance of public enterprises both in general and in specific ways. Market competition is one of the most obvious influences. It is generally acknowledged that the needs of buyers change as products change or new processes are found, and as different
equipment and materials come into the market. The enterprise must modify itself to the needs of buyers. This situation will encourage the management of each enterprise to work more effectively and efficiently to hold its share of the market. Thus, the operation of the enterprise is expected to increase its efficiency as well. In the transportation arena, the railway has to compete with transportation by road, air, and waterway and communication services, such as mail and telegrams.

Besides market competition, the enterprise may be affected by the other kinds of economic conditions such as the gross national product (GNP), the gross domestic product (GDP), consumer prices, and the average wage rate (Koontz and O'Donnell, 1976, pp. 76-80; Farmer and Richman, 1965). Thus, economic conditions can have a far-reaching effect on the operation of enterprise.

Hypothesis: The greater its market competition, the more efficient is the enterprise's performance.

Variables for Operationalizing Market Competition:

1. motor vehicles in use (MOTOR)
2. merchant ships registered (SHIPRE)
3. passenger aviation in kilometers (PASAVIA)
4. freight aviation in ton-kilometers (FREIGHTA)
5. number of domestic flights (FLIGHT)
6. length of highways (HIGHWAY)
7. mail traffic (MAIL)
8. telegrams (TELEGRAM).

Hypothesis: The better national economic conditions, the more efficient is the public enterprise's performance.

Variables for Operationalizing Economic Conditions:

1. gross national product (GNPX)
2. gross domestic product (GDPX)
3. gross national product per capita (GNPCAPX)
4. gross national saving (GNSX)
5. gross domestic investment (GDIX)
6. investment financing (GDIGNSX)
7. consumer price index (CPI)
8. wholesale price index (WPI)
9. total national resources (NATRESX)
10. balance of payment (BOPX)
11. budget standing (BUDGETX)
12. total national external debt (DEBTX)
13. total government debt (GOVDEBTX)
14. assets in monetary system (MONETARX)
15. total national labor forces (LAFORCES)
16. total national unemployment (UNEMPLOY)
17. export of goods (EXGOODSX).
Social and Industrial Relations Conditions

Social conditions have an effect on government expenditures on behalf of the public. The level of education and literacy affects the performance of public enterprises in varying degrees, as do labor-management relations in industry (Labor relations are included in the social conditions as an exception of the limitation of the study that excludes the management perspective of the organization). The actions and reactions of workers and management may have an effect on the society and social conditions. In the case of public enterprises, the interaction among government, industry, and labor is particularly important. Thus, labor relations are considered as another major social factor that may affect the enterprise.

The status of employees of public enterprises is different from that of civil servants who are subject to the rules and regulations imposed by the Civil Service Commission. The status of a public enterprise's employees is considered special. This special status also varies among public enterprises, depending on how such an enterprise was created. Thus, rules and regulations for one enterprise may not be the same as for others. These varied provisions regulate methods of entry, management and promotion of personnel, methods of determining remuneration and
conditions of employment, and overall control of the numbers to be employed both in total and in different grades. In Thailand, if allowed by the government, the staffs and employees of public enterprises can unionize. They can use collective bargaining to negotiate with management, and they are even able to strike or discontinue working during a period of dispute. The motivating force behind these provisions is the desire of the government to ensure that public enterprises use their freedom responsibly in acting as commercial employers.

The effect of social changes on the national economy and domestic enterprises in general as well as the effects of changes on industrial relations have been previously studied (Koontz and O'Donnell, 1976, pp. 605-606; Carlisle, 1982, pp. 75, 171, 193-195, 401-403). This study examines the changes in social and industrial relations resulting from government expenditure, the population's education, labor movements in the nation, and labor relations within the enterprise's organization.

**Hypothesis:** The higher government expenditures on behalf of the public, the more efficient is the enterprise's performance.

**Variables for Operationalizing Government Expenditures:**

1. military expenditure (MILITARX)
2. general public services expenditure (PUBSERVX)
3. defense, public order, and safety expenditure (DEFENSEX)
4. education expenditure (EDUCATX)
5. health expenditure (HEALTHX)
6. welfare and social security expenditure (SOCIASEX).

These variables are not measured on a per capita basis because all expenditures were adjusted to the constant Baht (Thai currency). In general, government expenditures increase along with the population growth. However, this hypothesis does not consider government expenditures as a whole, but as separate segments. As a result, the effect of population growth will equally affect all segments of expenditures; thus, there is no need to adjust to a per capita basis.

**Hypothesis:** The more highly educated the population, the more efficient is the public enterprise's performance.

**Variables for Operationalizing Educational Conditions:**

1. adult literacy rate (LITERACY)
2. children in primary schools (PRIMARY)
3. children in secondary schools (SECOND)
4. vocational enrollment (VOCAT)
5. students in universities (UNIVERSI).

**Hypothesis:** The more active labor movements are, the more efficient is the enterprise's performance.

**Variables for Operationalizing Labor Movements in the**
Nation:

1. number of strikes and lockouts (STRIKES)
2. number of workers involved in strikes and lockouts (INVOLVED)
3. number of working days lost (DAYLOST)
4. number of days of work stoppages (DAYSTOP)
5. number of labor disputes (DISPUTE)
6. number of workers involved in dispute (INVODISP)
7. number of labor unions (UNIONS)
8. number of labor union members (UMEMBER).

Hypothesis: The better rewarded employees are, the more efficient is the enterprise's performance.

Variables for Operationalizing Employees' Rewards:

1. number of welfare items provided for employees (WELFARE)
2. ratio of wage changes of each year to its following years (WAGE)
3. amount of fringe benefits provided for employees as welfare (FRINGEX)
4. personnel expenses in RSR (PERSONX)
5. fringe benefits per permanent employee (BENEFITX)
6. salary and wages (SALARYX)
7. wage and salary per employee (AVERAGEX)
8. number of employees training in RSR institute (TRAINEMP)
9. number of training programs the RSR's employees attended in Thailand each year (DOMESTIC)

10. number of employees trained each year in Thailand but but not from RSR (INTHAI)

11. number of the foreign training programs the RSR's employees attended abroad each year (FOREIGN)

12. number of RSR's employees trained outside Thailand (OUTTHAI)

13. average minimum wage the RSR provided for employees each year (RSRWAGEX).

The term "employees' rewards" means the combination of compensation and opportunities available to employees. An increase in employees' rewards may motivate the workers to work more, raising the performance and efficiency of the enterprise.

Some of the above variables deserve more consideration:

1. The number of welfare items provided for employees (WELFARE) is counted according to the number of types of welfare. In 1969, for example, the RSR provided four types of welfare: child allowance, maternity grant, death grant, and pension or living allowance (The Royal State Railway of Thailand, 1969, p.14), while in 1975, the RSR provided ten types of welfare: child allowance, maternity grant, death grant, pension or living allowance, living quarters, medical service reimbursement of medical charges, children's school
tuition fees, children's school supplies and other related fees, and retirement benefit from the Provident Fund Scheme (The Royal State Railway of Thailand, 1976, p.15).

2. The ratio of wage changes of each year to the following years (WAGE) is the proportion of the average wage and salary per employee of each year and the year after. The term "employees" means the total employees (both permanent and temporary employees).

3. The fringe benefits (FRINGEX) means the amount of welfare benefits the RSR provided for all employees in terms of money cost annually.

4. The personnel expenses in RSR (PERSONX) means the amount of expenditures the RSR spends for all RSR's employees annually. This expenses include wage, salary and all kinds of fringe benefits provided for employees.

5. The fringe benefits per permanent employee (BENEFITX) means the average welfare benefits provided to permanent employees only each year. The permanent employees receive full benefits from the RSR while the temporary employees receive only some particular types of welfare.

6. The salary and wages (SALARYX) means the total amount of RSR's expenditures for salary and wages of all employees annually.

7. The wage and salary per employee (AVERAGEX) is the average amount of RSR's expenditures annually paid in
employees wages and salaries only. "Employees" means both the permanent and temporary workers and personnel of the RSR.

8. The number of employees training in the RSR institute (TRAINEMP) means those RSR's employees who receive either on-the-job training or in-service training from the training program provided by the RSR each year.

Hypothesis: The more frequently labor-management frictions occur, the less efficient is the enterprise's performance.

Variables for Operationalizing Labor-Management Relations in the Enterprise's Organization: The conflict between the workers and management may cause the performance of the enterprise to deteriorate. The following variables are indicators of labor-management frictions.

1. number of labor negotiations in RSR (NEGOTIAT)
2. number of agreements over labor disputes in RSR (AGREEMEN)
3. number of disagreements over labor disputes in RSR (DISAGREE)
4. number of government involvements in labor dispute (GOVINVOL)
5. number of strikes and lockouts in RSR (RSRSTRIK).

These variables are different from those used in the labor movement hypothesis, since they are relevant to the labor movements in the RSR's organization only. The
variables used in the previous hypothesis are the movements of labor unions in the nation.

Organization of the Research Study

The first chapter has provided a general idea of the role of public enterprises in developing countries, Thailand, in particular. It has also introduced the significance of the study and the hypotheses to be tested. The general theoretical framework of the research has been presented.

The next chapter will concentrate on the literature covering the factors in this study. This literature review will be composed of two sections: the general organizational performance indicators and the special indicators that have been used to study developing countries. This chapter is intended to generalize various points of view in the context of organization theory, and then to synthesize them with the theoretical framework of the study.

The third chapter will focus on the method of data analysis. It will provide both the general method of analysis, the regression technique, and the supplemental method, the principal component analysis technique. Also, it will concentrate on the treatment of missing data. It is recognized that all hypothesis testing will be useless if the variables for testing are insufficient. However, systematic data gathering is a major task for researchers
interested in developing societies. The only option is gathering as many data as possible and scientifically creating new data from the original data. This scientific approach is widely used in physical science and is called the numerical method for estimation and approximation.

The fourth chapter will focus on the twenty hypothesis testings. The findings will be stated in terms of relationships between each factor and the efficiency of the enterprise. In other words, this chapter will show the twenty simple regression equations along with tables of statistical results. The significance of relationships will be pointed out along with the arguments of scholars (if present) on each topic.

The fifth chapter will interpret and explain the results of the two multiple regression testings. For the first test, a data reduction technique (principal component analysis) will be used to find the representative variables for six clusters, using the framework published by Van Meter and Van Horn to define the clusters. If the first test does not provide a satisfactory result, the second test will employ factor analysis, using the principal components extraction and varimax rotation to find the factor solutions. The new factors will be labeled according to their structural characteristics and used in the multiple regression equation. The statistical results of both
multiple regression equations will be discussed.

The last chapter will include a summary of the findings, the conclusions, the implications, and comments and recommendations for further study. It will show the basic elements that the governments of developing countries need to recognize as factors that affect the efficient performance of a public enterprise in a developmental environment.

Chapter Summary

This chapter describes the research design used in this project. It establishes the significance of the study, describes the general method of the study, as well as its scope and limitations, and sets forth twenty hypotheses along with the variables for testing.
CHAPTER BIBLIOGRAPHY


Feldstein, Martin. 1967. *Economic Analysis for Health*
Services Efficiency. Amsterdam: North Holland Publishing Co.


Opoku-Afriyie, Yaw. 1982. The Political Control of Public


CHAPTER II

THE LITERATURE REVIEW

This chapter begins with a presentation of the general idea of contingency theory, which is a subtheory of systems theory. It then turns to the literature on factors to which scholars of developing countries pay the most attention.

Contingency Theory and Its Application to System Analysis

Certain scholars have discovered a situational, or contingency theory of management. They have pointed out that what managers must do is to consider the situation --the environment in which their actions are to work. As Lawrence and Lorsch pointed out

This contingency theory of organizations suggests the major relationships that managers should think about as they design and plan organizations to deal with a specific environmental condition . . . This contingency theory . . . provides at least the conceptual framework with which to design organizations according to the tasks they are trying to perform (Lawrence and Lorsch, 1967).

Thus, according to contingency theory, environmental differences affect what managers do. Certainly, no manager can find a best way of doing things without taking contingencies or the situation into account.

Systems theory clearly establishes that a social system such as an organization is composed of two sets of
variables: those that are internal parts of the system and those in the environment. The former is called internal environment, and the latter is called external environment. Between these two, there is an abstract boundary line. Which variable is included in internal or external is dependent upon whether its influence on the operation of the organization is direct or indirect. If there is direct influence, it is considered as internal. If there is indirect influence, it is called external. So, one must keep in mind that in any given situation one variable may be considered as external, but, when time and circumstance change, the variable may become an internal one, or vice versa.

To classify the internal or external variables for public enterprises, one must keep in mind that public enterprises have dual characteristics: those associated with business and those with public agencies. As a result, the performance of a public enterprise can be the target of study both from the private business and the public viewpoints.

The approach of Johnson, Kast and Rosenzweig (1973), for example, identifies four major internal components within the organization as the subsystems of the organization. These are composed of goals and values, psychological, technical, and structural and managerial subsystems. These components provide inputs and receive outputs within the
organization. The authors view these major subsystems and their relationships as primary factors in explaining how an organization performs. Another useful approach was developed by Harold Leavitt, an industrial psychologist who applied his model to organizational change, as he stated:

To classify several major approaches to change, I have found it useful, first, to view organization as multivariate systems, in which at least four interacting variables loom especially large. These variables are task, structure, technology, and actors (usually people) (Leavitt, 1973, p. 57).

Between these two approaches, there are some similarities about the significant subsystems that influence the performance of an organization: actors and their relationships (including psychological effect); tasks, techniques, and technology of the operation; organization structure and management; and goals and values. These factors are considered as internal variables.

Variables such as political, economic, and social conditions are usually considered as secondary in a business viewpoint (Carlisle, 1982; Koontz and O'Donnell, 1976; Farmer and Richman, 1965; Negandhi and Estafen, 1965). In other words, these variables are classified as the outside forces from the external environment. When these external forces are added, a comprehensive situational model evolves, providing a focus for understanding change or managing organizations.
In the public point of view, the general idea of organization-environment exchange is quite different. The demand and support of an organization's public are the major inputs in a political system (Easton, 1965). Political, social, and economic factors can immediately and directly affect the performance of the public organization. Thus, even though they are considered as part of the external environment of a business organization, they can significantly influence the performance of a public enterprise to a very high degree.

Consequently, the operation of public enterprises is affected by several factors: political, economic, and social phenomena; management skills; the nature of task and technology; the unit's goals and values; and organization structure. All simultaneously affect the performance of the enterprise. Among these factors, management skills are generally considered to be the most dynamic factor in the world of business. The role of public manager is not as critical in the bureaucratic system of public enterprise since management must follow rules and regulations set by the boards of directors and parent agencies. As one of the World Bank staff working papers reported:

Governments may have established State-Owned-Enterprises (SOE) for reasons quite different from --and often compatible with-- profit maximization. SOEs often operate in noncompetitive markets, the absence of competition is one reason for creating them. Their
autonomy is often compromised by government intervention in their operating decisions. Managers may not be held accountable for results or given incentives to improve performance. The way they are selected and rewarded often encourages qualities more appropriate to a central bureaucracy than to a competitive enterprise. Even nonviable SOEs are seldom liquidated (World Bank, 1985, p. 74).

Only in the area of industrial relations has public enterprise management increased its role in order to deal with labor unions.

Internal Environmental Factors

There are three major factors that are considered as internal environmental factors for the purpose of this study: goals and objectives, resources, and organization structure. Each factor affects the enterprise's performance and all are related in some way to one another.

Goals and Objectives

Business management frequently uses goals as a means of judging organizational performance. Goals are one factor that influence the behavior of people, restrict and channel the use of resources, and/or measure the quality of outputs or results. With goals, management can have optimum control over at least labor and total performance. However, there are some semantic difficulties about goals, especially the interchangability of "goals" and "objectives." Goals, in general, have been used in terms of "purpose" (Follet in
Metcalf and Urwick, 1940, p. 262; Barnard, 1938; Mooney, 1947, p. 10; Carlisle, 1982, pp. 222-223); "ideal" (Emerson, 1913, p. X); "charter" (Koontz and O'Donnell, 1976, pp. 480-481; Carlisle, 1982, p. 222); "Mission" (Air Force Manual 25-1, 1954; Koontz and O'Donnell, 1976, pp. 480-481; Carlisle, 1982, p. 223); "target" (Koontz and O'Donnell, 1976, p. 157; Carlisle, 1982, p. 222); "quotas" (Carlisle, 1982, p. 222); "standards" (Perrow, 1972, p. 11). Meanwhile, some scholars such as Perrow (1972) and Drucker (1954) try to differentiate "goals" and "objectives" based on the measurability of the statements. At any rate, in popular usage, the terms "objective" and "goal" are interchangeable. Both represent future desired conditions, although the more restrictive interpretation is that objectives are more specific and short-term than goals.

Goals are very important in the planning process. Strategic planning, in particular, is based on the establishment of goals. Goals are a prerequisite to programming and scheduling of operations and activities and set priorities for organizations and specify which paths are to be followed (Schick, 1966, pp. 243-258; Pyhrr, 1977, pp. 1-8). Goals can also be highly motivational and improve the performance of both individuals and work units. In an article, "Goal-Setting: A Motivational Technique That Works," Latham and Lock found support for the conclusion
that goal setting is more effective than alternative methods in influencing motivation. Latham and Locke have summarized ten separate studies that show that performance improved an average of 17% through the use of goal-setting techniques (1979, p. 75).

As was indicated earlier, public agencies usually develop goals/objectives that are much broader than those of the typical business firm because their primary purpose is social responsibility. The broad and vague goals/objectives can easily lead to confusion for those who are supposed to implement them. Several classical scholars such as Fayol and Urwick, for example, emphasized that goals must be stated in a strict sense so that all goals can be practically applied (Fayol, 1949; Urwick, 1938). Various strategies have been used to define goals/objectives so that goals/objectives are attainable. Classical theorists such as Emerson, Robb, Barnard, and Davis proposed different strategies for the unambiguous definitions of goals/objectives. Emerson, in his book *Twelve Principles of Efficiency*, stated that the first principle to eliminate waste and create a more efficient industry is the clearly defined ideal (Emerson, 1913, p. 29). Emerson did not use the term "goals" or "objectives" as many others do, but "ideals" meant essentially the same thing, since he hoped to reduce intraorganizational conflict, vagueness, uncertainty,
and the aimlessness that arose when people did not understand and/or share a common purpose. Robb mentioned goals/objectives as "duties" of the military, and argued that even though the objectives of business differed from that of the military, much could be learned from the military framework of the clearly defining "duties" (Robb, 1910, pp. 161-175). Barnard also mentioned the need for the clearly defined objective, but stressed that the definite formal channel of communication must be as direct and short as possible, to act a tool to frame the objectives, so that those objectives will not be distorted (Barnard, 1938, pp. 175-177). Finally, Davis argued that executive leadership is a motivating force, and planning is required to clearly define the factors, forces, effects and relationships that enter into business problems, so that that organization achieves its objectives (Davis, 1951, p. 43).

Scholars such as Newman (1953) and Terry (1953) also linked the importance of goals and objectives. Newman argued that goals/objectives must define clearly not only the purposes of organization, but the place and niche of that particular firm's industry, and serve to establish the general managerial philosophy of the company (pp. 221-223). Terry, in his book *Principles of Management*, stated firmly that clear objectives should be considered as a major principle of management so that the activity that plans,
organizes, and controls the operations of the basic elements of men, materials, machines, methods, money, and markets, will be provided direction and co-ordination. He also saw goals as giving leadership to human efforts, so as to achieve the sought objectives of the enterprises (1953, p. 9). Terry later defined the principle of objectives in detail saying, "A clear and complete statement of the objective is essential, and it should be made known to all members of an enterprise affected by it, so that management activities can be directed in a unified, orderly, gainful, and effective manner" (1953, p. 56).

The best-known scholar on the subject of objectives is Drucker. In 1974, Drucker's introduction of management by objective (MBO) was widely accepted as the most practical tool to achieve goals (Singular, 1975, pp. 47-50). Drucker (1954) argued in his book, The Practice of Management, that if managers know the objectives of their units and those of the enterprise, the managers could direct their own activities:

The only principle that can do this is management by objective and self-control . . . It substitutes for control from the inside. It motivates the manager to action not because somebody tells him to do something . . . but because the objective needs of his task demand it (p. 136).

The merit of MBO is widely recognized because it is based on setting goals into measurable objectives; objectives become
less vulnerable, and it is the best standard to measure the efficient performance of any organization or individuals who carry out this strategy (Drucker, 1954, pp. 63, 101 and 1976, pp. 12-19; Professional Management in General Electric, 1954, p. 113; McGregor, 1957, pp. 89-94; Schleh, 1961, pp. 18-19).

Even though goals and/or objectives have been mentioned frequently by many scholars cited earlier, only a few of them have defined clearly the implementation of goals and/or objectives. Drucker's MBO was probably the first method mentioned for the operationalization of objectives. However, Koontz and O'Donnell are the ones who specifically stated the need for operational goals/objectives as they placed an emphasis on the "verifiable" objective instead of plain management by objectives as follows:

As is eminently clear, a system of managing, or appraising managers, by verifiable objectives is a reflection of the purpose of managing itself. Without clear objectives, managing is haphazard and random, and no individual, no group can expect to perform effectively unless a clear goal is sought (1976, p. 164).

Koontz and O'Donnell continued their arguments that objectives can be verified either in terms of quantitative or qualitative but the easiest way is to put goals in "quantitative terms" (p. 165). Qualitative goals can be made verifiable, although not with the complete degree of accuracy possible in quantitatively stated objectives, by
spelling out the characteristics of the program or other objective sought and a date of accomplishment (pp. 165-166). The goal verifiability is also supported by Carlisle (pp. 251-252).

At this point, it is generally recognized that the style of management of each organization must be consistent with the goals of the organization. Business organizations tend to be more directive because it is assumed this management style will result in the coordination and control necessary to optimize efficiency (Down and Larkeys, 1986, p. 223). By the same token, the public enterprises that operate in a businesslike manner also need directive goals so that they can fulfill their purpose (Philip, 1984, p. 40; Wu, 1967, pp. 152-153). Goals, consequently, become the factor that can influence or control the operation of the public enterprise (Rein and Rabinovitz, 1978, pp. 323-327; Tierney, 1984, p. 90).

The final discussion is concerned with organizational goals and the environment. Politics within an organization may have an important impact on organizational goals. Thus, goals of the enterprise may not be attainable. Conflicting goals can happen frequently when resources fall short (Wildavsky, 1979, pp. 137-138; Bhatia, 1983, p. 272; Perrow, 1979, p. 157; Walton, 1969, pp. 73-82; Pondy, 1967, pp. 296-297). Goals may be matters of contention in
organizations; groups fight over them, and goals may be not what they seemed to be (Selznick, 1949; Perrow, 1961, pp. 854-865; Cyert and March, 1963; Edelman, 1964; Hrebinjak, 1979, pp. 173-209; Bower and Christensen, 1978, p. 1).

Organizational goals are usually set by the top management, board of directors, or shareholders in private enterprise. For the public agency, the government (elected officials) usually set goals that all public agencies are required to follow. However, some goals may be set by outsiders, rather than the government (Selznick, 1949; Thompson, 1955, p. 127; Thompson and McEwen, 1958, pp. 23-31). For example, a public enterprise in Thailand that receives a huge financial aid or loan from a financial institution, such as the World Bank, may establish goals according to the creditor (Yongkittikul et al., 1978; Garner, 1984; Ramanadham, 1984b). This external influence on goal-setting causes a critical problem for management in evaluating the enterprise's performance since it is quite inappropriate that the performance of that enterprise be measured by the stated goals of the government because its actual goals come from outside (Festinger, 1957). The RSR of Thailand is a good example of this goal dissonance. Its performance cannot be measured according to the original government-established goals since the enterprise is obliged to fulfill the loan contract to the World Bank. Therefore,
the study cited here measures the performance of the RSR not according to the government-established goals, but according to the goals set in the master plan of the organization.

Resources

Management at all levels requires resources to accomplish its goals (McFarland, 1958, p. 42; Koontz and O'Donnell, 1976; Becker and Neuhauser, 1975; Yutchman and Seashore, 1967). By relating these resources to the goals themselves, superiors are better able to see the need for and economics of allocating them.

The importance of resources has been widely accepted. Besides what Becker and Neuhauser (1975) stated in their book, The Efficient Organization (pp. 85-86), Koontz and O'Donnell (1976) echoed that,

One of the major advantages of setting up a careful network of verifiable goals and a requirement for doing it effectively is to tie in the need for capital, material, and human resources at the same time. All managers at all levels require these resources to accomplish their goals (p. 171).

Levine and White argued that among environmental factors, resources are essential to goal attainment and organizational productivity (1961, pp. 583-601). Pfeffer also argued that organizations attempt to manage their dependence on the environment by seeking to obtain resources and to stabilize relations with other organizations in their
environment (1972, pp. 382-394). Bardach pointed out that source of funding is a major factor that affects the implementation process (1977, p. 36). Rein and Rabinovitz agreed with Bardach as they stated that "implementation is also a function of the type and level of resources required for action . . . we expect that the pattern of implementation will vary according to the nature of the resources required" (1978, p. 329).

Resources for organizational performances can be either tangible such as money and staffing or intangible such as staff expertise and training (Roseman, 1971). Intangible resources such as expertise have been increasingly important recently, and have become an issue of controversy because they play a critical role in the policy-implementation process (Benveniste, 1977; Mintzberg, 1979). Tangible resources are very obvious and are recognized in all organizations. Mechanization, in particular, is of continuing interest as a tangible resource (Price and Mueller, 1986, p.169). In public enterprises tangible resources create a dependency relationship due to the organization's being financed mainly by the government. This financial dependency, in turn, raises the question of the enterprise's autonomy. As Leazes (1984) pointed out, financing is a key variable in explaining corporate autonomy. Also, inadequate funding can lead to limitation of
the operational potential of public organizations
(Organization for Social and Technical Innovation, Inc.,
1972, p. 22).

The allocation of funds from the government to the
agencies has been the major political issue for a long time
(Key, 1940; Dahl, 1963; Wildavsky, 1979). Budgets are
usually planned in terms of monetary resources but can also
be planned in terms of any other resource such as the
manpower budget (Benveniste, p. 12). For all organizations,
budget funding or resources are the major factor that
controls the inputs of the organization (Koontz and
O'Donnell, pp. 659, 661). Benveniste has classified budgets
that can manipulate the environment. The three types are (1)
conventional, which focuses on inputs; (2) recurrent, which
refers to expenditures the organization incurs in normal
operations such as salaries and materials used year after
year; and (3) development, which refers to expenditures the
organization incurs only from time to time for facilities
that will last a long time (p. 12). Uneven allocation and
control of budget resources and differences in internal
dependencies provide the basis for varying levels of power
within the organization (Hrebinjak, 1979, p. 269).

Planned goals and objectives cannot be accomplished
without budget or other resources. The administration can
base its request on what it needs for meeting output goals
and improving performance by concentrating on the resources. Thus, as Koontz and O'Donnell pointed out "to be most effective, budget making and administration must receive the wholehearted support of top management" (p. 666).

Another view of resources is their relationship to objectives of the organization. As Wildavsky pointed out "Without resources there can be no objectives, . . . if the first one or two exhaust all available resources, it doesn't matter what the rest are, or in what order" (p. 182). Programs that combine compromises between resources and objectives can make workable alternatives. Altering objectives to fit resources, therefore, is as much a part of good analysis as varying resources to accomplish objectives (Wildavsky, p. 183). This is one reason why management by objectives is considered self-defeating: long lists of objectives are useless because rarely do resources exist to carry out more than the first few (Wildavsky, p. 184).

Resources are thus an important factor in an organization's performance. The role of resources is not only the determinant of the organizational performance, but a base of power that contains the potential sources of influence (Mechanic, 1962; Jacobson, 1972; Kipnis, 1974; Hickson et al., 1971; Hall, 1972; Hrebiniak, 1979).

The efficiency of an organization will be worse without resources. In system theory perspective, the inter-
dependence between an organization and its environment takes the form of an input/output transaction that involves resources. The attempted acquisition of these resources can lead to competition among organizations or even within an organization. As Yuchtman and Seashore pointed out, "Resources are generalized means or facilities that are potentially controllable by social organization and that are potentially usable, however indirectly, in relationships between the organization and its environment" (1967, pp. 156).

Resources are related to economic conditions. Outside factors can limit the availability of resources. Thus utilization of production factors is a matter of importance. Cycles in employment of capital manpower can understandably have a disturbing effect on enterprises that must use, and plan to utilize for some time, these resources. While no management would expect perfect stability in resources, a growing acquisition of resources is advisable. Uncertainty in these resource factors can hinder planning, and affect the performance of the enterprise's organization.

Organization Structure

The essence of organizational structure has been recognized among organization theorists. As Dalton et al. argued
Organization structure may be considered as anatomy of the organization, providing a foundation within which the organization functions. Organization structure is believed to affect the behavior of organization members . . . (1980, p. 49)

According to Thompson, structure refers to "internal differentiation and patterning of relationships, so structures are commonly characterized as "loose" or "rigid" (Thompson, 1967, p. 51). These terms often serve as summary representations of the degree of hierarchy, reliance on rules and regulations, and job autonomy, among other variables. Perrow also agrees with Thompson that when the tasks people perform are well understood, predictable, routine, and repetitive, organization structure is the most efficient, and things can be programmed (1979, p. 166). It is assumed that, where tasks are not well understood, the tasks are non-routine, and such units are difficult to bureaucratize. Downs, in his famous book Inside Bureaucracy, suggests furthermore that age and scope of previous experience enables some organizations to develop a more formalized rules system covering a wider range of situations that they were likely to encounter during work performance (1967, p. 18). Duncan is another scholar who argues that all decision units face routine and non-routine decisions. He predicted that "on the bases of information need, decision units operating in uncertain environments would show greater differences in their structural profile in
order to make these routine and non-routine decision than
decision units operating in a relatively certain
environment" (Duncan, 1973).

Thus, in its most general form, contingency theory may
argue that the performance of organizations is contingent
upon appropriate alignment of all or some dimensions of the
organization. The structure of the organization is the
dimension that all organization theorists agree upon as the
primary factor in organizational performance but the
structural dimension could vary along with other independent
dimensions (Hall, 1963, pp. 32-40; Pugh et al., 1968, p.
88).

The structure of one organization may differ from another
organization in various aspects: rules and regulations, age,
size, control mechanisms, administrative components, etc.
Such different structural configurations always become the
target of study of scholars. In this study, four major
components of organizational structure will be examined:
rules and regulations, age of the organization, size of the
organization, and size of the administrative component.

Rules and regulations. Related to the organization's
resources are rules, regulations, and procedures in
organization. Pertaining to procedures, Becker and Neuhauser
argued in their book, The Efficient Organization, at one
point in the "Entrepreneurial Theory" that

To place these variables within the context of the Entrepreneurial Theory we need simply state that in the Entrepreneurial Theory an organization consists of a combination of resources (people and things) and procedures (ways of doing things by, to, and with resources). The owner sets the goals and attempts to achieve it by storing in specific form of a higher or lower proportion of the organization's resources, and by specifying a higher or lower proportion of the organization's procedures. The owner's ability efficiently to combine the appropriate resources and procedures, to cope with the limitation imposed upon him by the environment, depends on his ability to specify procedures to increase potential visibility of consequences so as to increase his actual visibility of consequences, his awareness of what is going on (pp. 86-87).

Rules and procedures play a variety of roles in organizations. One major role is that of controlling and processing activities. Rules and procedures are different but closely related concepts. Basically, procedures are understood as a specific series of tasks, normally chronological, to be followed in performing work or accomplishing an activity, while a rule is a specific requirement that often relates to employee conduct (Carlisle, 1982, p. 232; Koontz and O'Donnell, 1976, pp. 138-139). A rule usually requires that a specific and definite action be taken or not taken with respect to a situation. It is thus related to a procedure, in that it guides action, but it specifies no time sequence. As a matter of fact, a procedure could be looked upon as a sequence of rules. A rule, however, may or may not be part
of a procedure. The essence of a rule is that it reflects a managerial decision that certain action be taken or not be taken.

The definition of rules and procedures is one of the classic characteristics of bureaucracy. Their role in an organization is rather straightforward. Rules are created to initiate changes and provide stability. However, rules and procedures may create tension occasionally (Merton, 1940; Gouldner, 1954). According to Weber, authority in bureaucracies is rational-legal authority, a type of domination based upon legally enacted, rational rules that were held to be legitimate by all members. Thus, rules are important for bureaucratic organization. Perrow even provided an analysis of the condition of organizations that have extensive rules:

A multitude of rules and regulations appears to be the very essence of a bureaucracy. The term "red tape" adequately conveys the problem. Rules govern everything; one cannot make a move unless one does it by the book . . . Every office in every department has seen to it that its autonomy is protected by rules. If one attempts to change one rule, he immediately runs into the problem that half a dozen other rules are connected to it; to change these, a geometric proportion of additional rules will be affected, and so on (1972, p. 23).

Rules are not always indispensible for all organizations. The organization that operates entirely on automation or relies entirely on personnel whose physical, intellectual, and personality characteristics are identical would have no
need or little need for rules (Hall, 1968, pp. 92-104). But in the bureaucratic society, rules are needed because machines cannot replace all people, all personnel cannot be inculcated as professionals if their occupations do not follow a sequence of professionalization steps (Hall, p. 97). Machines and professionals are occasionally too expensive to be used in the low-tech operations characteristic of developing countries. The use of both machines and professionals is an expensive substitute for rules.

Weber’s stress is on rules as a means of maximizing bureaucratic efficiency by reducing the inevitability of human variability that exists in their absence (1952). Gouldner even goes so far as to say that

Rules are functional insofar as they reduce status-located tensions stemming from close supervision and organizational tension stemming from interaction of different values, ambiguous legitimacy of authority, unreciprocated expectations, decline in informal interaction, discontinuity in the hierarchy of authority, limited communication, challenge to managerial expertise, and incongruence of organizational and group goals (1954, p. 240).

Thus, if the instrumental value of rules and procedures to the organization is to maximize efficiency by assuring predictability of results, the fundamental value of rules may well be to reduce the tension that the emphasis on predictability creates.
Rules are independent variables that control, in some part, the performance of organization. Carlson's study of school superintendents reveals that new rules serve a new incumbent well (1962, pp. 24-25). New rules can fulfill both individual and organizational needs. As Gouldner pointed out "the successors often become preoccupied with rules and rule making because of the needs that rule making satisfy" (Gouldner, 1954, p. 94). The study of Pugh et al. found a positive relationship between the number of specialists in the fifty-four organizations studied and the degree to which procedures were standardized (1971, pp. 19-29). Another study by Blau and Meyer revealed that formalized procedures for hiring and promotion in government finance departments were found to be positively associated with the degree of automation and the proportion of the staff required to have bachelor's degrees (1971). Thus, it is obvious that rules, regulations, and procedures are widely recognized as a critical factor in efficient bureaucratic performance.

It should be noted that rules and procedures are mainly cited in the study of bureaucratic organizations. The reason is that organization structure is typical of both industrial and governmental organizations. Bureaucratic structure in industry reflects not only the sophistication of the technical system, but also its designer's ability to identify routine, simple, specialized, and above all
regulating tasks that can be performed by skilled operators or by machines. In government, bureaucratic organization reflects not only routinized tasks, but also the quest for accountability.

**Age of Organization.** An organization's age has been the subject of study as well. It has often been suggested that as organizations age, all other things being equal, they repeat their work, with the result that it becomes more predictable, and so more easily formalized. As Starbuck pointed out:

New organizations tend to have vague definitions of their tasks. They are not sure which task segments are important or necessary, and they are not sure how the overall tasks should be factored . . . As an organization gets older, it learns more and more about coping with its environment and with its internal problems of communication and coordination . . . The normal organization tries to perpetuate the fruits of its learning by formalizing them. It sets up standard operating procedures; it routinizes reports on organizational performance . . . (1965, p. 480).

In recognition of the tendencies for organization to bureaucratize themselves as they age, a variety of explanations has emerged. Goodman and Goodman (1976) call this phenomenon a "temporary system," and Toffler (1970) calls it the "disposal organization." Samuel and Manneheim did an empirical research study on the impact of organizational age of the plants, and found statistically significant evidence that the older plants are more
Mintzberg pointed out that "Survival for organization would have meant the adoption of formal patterns of behavior and coordination and the construction of a more elaborate administrative component, in other words, the significant shift from organic to organization structure" (1979, p. 243). Such a transition, as Perrow pointed out, is typical of most organizations that are able to survive beyond their formative years and to leave small-scale operations behind (1970, p. 66). Thus, as Inkson et al. replicated the study of Pugh et al. (1963, pp. 289-315) four to five years later, they found that thirteen out of the fourteen companies increased their formal patterns of behavior by more activities formalization and more administrative coordination, in other words, those companies are more bureaucratized (Inkson et al., 1970, pp. 318-329).

**Size of organization.** Size appears to be a variable that is part of the interface between the organization and its environment. But size is more likely to be treated as an independent variable. As Scott (1981, p.235) pointed out: If technology assesses what type of work is performed by the organization, size measures how much of that work the organization carries on -- the scale on which the work is conducted.

In 1956, Blau argued that the large size of organizations is undoubtedly the single most important condition that leads
to bureaucratization:

Large business, industrial, governmental, church (organizations) . . . are bureaucratic in nature. In order to survive and maintain some degree of efficiency in accomplishing their goals, most of these large organizations have greatly depended upon hierarchy, specialization, rules, and impersonality (1956, p. 40).

More recently, a growing body of empirical research has tried to determine the effect of organizational size on several dimensions of organizational structure. Blau and Schoenherr conclude that "Size is the most important condition affecting the structure of organization" (1971, p. 57). Pugh et al. conclude from the Aston studies that size is the primary causal variable for certain structural variables (1969, pp. 91-114). Also, Child (1972) agreed with Pugh et al. (pp. 1-22). The relationship of size to other organizational variables remains a controversial issue.

Organizational size has been shown to be associated with complexity (Blau et al., 1976, pp. 20-40; Child, 1973a, p. 171); formalization (Hall et al., 1967, p. 911; Child, 1973a, pp. 168-185); administrative components (Terrien and Mills, 1955, pp. 11-14; Pondy, 1969, pp. 47-61); and decentralization (Blau and Schoenherr, 1971, p. 57).

Just as the older organization formalizes what it has seen before, so the larger organization formalizes what it sees often. The larger the organization, the more often behaviors repeat themselves; as a result, the more
predictable they become, hence the greater the propensity to
formalize them (Holdaway, 1971, pp. 278-286; Hendershot, 1972, pp. 149-153). Child's findings sum up the situation best:

Much as critics may decry bureaucracy, we found that in each industry the more profitable and faster-growing companies were those that had developed this type of organization in fuller measure with their growth in size above the 2,000-or-so employee mark. At the other end of the scale, among small firms of about 100 employees, the better performers generally managed with very little formal organization. The larger the company, the higher the correlation between more bureaucracy and superior performance (Child, 1974, p. 14).

Samuel and Mannheim found that larger size meant less control by direct supervision, but more by rules and procedures (Samuel and Mannheim, 1970, pp. 216-228). This literature suggests positive relationships between increasing formalization and increasing size. In other words, with their greater specialization, more unit differentiation, greater need for coordination by formal means, and more elaborate administrative hierarchies, larger organizations will be more regulated by rules and procedures.

The positive influence of organizational size towards organizational performance seems to be challenged by later scholars. Gooding and Wagner (1985, p. 481) reviewed the literature and concluded that
Organizational size and organizational efficiency defined as performance measured in relative (output-input) terms, are shown to exhibit no positive relationship to each other, casting doubt on the existence of a positive net relationship between organizational size and economics scale.

How does one measure organizational size? Khandwalla used annual sales to measure size, instead of the number of employees in the organization, and found that annual sales size can predict the level of bureaucratic control and decentralization (1974, pp. 74-79). Khandwalla's findings not only support the previous literature on the role of organizational size but also raise the question, is measurement justified? As a matter of fact, some previous empirical studies used other subjects besides manpower as the dependent variable. For example, Pugh et al. used net assets (1969, pp. 91-114), Aldrich used organization's outputs (1972, pp. 26-43), and Child used several kinds of measures (1973a, pp. 168-185). Thus, measurement appears flexible in research studies. As Jackson and Morgan pointed out, "Size is much more conceivable in terms of any indicators that can be measured in terms of numbers such as number of sites, sales volume, customers, volume of products and budget" (1978, p. 211).

Administrative component. Not only is the size of an organization important, but also the size of the administrative component. The question is raised as to
whether the size of the administrative component has any significant relationship to the efficient performance of the enterprise. Since human resources constitute the chief resources of most organizations, the staffing and use of human inputs can be an important source of efficiency. Terrien and Mills argued that the proper combination of indirect or supportive personnel to workers is directly involved in producing the organization's product and service. When an organization grows, operational economies of scale should allow it to decrease the proportion of personnel allocated to indirect activities, and thereby achieve greater efficiency (1955, pp. 11-14). However, the argument of Terrien and Mills is questioned by Coates and Updegraff (1973, pp. 576-588) and Murphy (1976, pp. 62-65) since the basic assumption of economies of scale has itself not been tested.

Tsauderos studied the effect of growth and decline on administrative office employees. Office staff grew as size increased, but in periods of decline, there was a negative relationship with size (Tsauderos, 1955, pp. 206-210). Also, Pondy and Rushing found in their study that ratios of managerial personnel (executive officers, professional personnel and clerical personnel) to production personnel were each consistently and negatively related to size, but positively related to increasing organizational complexity

To conclude, all four sub-factors—rules and regulations, age, size, and administrative components—have substantial impulse to drive the organization to be more formalized. The formal structure is usually represented by increasing rules, regulations, and procedures within the organization. Thus, the structure of organization is a major factor that influences the performance of the organization.

External Environmental Factors

Three external conditions are the subject of this study: political, economic, and social (industrial relations) conditions. As was stated earlier, there are no clear-cut relationships among these three variables, but they are related and overlapping, often influencing one another.

Political Factors

Politics is always concerned, more or less, with the performance of public enterprise in developing countries (Hanson, 1965; Carey-Jones et al., 1974; Sharkansky, 1967). Political changes are considered as the major forces for national development. Nevertheless, political disorders can lead to the ruin of a national development plan. Changes in political conditions affect the public as a whole.

A private enterprise may go into bankruptcy if losses become unbearable and unavoidable. A public enterprise
usually does not have this option because political considerations influence the government to keep the enterprise alive by meeting the loss through treasury subsidy. Consequently, the enterprise is then subjected to an increasing degree of supervision, control, and regulation by the government because all governments feel compelled to return the enterprise to a viable condition and to enhance its efficiency and productivity through sound and effective management.

Public enterprises are always concerned with the body politic. The political leader can utilize the public enterprise to enhance his or her personal power base by patronage, investment decisions, locational decisions, and personal funding (Sherwood, 1971). The military can get involved both directly and indirectly, depending upon the degree of its power over the civilian government (Nordlinger, 1977). Civil servants can get involved in public enterprise as compensation before retirement (Scott, 1972). A report of the United Nations found that in developing countries the practice of secondment of civil servants to the public enterprises is very popular (United Nations, 1973, pp. 38-40). Jones also supports this argument and points out that "governments in developing countries always exist and, to a greater or lesser extent, intervene in the production and distribution of goods and services."
Public enterprises are simply one means of achieving this intervention" (Jones, 1975, p. 1).

Another aspect of the politics of public enterprises is the relationship between government officials and the private economy. In developed countries such as the United States, for example, the appointment of some public officials is related to election campaigns and to the quid pro quo of candidate support. These relationships are the stuff of party politics. Public authorities even tend to be co-opted by the banking and business interests with whom they work. This co-option is the essence of interest group politics (Walsh, 1978, p.332). In developing countries, the government has always been sensitive to the possibility of public enterprises abusing their autonomy. It is the responsibility of government to prevent abuse. However, political and administrative leaders may find it necessary to offer patronage or to distribute resources in terms of funds, contracts, or employment in order to increase their political power or reduce political opposition.

Also worth noting is the fact that in many developing countries, personal relationships between the heads of major public enterprises and the ruler of the country are often very close. As Heath pointed out, "the heads of such enterprise may know only too well how to manipulate matters to their advantage and the civil servant may be powerless to
intervene" (1984, p. 112). However, it is also true that the heads of public enterprises and the high-ranking civil servants often cooperate within special relationships. In Thailand, for example, the top-level civil servants are so powerful that they can readily involve themselves in the business of public enterprise, even without a previous special relationship to the heads of those public enterprises. Thus, many top-level civil servants have a second job in a certain number of public enterprises (Riggs, 1966; Scott, 1972). Consequently, these civil servants may intervene in a variety of ways to achieve personal and political ends. At the same time, both the enterprise and its head may be promoted and supported.

Another political aspect of public enterprise is parliamentary supervision and control, which may even have the effect of deflecting a decision of the enterprise. However, the degree of supervision and control of the legislature is different between developed and developing countries. In developed countries such as the United States, for example, public corporation flexibility, to make decisions as a corporation normally would to compete in the market place and establish a relationship between cost and prices, is subject to political direction by Congress. Congress, from time to time, acts as a corporate board, intervening in broad policy decisions and day-to-day
activities. Congress, not surprisingly, expects the public enterprise to respond to the service and policy demands of elected officials (Leazes, 1984, p. 156). This is a quite different role from that of parliaments in developing countries. The parliamentary role has been either weak, insufficient and ineffective, too politically oriented, or focused on detailed operation rather than on policy matters (International Legal Center, 1976, pp. 27-28; Pozen, 1976, pp. 69-76). The reason is that the government in power can arbitrarily act to dissolve or disband the parliament at any time, a frequent occurrence in developing countries.

The UN report identified five methods commonly available to the parliament to exercise supervision and control over public enterprises: examination of annual reports and accounts, approval of the budget, parliamentary question, use of parliamentary committees, and the practice of having members of the parliament on boards of public enterprises (United Nations, 1974, pp. 98-111). However, the degree of supervision and control by parliament is usually second to that of the politician and civil servant in the government. It could be said that the role of parliament cannot be effective at all if, at the slightest inconvenience or irritation, the government in power may act to dissolve or disband the parliament.
Another major point of political involvement in public enterprises is the practice of political appointment to the executive board of the enterprise (Opoku-Afriyie, p. 293; Walsh, p. 332; Heath, pp. 110-111; Riggs, p. 297). The size of executive boards becomes the subject of study, when it is recognized that the executive board (either the board of directors or the board of commissioners) is the top rank position of the organization, and that it contributes a great deal to the operation of the organization (Bradburry, 1972, p. 908). Pfeffer's study of a hospital board of directors found that since the boards not only make the organizational policies, but also link the organization's environment to the organization's performance, the larger the board, the more successful it is in sustaining linkages to the organization's environment, particularly in terms of attracting resources from the community (1973, p. 362). In contrast, O'Donaughue and Carlson argue that the relative size of the board should not be larger than eleven members, so that the agencies may operate more effectively (1972, p. 362).

In developing countries, the size of boards has also been discussed in terms of their contribution to the organization's performance. Surprisingly, the focus of the discussion is not on the relationship between the size of the executive board and the organization's productivity, but
on the linkages to the sectional interests and the practice of the secondary positions of the board members (Prakash, 1963, p. 131). There are both pros and cons on this matter. The cons argue that the appointment is nothing but a convenient way of giving appointees an additional source of income as a reward for loyal support of the political leadership (Riggs, p. 297; Scot, p. 61), interfering with the autonomy of the public enterprise (Abdulrahman, pp. 307-308; Garner, pp. 25-26), and bringing a play-it-safe attitude, red-tape, and ignorance of accounting and financial concepts to the organization's decision-making process (Medhora, pp. 17-19). The pros argue that this practice will ensure that the public interest will be better safeguarded and promoted by having suitable civil servants and/or politicians on the executive boards. A civil servant can act as a buffer against what might be an undue degree of commercial orientation in public enterprises that have wider social, political, and economic goals to attain (Garner, p. 24). A civil servant is able to bring to the boards a knowledge of government policy and thinking. He helps provide desirable channels of communication between the public enterprise and the government (Saddique, p. 431; Abdulrahman, pp. 243-244). Also, the politicians and political appointees may bring to the board a high sense of purpose and commitment to a given government policy
At any rate, there is a tendency in developing countries to appoint civil servants to the boards of public enterprises, even though this practice was found unsatisfactory to some extent. In these cases, the appointees have been seen as either representatives of their respective ministries (if they are civil servants), or representatives of other interest groups, (if they are not civil servants), rather than representatives of the enterprise (El-Namaki, p. 212).

Prakash studied the composition of governing bodies of public enterprise in India. He found that the appointment of department secretaries on the boards of public enterprise has caused a great deal of instability because their average tenure is quite short, and they can attend only a very few meetings, if any (1963, p. 128). Prakash pointed out that every new representative must take some time to learn his job. Moreover, these departmental secretaries are subordinate to the dictates of their respective ministers-in-charge. They are not armed with full power to make decisions. Also, since departmental secretaries from several ministries serve on one board, they often disagree. Finally, when ministers (like civil servants) move from department to department, their responsibility for efficient management tends to be more illusory than real (Prakash,
1963, p. 133).

Two points of view exist concerning the role of the board. While the board, on one hand, was once a hallmark of a public enterprise, it would also react against political interference from outsiders (Leazes, 1984, p. 94). On the other hand, they are the ones who implement the national policy of the government and politicians (Abdulrahman, 1979, pp. 307-08). It was, therefore, suggested by some that the board of directors should be composed entirely of professionals. Nonprofessionals would only issue policy directives at the ministry level (International Legal Center, 1976, pp. 29-30). Some difference of opinion exists as to what should be the precise functions of officials appointed to boards. One view is that, since officials are agents of the government, their function is to ensure that public enterprises comply with national policy. Another view is that they should act independently and draw on their personal knowledge and experiences in guiding the enterprise. So far, this issue has not been resolved.

In developing countries, strong dissatisfaction with the actual functioning and performance of the executive boards exists with regard to both the issue of composition of boards and the issue of the functions and authority of the boards (International Legal Center, pp. 28-29; Abdulrahman, p. 300). It could be that a capable and responsible board is
thus a prerequisite for the successful performance of a particular enterprise. But what is more important is that the board must be sensitive and knowledgeable about the environment in which the enterprises operate (Phatak, 1969, pp. 348-349).

In summary, political bodies can provide supervision and control over public enterprise in various forms according to time and circumstances. When a country embarks on the creation of public enterprises, it must make choices. The first is which control mechanisms should ensure adequate accountability and responsibility: the ministry or ministers, parliament, or the judiciary. (some responsibility may be given to the judiciary through a system of administrative law). Other possibilities include representatives of the general public and the civil service administration. Statutes or commercial law to which the enterprise must conform and budgetary controls are yet other options. Accountability may be enforced politically through government supervision or by the appropriate minister being held responsible.

Economic Factors

Another environmental factor that has been recognized widely as having influence over the performance of the organization is economic conditions. Yet, there is no major
research that extensively studies the influence of economic conditions over the performance of public enterprises in developing nations. This study is an attempt to specify some factors that are expected to contribute substantially to the efficient performance of public enterprises in developing countries like Thailand.

Market competition seems to be the most important factor influencing the performance of public enterprise. Competition leads to the growth and enlargement in the size of enterprise. Reid and Allen pointed out that "... the growth of British Railways was due in part from the increasing competition among alternative transport modes, particularly road" (1970, pp. 110-111). With the high market competition, the business of decision making must be quick to adjust to rapidly changing market conditions (Jones, 1975, p. 177). This quick change will encourage innovation and experimentation and, at the same time, the competitive market will force management to ensure the efficiency of capital utilization, and thus encourage the enterprise's management to quantify the cost of non-commercial goals, if they are present (World Bank, 1983, p. 83).

It is always recognized that in a capitalist society competition drives enterprise. Competition can also lead to more efficient performance. As the report of a World Bank
staff said

Where it is possible to do so, however, exposing State-Owned-Enterprises (SOEs) to competition can be a simple and effective way to promote their efficiency. And if managers are required to pursue noncommercial goals for political or social reasons, competition will help to quantify the costs of those goals. . .

Competition has increased the pressure for better performance and helped clarify the costs of keeping inefficient producers alive and of meeting noncommercial goals (World Bank, 1985, pp. 42-43).

Thus, it is believed that market competition is the major factor influencing the efficient performance of public enterprise, as well as private enterprise.

Another factor is the general economic conditions of the country, although it is hard to measure how this affects the performance of public enterprises. So far, there has been no research conducted specifically on which economic factors direct the enterprise's performance. Nevertheless, most scholars have recognized that since the efficiency of public enterprises is largely dependent upon their ability to compete in the market, any economic factors that make the market condition change will also make the enterprises' policies and strategies change. As Farmer and Richman, for example, pointed out, the efficiency of individual firms may be ascertained by looking at a number of economic indicators:

1. profitability as measured either by the return, or the net worth, or the assets employed
2. how well the firm competes in export markets  
3. the extent to which a firm utilizes its plant capacity  
4. the output per employee  
5. the level of cost and prices and their relationship to those of other firms  
6. the matter of long-run innovation and whether policy and action are optimizing short-range performance at the expense of long-range performance, or vice versa (1965, pp. 63-69).

Koontz and O'Donnell proposed that economic factors that may influence a business enterprise should be capital, labor, price levels, productivity, entrepreneurs and managers, government fiscal and tax policy, and customers (pp. 77-80). Nevertheless, all of those factors have never been tested empirically to determine whether a relationship exists with the efficient performance of public enterprises. Moreover, there are more major economic factors that Koontz and O'Donnell overlooked, such as those that are regularly presented in the statistical yearbook of the United Nations, for example, the gross domestic product (GDP) and the gross national product (GNP). It is thus appropriate that this study conduct empirical research on a wide range of economic indicators.
Social and Industrial Relations Factors

Conceptually, the social environment is made up of attitudes, desires, expectation, degrees of intelligence and education, beliefs, and customs of people in a given group or society (Koontz and O'Donnell, p. 81). In any classification of environmental elements affecting the performance of an enterprise, the social factors are difficult to separate, even for discussion purposes.

The interweaving and complexity of the social, political, and economic environmental elements are such that their study and comprehension are difficult. To forecast them so that the management of the enterprise can anticipate and prepare for changes is even more difficult. However, it is conventionally recognized that any management that moves from one social group or society to another must take into account these facts about attitudes, beliefs, and values, and must consciously respond to them in some way.

Kenneth Boulding argued that organizations and the environment in which organizations exist are continually evolving:

The organizations, institutions, ideas, and techniques of one period permit the rise of new organizations, institutions, ideas, and techniques which eventually may displace the former set almost entirely, and which, in turn, permit the rise of a still further succession. We thus see human history as structurally a continuation of the immense drama of evaluation. Countries, businesses, unions, co-ops, churches, are the successors in the immense process of ecological
change. . . Moreover, organizations of men at any one
time form part of the whole ecosystem (1953, p. XXIII).

Whether subsidies are involved, public enterprises always
have a dimension of social purpose (Aharoni, 1981, p. 1341;
Beesley, 1984, p. 206). Thus, public enterprises must
recognize social change in the society they are serving.
Social change is always accompanied by a change in
technology. Several studies have pointed out how technology
can affect the performance of organizations (Woodword, 1965;
Burn and Stalker, 1966; Lawrence and Lorsch, 1967; Perrow,
1965; Galbraith, 1971; Khandwalla, 1971). To survive in the
business world, an enterprise must modify itself to consumer
behaviors, including customs, attitudes, and tastes, which
always change when time and technology change (Carlisle, p.
220). Emery and Trist classified social change according to
the type of change, in which the environments are seen as
being causal for the organizations within them. Their
classifications form a continuum: (1) "placid and
randomized" (or static)-- the organization is simple and
cannot predict the environment but can operate independently
because units are small and simple; (2) "placid and
clustered" (or routine)-- the environment is still not
rapidly changing but is somewhat more predictable and
organizations become larger and more hierarchical; (3)
"disturbed and reactive" (or dynamic)-- there are similar
and competitive organizations; the ability to predict the environment is confused because of the interference of the other organizations; and (4) "turbulent"—the highly complex, rapidly changing environment is a result of organizational interconnection, interdependence, and market competition (1965, pp. 21-32).

Khandwalla also supports and follows Emery and Trist, in his analysis, by categorizing the social environments into five categories according to their property: turbulence, hostility, diversity, technical complexity, and restrictiveness (1977, pp. 336-346). This property approach is more specific than merely states as social environments.

Some scholars explored the relationship of the environment to conditions within organizations. Terreberry developed the hypothesis that organizational change is largely externally induced (1968, p. 609). Katz and Kahn concluded that the "History of organizations is littered with the corpses of enterprises which failed to respond appropriately to the demands of the environment for change" (1966, p. 305). Blau, in his book Bureaucracy in Modern Society, outlined the historical conditions that help promote the development of a bureaucratic form of organization: money economy, capitalistic system, protestant ethic, and large size (1956, pp. 36-40). Finally the study of Stinchcombe found that "Organizational types generally
originate rapidly in a relatively short historical period, to grow and change slowly after that period, and the time at which this period of growth took place is highly correlated with the present characteristics of organizations of the type" (1965, p. 168).

Social environments, thus, affect the rate of formation of new organizations, particularly organizations of a new kind or those with a different structure (Stinchcombe, p. 143). Social conditions, Stinchcombe continued, are thought to affect the motivation that people have to start new organizations, as well as the likelihood that an organization will succeed. Thus, characteristics of individuals' motivation to organize are affected by the makeup of this social structure, and the probability that a person or a group of persons will be motivated to start an organization is seen as dependent upon both the social structure and the positions that the founders occupied within it (pp. 143-146).

Stinchcombe also argued that organizations are more likely to form when the following historical conditions are present: general literacy and special advanced schooling are available; urbanization is present; a money economy exists; political revolution occurs; and greater richness of social/organizational life exists (pp. 148-152). The arguments of Stinchcombe and Blau are thus similar in some
points, in terms of social conditions: a money economy and a capitalistic system. The conditions Blau missed are literacy and urbanization. Stinchcombe (1965) argued that these last two conditions are important. Societies of illiterates are quite different from societies of literates; practically, every variable that encourages the formation of organizations is increased by literacy and schooling. In a society with a small literate elite, organizations are much less likely to arise than in societies where literacy is widespread. They are likely to look quite different as well. Stinchcombe argued that urbanization has the same effect as literacy on the facilitation of organizational formation, by pointing out that innovators are attracted to urban areas where they can exchange ideas, methods for organizing resources, and so forth (pp. 148-152).

Urbanization in a developing society creates dramatic social change. When people move from rural to urban areas, they have an opportunity to unionize and create a new force in urban area. As Hrebiniax pointed out:

The growth of the union into a powerful-economic factor will affect the structure and process of the organization. Specifically, the organization will develop an internal political system suitable for coping with union-related contingencies. To the extent that union growth is seen as a threat or a critical issue, the distribution of intraorganizational power will change. It will reflect the increasingly important contributions of those responsible for eliminating or relieving the union problems (1979, p. 269).
This argument thus supports Farmer and Richman's view on the effect of sociological-cultural constraints in the enterprise's performance, since these constraints may create the difficulties of achieving a consensus in the work society and even add a new element to management's environment (Farmer and Richman, 1965, pp. 109-112).

Chapter Summary

This chapter reviews the literature related to hypotheses stated in the first chapter in order to identify factors that may affect the performance of public enterprises. The first three factors are internal variables: goals and objectives, organizational resources, and the organization structure of a large organization. The second three factors are external variables: political conditions, economic conditions, and social and industrial conditions. The external variables are mainly drawn from the arguments of those studies related to developing societies. Sources overwhelmingly agree that these factors exert a certain degree of influence on the enterprise's performance. However, very few of these views are empirically tested, and none of them has been tested in a macro perspective, which is what this study will attempt.
CHAPTER BIBLIOGRAPHY


273-291.


International Legal Center. 1976. *Law and Public Enterprise*
in Asia. New York: Praeger Publisher.


Lawrence, P. R., and J. W. Lorsch. 1967. Organization and


Pfeffer, Jeffrey. 1973. Size, Composition and Function of


Books.


Terrien, Frederick W., and Donald L. Mills. 1955. The


CHAPTER III

METHOD OF ANALYSIS

Several statistical techniques are used for analysis in this project since the number of variables is as many as 274 and the units of analysis is the years from 1960 to 1984. This chapter describes the methods used and outlines how they will be applied in subsequent chapters. Computations were made by using two major statistical packages: Statistical Packages for Social Sciences-Extended (SPSS-X) and Statistical Analysis System (SAS).

For the purpose of testing all hypotheses, regression analysis is used to find the association between the independent variables and the dependent variable. This statistical method will clarify not only the association between independent variables and the dependent variable, but also the partial correlation of each independent variable with the dependent variable, when all independent variables are included in the equation of multiple regression. The sign of each independent variable, either positive or negative, will indicate the direction of the relationship between that particular independent variable and the dependent variable. The coefficient of Determination (R Squared) will show how strong the
relationship is between the independent variables taken collectively and the dependent variable, when a perfect linear relationship is represented by an R Squared of 1.0, and no linear relationship by a value of 0.0. R Squared can be interpreted in terms of percentage of variation. It helps clarify the proportion that co-variation between the dependent variable and the independent variables is as a proportion of the dependent variable variance. Variance not explained by any given R Square is the effect of other independent variables besides those in the equation or of measurement error.

Data Gathering Procedures

The data for this research project are derived from various sources as follows (see Appendix 1 for a complete list of variables and the sources used to gather data to measure them):


3. Unpublished official records from various public agencies in Thailand such as the Ministry of Education; Department of Customs, Ministry of Finance; State Highway Department, the former Ministry of National Development; the Office of Registration, Department of Labor, Ministry of the Interior; and the Royal State Railway Authority of Thailand.

The units of analysis are the years from 1960 to 1984. Frequently one source of data did not cover all twenty-five years. Many variables are measured by data from different sources for different periods.

It should be noted that data for many variables in the 1980s are absent from the statistical records published by the international organizations, which are major sources for this research project. Thus, most data for this period are drawn from unpublished official records from various sources in Thailand and from some other supplementary sources such as books and articles published in Thailand by the Social Science Association of Thailand. *The Thai Public Enterprises: Past, Present and Future* (Department of Economic, Thammasat University, 1984) is especially important, and so are the research papers of the Social Science Association, such as "The Relationships Between the Legislature and Public Enterprises in Thailand" (Hongsanun,

Some variables such as goals and objectives, legislative oversight, labor movements and labor-government relations have been manually counted and tallied because there has been no measurement before. The counting was done according to the framework of this research project.

Statistical Procedures

For the purpose of hypothesis testing, the following data analysis steps will be undertaken.

1. Since twenty hypotheses are stated for testing, the relevant variables will be classified into clusters. Each cluster contains the indicators available for testing one hypothesis. However, four hypotheses—age of organization (YEAR), number of board members (BOARD), average tenure of the board members (TENURE) and the concurrent positions held by the board members (CONCUR)—are operationalized by only one independent variable. These four variables will be set aside to test each hypothesis directly without employing the factor analysis technique.
2. For the clusters representing concepts operationalized by multiple indicators, it will be necessary to identify a single measure of each concept in order to keep the number of independent variables in the regression analyses manageable. An appropriate statistical method for this purpose is factor analysis, particularly principal components analysis.

3. After a principal components analysis has been computed for each cluster, the variable that exhibits the highest covariation with (loading on) the first principal component will represent the cluster as a whole to test its simple regression with the efficiency variable, the dependent variable for all hypotheses. Also, the four variables: YEAR, BOARD, TENURE and CONCUR will be used to test those four hypotheses whose concepts they operationalize.

4. After all hypotheses have been tested by simple regression, the results of the statistical computation will be examined to determine whether there is any relationship between the hypothesized independent variables and operating efficiency. The degree of relationship will be assessed in terms of the coefficient of determination (R Squared). At this stage, all hypotheses will have been tested in isolation.
5. However, it is the purpose of this research project to find out the factors that affect operating efficiency as a whole. Thus, it is necessary to test how the three internal factors (goals and objectives, resources, and organization structure) and the three external factors (political, economic and social conditions) together affect the operating efficiency of the organization according to the conceptual framework provided by Van Meter and Van Horn. At this point, the variables that represent the twenty clusters will be grouped into six groups (three groups for internal factors and three groups for external factors). Then principal component analysis will be used again for data reduction purpose to produce only six variables to represent the six factors proposed by Van Meter and Van Horn. The multiple regression analysis will be used to analyze the partial regression coefficient of the efficiency variable on each factor.

6. If the multiple regression model proposed by Van Meter and Von Horn is not successful, the factor analysis technique will be used to compute a new factor structure to represent the composite variables that affect the efficient performance of the Thai state railway.
Missing Data

At first, the objective of this project was to conduct a longitudinal analysis by using time-series data from 1951 (the year the RSR emerged as public enterprise) to 1984, with a total of 213 variables. Unfortunately, 105 out of the 213 variables have missing-data points, and 69 out of 105 variables have missing-data points for over 25% of their cases. In other words, of the total 34 cases (years), 8 or more have missing values. As a rule of thumb, longitudinal analysis is not suitable in such cases. The project therefore has been scaled down to the period between 1960 and 1984. In this period, 66 out of 213 variables have missing-data points, but only 16 variables contain missing-data points for over 25% of their cases. In other words, of the 25 total cases, 6 cases (years) or more are missing.

There are several reasons for the missing data.

1. There are no data from the RSR Information Booklet for the years 1960 to 1962 and 1965. The RSR did not publish the reports until 1963. The 1965 booklet is missing from the RSR's library and it was unable to acquire it anywhere. Forty-nine variables have missing data values for those three years.

2. The information is not always comparable from year to year. Some variables have just been recorded recently in
the booklets. Before 1971, for example, operating expenses were categorized into the following categories: maintenance of way and structures, maintenance of equipment, traffic and transportation expenses, and general expenses. After that they were changed to equipment cost, fuel cost, labor cost and depreciation cost. As a result, even though the data for total operating expenses are all recorded, the data for operationalizing sub-variables are missing.

3. Old editions of these statistical record publications contained fewer data in past than in present editions. Also, the past data were always recorded as an index for a period, such as for every five or ten years, and it is not possible to find yearly data for those periods. For example, data on economic and social conditions between 1951 to 1960 are missing.

4. Some data have never been recorded yearly. The adult literacy rate in Thailand, for example, has actually been surveyed only four times: 1947, 1960, 1970 and 1980. The data presented in all statistical records about the literacy rate besides these four years are the result of the projections, but they were recorded yearly in various United Nations's statistical yearbooks. These projected data are used here to prevent a missing-data problem.

5. When there were no such activities or events, these are recorded as a zero. For example, data-points of
industrial relations variables are always zero in 1951 to 1956 and 1959 to 1971. There were no missing values, because there was no law allowing workers to unionize themselves legally.

6. Some data have been recorded and published inconsistently in Thailand, such as ships' registration, domestic flights, passenger aviation, and freight aviation. Those variables have consequently contained missing-data values for those unrecorded years.

7. Some data from recent years, from 1980 to 1984 in particular, had not yet been published in the statistical records publications by the time this project started: total national resources, total national labor forces, gross national income per capita, and repayments of loans by the RSR are specific examples. Thus, these variables have missing values for those years.

Missing-Data Treatment

As a result of these data gathering problems, some consistent missing-data treatments are needed. The use of statistical computation is worthless if the data of all variables are not consistent for the whole period of analysis. Essentially, all methods of correlation computation are based on the correlations of all unit values. If a value of one variable is missing, there will be
no correlation computation. To cope with this missing-data problem, this project uses least-squares regression as the basic method.

Least-squares regression methods are usually varied and dependent upon the characteristics of variables. Three major techniques are applied for this research study: (1) time-series trend estimation when used with the time-related measures; (2) regression analysis when used with variables that are not time-related; and (3) least-squares piecewise interpolation when used with the time-related measures on a limited range of the entire curve that exhibits linear correlation. These three techniques will be used to cope with the missing-data problems for 59 out of 66 variables.

Besides the three major techniques noted above, minor techniques are used for the other missing-data variables: mean substitution, idle (remain missing), and elimination (remove from the analysis). Each of these techniques has its own rationale, strengths and weakness, and deserves further discussion.

For the purpose of this analysis, the SPSS-X statistical programs are used to find out the slope ($B$) and the intercept ($a$) of each regression equation. The missing-data points are separately calculated by an IBM micro computer (MS-DOS 2.0) using the BASIC programing language.
Time-Series Trend Estimation

The missing data for six variables are estimated using least-squares trend estimation: depreciation (DEPRE), special funds (SPECFUND), number of passenger cars in service (SPASSCAR), telegram (TELEGRAM), welfare for employees (WELFARE), and average age of diesel locomotives (DAVERAGE). Since it uses the least-squares method of analysis, according to Dunn, trend estimation is considered the most accurate technique for extrapolating a linear trend (1981, p. 154). Least-squares trend estimation is based on the assumptions of persistence, regularity, and data reliability and validity of the past variations in observed trends through the future (Dunn, 1981, p. 151).

The statistical procedure for least-squares trend estimation can be applied to these six variables as follows:

1. Year is always represented on the horizontal or X axis.

2. The dependent variable on the vertical or Y axis is one of the six variables listed above.

3. For the purpose of this analysis, if there is a linear or straight line relationship between the two variables, and the value of the coefficient of correlation is as high as .80 or over, that linear relationship is assumed satisfactory to estimate missing-data points.
4. The computation of linear trend with least-squares regression is based on the following formula:

\[ Y_t = a + b(X) \]

where

- \( Y_t \) = the "trend value" for a given period;
- \( a \) = the value of \( Y_t \) when \( X = 0 \) (intercept);
- \( b \) = the slope of the trend line representing the change (increase or decrease) in \( Y_t \) for each unit of time;

and

\( X \) = the time sequence number for any given year.

5. Once the value of \( a \) and \( b \) have been calculated, it is possible to estimate missing-data points for any time value in the observed time series or in any projected time period.

Figure 1 is an example of using time-series least-squares trend estimation between YEAR (time measure) and DEPRE (depreciation variable with missing data).

This illustration provides both a plot and descriptive statistics for the relationship between the two variables. Thus, the computation for missing-data points is as follows:

\[ Y_t = a + b(X) \]

where

- \( a = -23.31 \)
- \( b = 7.77 \)

So,
Figure 1. Depreciation: 1960-1984

Depreciation (In Million Baht)

Year Sequence

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Statistics...

Correlation (R) .96  Significance .0000
Intercept (a) -23.31  Slope (b) 7.77
Plotted values 19  Missing Values 6
DEPRE = -23.31 + (7.77 * YEAR)

If 'YEAR' is 1 (or year 1960), for example,

DEPRE = -23.31 + (7.77 * 1)
= -15.54

Thus, the multiplication of 1 gives the estimation or approximation of missing-data value of the 'DEPRE' variable for year 1960 for further analysis.

Table 1 shows that all six missing-data variables have a very strong association with the time measure (YEAR) since their correlation of coefficients are over .80 (.9640; .9860; .9940; .9438; .9695; and .9355 respectively). This finding also means that each bivariate relationship forms an almost perfect straight line. The estimated values of the missing-data points are expected to fall somewhere along this line. Thus, the statistical procedure for time-series least-squares trend estimation is practical and useful for these six variables. The results for all six variables using this method of estimation are shown in Appendix 2.

Regression Analysis

Regression analysis uses least-squares estimation, as does the time-series least square trend estimation. But in regression analysis, any two variables can be correlated to estimate measuring data values. The missing data for thirty-nine variables are estimated using regression
### Table 1. Correlations with Time-Measure

<table>
<thead>
<tr>
<th>Variables</th>
<th>Correlation of Coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depreciation (DEPRE)</td>
<td>0.9640</td>
</tr>
<tr>
<td>Average Age of Diesel Locomotives (DAVERAGE)</td>
<td>0.9860</td>
</tr>
<tr>
<td>Special funds (SPECFUND)</td>
<td>0.9940</td>
</tr>
<tr>
<td>Number of Passenger in Service (SPASSCAR)</td>
<td>0.9438</td>
</tr>
<tr>
<td>Telegrams (TELEGRAM)</td>
<td>0.9695</td>
</tr>
<tr>
<td>Welfare for Employees (WELFARE)</td>
<td>0.9355</td>
</tr>
</tbody>
</table>

Source: Computed by the author

Analysis: current assets of railway (CURASSET), labor costs (LACOST), equipment costs (EQCOST), number of workers involved in disputes (INVODISP), accrued depreciation (ACCRUDE), amount of gross pay (GROSSPAY), freight aviation in ton-kilometers (FREIGHTA), consolidated income or loss (CONSOLID), pension and welfare reserve (RESERVE), number of steam locomotives in service (STEAMS), number of diesel locomotives in service (DIESELS), age of steam locomotives under twenty years (SUNDER20), age of diesel locomotives over ten years (DOVER10), age of freight cars between twenty-one to thirty years (F21TO30), repayments of loans by RSR (REPAY), government-labor relations (GOVLA), merchant ships registered (SHIPRE), passenger aviation in kilometers (PASAVIA), number of domestic flight (FLIGHT), mail traffic (MAIL), total national resources (NATRES), real gross
domestic income per capita (REALGDY), assets in monetary system (MONETARY), total national labor forces (LAFORCES), total national unemployment (UNEMPLOY), export of goods (EXGOODS), adult literacy rate (LITERACY), number of days of work stoppages (DAYSTOP), general public services expenditures (PUBSERVE), defense, public order and safety expenditures (DEFENSE), education expenditures (EDUCAT), health expenditures (HEALTH), welfare and social security expenditures (SOCIASEC), number of training employees (TRAINEMP), ratio of wage changes (WAGE), average minimum wage in RSR (RSRWAGE), total national external debt (DEBT), average age of steam locomotives (SAVERAGE), and number of diesel locomotives aged between eleven to twenty years (D11TO20).

Because regression analysis uses the same statistical method as least-squares trend estimation, it is a general statistical procedure that yields precise estimates of the pattern and magnitude of a relationship between a dependent variable and any one or more independent variables (not just time). Since regression analysis is based on principles of least-squares estimation it provides the one best 'fit' between data and the regression line by ensuring that the squared distances between observed and estimated values represent a minimum of least value (Dunn, 1981, p. 187).
According to Dunn (1981), the equation used to fit the regression line to observed data is identical to that used to estimate linear trend, with some minor differences as follows:

1. The symbol $Y_t$ (the subscript $t$ refers to a "trend value") is replaced with $Y_c$ (the subscript $c$ refers to a "computed value"). These different subscripts indicate that least-squares regression is applied to two substantive variables, whereas in least-squares trend estimation, one of the variables is time.

2. The formula for the regression equation is

$$Y_c = a + b(X)$$

where

- $a$ = the value of $Y_c$ when $X = 0$, called the $Y$ 'intercept' because it shows where the computed regression line intercepts the $Y$ axis.

- $b$ = the value of changes in $Y_c$ due to a change of one unit in $X$, called the 'slope' of the regression line because it indicates the steepness of the straight line.

$X$ = a given value of any independent variable.

The selection of trend estimation or regression analysis is dependent upon which variable exhibits the highest relationship with the particular missing-data variables: the
time measure or another substantive variable. If the highest relationship is exhibited with the time measure, least-squares trend estimation is used. Otherwise, regression analysis is used.

Figure 2 shows an example of using regression analysis between a missing-data variable: current assets of RSR (CURASSET) and its matching variable: total assets of RSR (ASSET). The illustration of Figure 2 is similar to Figure 1. Both plots of relationships and descriptive statistics are presented. However, the value of Y (predicted variable) is derived from the value of a substantive variable, rather than from the trend (time) value.

The computation for missing-data points is as follows:

\[ Y_c = a + b(X) \]

when

\[ a = 338.86 \]
\[ b = .08 \]

then,

\[ \text{CURASSET} = 338.86 + .08 \times \text{ASSET} \]

If total asset (ASSET) in 1965 is 5967 million baht, then the approximation of current asset (CURASSET) is as follows,

\[ \text{CURASSET} = 338.86 + (.08 \times 5967) \]
\[ = 816.22 \]

Thus, the estimated value of CURASSET for year 1965 is 816.22 million baht.
Figure 2. Current Assets: 1960-1984

Current Assets of RSR
(In Million Baht)

Total Assets of RSR
(In Million Baht)

Statistics...
Correlation (R) .84
Intercept (a) 338.86
Plotted Values 21

Significance .0000
Slope (b) .08
Missing Values 4
Table 2 shows the correlation coefficients (R) for each missing-data variable and its matching variable. Only six out of the thirty-nine variables show an R of less than .90 but over .80 (CURASSET, INVODISP, F21T030, UNEMPLOY, TRAINEMP, and D11T020). The rest of them show R to be .90 or over. This finding can be interpreted to mean that those six variables have relatively strong linear regressions with their matching variables, while the other thirty-three variables form almost perfect linear regression lines. Thus, regression analysis is practical for estimating missing values for these thirty-nine variables. The results of using this method of estimation for all thirty-nine variables are shown in Appendix 3.

Piecewise Interpolation

Piecewise interpolation uses the same method of least-squares estimation as do time-series least-squares trend estimation and regression analysis. As a matter of fact, the piecewise interpolation technique is similar to the time-series least-squares trend estimation discussed earlier since it estimates one dependent variable from the time-series variable. The difference is that piecewise interpolation is used when data are linear for only a limited range in the entire curve of the relationship of X and Y; only the missing-data points that fall into this
Table 2. Correlations with Nontime-Measure

<table>
<thead>
<tr>
<th>Missing-Data Variables</th>
<th>Matching Variables</th>
<th>Correlation of Coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURASSET</td>
<td>ASSET</td>
<td>.8437</td>
</tr>
<tr>
<td>LACOST</td>
<td>PERSONEX</td>
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<tr>
<td>ECOST</td>
<td>MAINCOST</td>
<td>.9934</td>
</tr>
<tr>
<td>INVODISP</td>
<td>DAYLOST</td>
<td>.8191</td>
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<tr>
<td>ACCRUDE</td>
<td>HIGHWAY</td>
<td>.9964</td>
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<tr>
<td>GROSSPAY</td>
<td>GOVDEBT</td>
<td>.9351</td>
</tr>
<tr>
<td>FREIGHTA</td>
<td>FRINGE</td>
<td>.9947</td>
</tr>
<tr>
<td>CONSOLID</td>
<td>NETINLOS</td>
<td>.9290</td>
</tr>
<tr>
<td>RESERVE</td>
<td>HIGHWAY</td>
<td>.9934</td>
</tr>
<tr>
<td>STEAMS</td>
<td>RULES</td>
<td>-.9963</td>
</tr>
<tr>
<td>DIESELS</td>
<td>DIESELB</td>
<td>.9154</td>
</tr>
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<td>SUNDER20</td>
<td>TRACK</td>
<td>-.9458</td>
</tr>
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<td>DOVER10</td>
<td>RULES</td>
<td>.9718</td>
</tr>
<tr>
<td>F21TO30</td>
<td>REALG Dy</td>
<td>.8791</td>
</tr>
<tr>
<td>REPAY</td>
<td>GDY</td>
<td>.9923</td>
</tr>
<tr>
<td>GOVLA</td>
<td>ROVER10</td>
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</tr>
<tr>
<td>SHIPRE</td>
<td>GNS</td>
<td>.9903</td>
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<td>PASAVIA</td>
<td>FRINGE</td>
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<td>FLIGHT</td>
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<td>MAIL</td>
<td>OFFICER</td>
<td>.9853</td>
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<tr>
<td>NATRES</td>
<td>GDP</td>
<td>.9978</td>
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<tr>
<td>REALG Dy</td>
<td>ASSET</td>
<td>.9906</td>
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<td>MONETARY</td>
<td>BENEFIT</td>
<td>.9950</td>
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<td>LA FORCES</td>
<td>ASSET</td>
<td>.9817</td>
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<td>UNEMPLOY</td>
<td>BUDGET</td>
<td>-.8699</td>
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<td>EXGOODS</td>
<td>CPI</td>
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<td>SOCIALSEC</td>
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<td>WAGE</td>
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<td>RS RWAGE</td>
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<td>DEBT</td>
<td>GOVDEBT</td>
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<td>S AVERAGE</td>
<td>HIGHWAY</td>
<td>.9911</td>
</tr>
<tr>
<td>D 11TO20</td>
<td>MOTOR</td>
<td>.8796</td>
</tr>
</tbody>
</table>
(Table 2. Continued)

Source: Computed by the author

Note:
CURASSET = Current assets
ASSET = Total assets
LACOST = Labor cost
PERSONEX = Personnel expenses
EQCOST = Equipment cost
MAINCOST = Maintenance costs
INVODISP = Number of workers involved in disputes
DAYLOST = Number of working days lost
ACCRUDE = Accrue depreciation
HIGHWAY = Length of highway
GROSSPAY = Amount of gross pay
GOVDEBT = Total government debt
FREIGHTA = Freight aviation in ton-kilometer
FRINGE = Fringe benefit
CONSOLID = Consolidated income or lost
NETINLOS = Net railway operating income or lost
RESERVE = Pension and welfare reserve
STEAMS = Number of steam locomotives in service
RULES = Number of rules and regulations in RSR
DIESELS = Number of diesel locomotives in service
DIESELEB = Number of diesel locomotives on book
SUUNDER20 = Number of steam locomotives aged under 20
TRACK = Length of track
DOVER10 = Number of diesel locomotives aged under 10
F21TO30 = Number of freight cars aged between 21 to 30
REALGDY = Real gross domestic income per capita
REPAY = Repayment of loans by RSR
GNP = Gross national product
GOVLA = Government-labor relations
ROVER10 = Number of railcars aged over 10
SHIPRE = Number of merchant ships registered
GNS = Gross national saving
PASAVIA = Passengers aviation in kilometers
FLIGHT = Number of domestic flights
MAIL = Mail traffic
OFFICER = Number of officers in RSR
NATRES = Total national resources
GDP = Gross domestic product
REALGDY = Real gross domestic income per capita
MONETARY = Assets in national monetary system
BENEFIT = Fringe benefit per permanent employee
LAFORCES = Total national labor forces
UNEMPLOY = Total national unemployment
BUDGET = National budget standing
(Table 2. Continued)

EXGOODS = Export of goods
CPI = Consumer price index
LITERACY = Adult literacy rate
POPULA = Population in Thailand
DAYSTOP = Number of working days stoppages
PUBSERVE = General public service expenditure
OREV = Operating revenue
DEFENSE = Defense and public order expenditures
EDUCAT = Education expenditures
MILITARY = Military expenditures
HEALTH = Health expenditures
SOCIASEC = Welfare and social security expenditures
WAGE = Ratio of wages change
TRAINEMP = Number of training employees
EXRATE = Exchange rate
RSRWAGE = Average minimum wage in RSR
OEXP = Operating expenses
DEBT = Total national external debt
SAVERAGE = Average age of steam locomotives
D11TO20 = Number of diesel locomotives aged between 11 to 20
MOTOR = Motor vehicle in use

particular range will be the subject of estimation. The important point is that the values of slope and intercept calculated from only this limited range are used for estimation. The merit of piecewise interpolation is recognized by Jain et al. (1985):

To obtain reasonably accurate results using interpolation, we may have to use polynomials of high degrees. With polynomials of high degrees, not only the computation becomes costly, but also computed results become unreliable because of roundoff errors. In order to keep the degree of interpolating polynomial small and also to achieve accurate results, we use piecewise interpolation. We subdivide the given interval (a,b) into a number of subintervals (Xi-1,Xi), i=1,2,...,n and approximate the function by some lower degree polynomial in each subinterval (p. 155).
The missing data for fourteen variables are estimated using least-squares piecewise interpolation. These fourteen variables are number of steam locomotives age over twenty years (SOVER20), number of passenger cars age under ten years (PUNDER10), number of passenger cars age between eleven to twenty years (P11TO20), number of passenger cars age between twenty-one to thirty years (P21TO30), number of passenger cars age between thirty-one to forty years (P31TO40), number of passenger cars age over forty years (POVER40), number of freight cars in service (SFREIGHT), number of freight cars age under ten years (FUNDER10), number of freight cars age between eleven to twenty years (F11TO20), number of freight cars age between thirty-one to forty years (F31TO40), number of freight cars age over forty years, (FOVER40), change of private investment (PRINVEST), domestic training programs employees attended (DOMESTIC) and number of labor disputes (DISPUTE).

For example, Figures 3 and 4 show and compare the relationships of the time measure (YEAR) and a missing-data variable: number of steam locomotives age over 20 years (SOVER20). In Figure 3, the plots and descriptive statistics of the number of steam locomotives aged over twenty years (SOVER20) between year 1960 to 1984 shows only a moderate linear regression with the time measure (YEAR) (R is -.57). In contrast, Figure 4 illustrates that SOVER20, the variable
Figure 3. Number of Steam Locomotives Aged over 20 Years and Time

Steam Locomotives Aged over 20 Years

Statistics...
Correlation (R) -.57  Significance .0030
Plotted Values 21  Missing Values 4
representing the number of steam locomotives aged over twenty years, from year 1960 to 1970 and the time measure \( \text{YEAR} \) shows a very high correlation of coefficient \( (R) \) at .93. With the piecewise interpolation technique, the value of the intercept \( (a) \) and slope \( (b) \) for this period can be used to find the value of missing-data points of the variable \( \text{SOVER20} \) for the years 1960, 1961, 1962, and 1965. The statistical procedure to find the estimated missing-data values of the piecewise interpolation technique is exactly the same as the time-series trend estimation.

Table 3 shows the correlation coefficient \( (R) \) for all fourteen variables with missing data estimated using the piecewise interpolation technique. The results of using this method are presented in Appendix 4.

Other Minor Methods

Mean substitution. There are two variables in this project for which the mean substitution technique is used to estimate missing data: change of export and non-factor services \( (\text{EXPONFS}) \) and investment programs of RSR \( (\text{INVESTPR}) \). Their means are substituted for their missing values because their highest linear correlations with the other variables are only .4841 with the \( \text{GOVINVOL} \) variable and -.5918 with the \( \text{REPAY} \) variable, respectively. As stated earlier, regression analysis is best used when variables are
Figure 4. Number of Steam Locomotives Aged over 20 Years (1960-1970) and Time

Steam Locomotives Aged over 20 Years

Year Sequence

Statistics...
Correlation (R) .93
Intercept (a) -2.24
Plotted Values 7

Significance .0010
Slope (b) 19.61
Missing Values 4
Table 3. Correlations with Time-Measure:
Piecewise Technique

<table>
<thead>
<tr>
<th>Missing-Data Variables</th>
<th>Period Used for Computation</th>
<th>Correlation of Coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOVER10</td>
<td>1960-1970</td>
<td>.9339</td>
</tr>
<tr>
<td>PUNDER10</td>
<td>1960-1968</td>
<td>.9963</td>
</tr>
<tr>
<td>P11TO20</td>
<td>1960-1968</td>
<td>.9900</td>
</tr>
<tr>
<td>P21TO30</td>
<td>1960-1968</td>
<td>-.9091</td>
</tr>
<tr>
<td>P31TO40</td>
<td>1960-1971</td>
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<tr>
<td>POVER40</td>
<td>1960-1975</td>
<td>.9476</td>
</tr>
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<td>SFREIGHT</td>
<td>1960-1967</td>
<td>.9825</td>
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<td>FUNDER10</td>
<td>1960-1969</td>
<td>.9588</td>
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<td>FOVER40</td>
<td>1960-1968</td>
<td>.9959</td>
</tr>
<tr>
<td>PRINVEST</td>
<td>1960-1964</td>
<td>.9640</td>
</tr>
<tr>
<td>DOMESTIC</td>
<td>1960-1967</td>
<td>.9603</td>
</tr>
<tr>
<td>DISPUTE</td>
<td>1971-1976</td>
<td>-.9864</td>
</tr>
</tbody>
</table>

Source: Computed by the author

Note:
SOVER20 = Number of steam locomotives age under 20
PUNDER10 = Number of passenger cars age under 10
P11TO20 = Number of passenger cars age between 11 to 20
P21TO30 = Number of passenger cars age between 21 to 30
P31TO40 = Number of passenger cars age between 31 to 40
POVER40 = Number of passenger cars age over 40
SFREIGHT = Number of freight cars in service
FUNDER10 = Number of freight cars age under 10
F11TO20 = Number of freight cars age between 11 to 20
F31TO40 = Number of freight cars age between 31 to 40
FOVER40 = Number of freight cars age over 40
PRINVEST = Change of private investment
DOMESTICS = Domestic training programs
DISPUTE = Number of labor disputes

related in a linear pattern; otherwise, it will yield a less reliable estimate. These two variables exhibited a very low degree of linear association with any variables, including
time. As a result, the best estimate of the missing values of these two variables is the average (mean) of their values.

Idle. Three variables: employees trained in Thailand (INTHAI), number of diesel locomotives aged under ten years (DUNDE10), and ratio of railroads vehicles aged under ten to those aged eleven to twenty years (RA10TO20) still contain missing-data points. The first two variables have no relationships with any other variables above .80. The RA10TO20 variable is the result of the computation between variable UNDER10 and A11TO20 which both have zero values on the years 1960, 1961, 1962 and 1965. Mean substitution is not used here because all the missing-data points are in the period of 1960 to 1964, which is the beginning of the time-series data. Substituting the mean would excessively inflate the would-be missing values. But the number of missing-data points for all three variables is lower than 25% of the total twenty-five cases (missing-data points number only one for the INTHAI variable and four for the DUNDE10 and RA10TO20 variables).

Elimination. Two variables: major labor movement (LAMOVE) and loan for survey and building new lines (LOAN)—are removed from the analysis since there is no linear relationships with other variables. The highest
coefficient of correlation of the LAMOVE variable with the UNIONS variable is .7653, and the LOAN variable with the ADMIN variable is -.5640. Both of them contain more than 25% missing-data (over 6 of 25 cases are missing).

Chapter Summary

This chapter focuses on two issues: the general statistical procedures for the data analysis and the treatment of missing data values. Discussion of the first issue on testing of relationships between variables using regression analysis techniques. It also indicates that the number of variables is reduced for the purpose of the multiple regression analysis by using the principal component analysis technique to select the best indicators for the conceptual clusters. Discussion of the second issue, which is the major part of this chapter, focuses on the missing-data problems and missing-data treatments. As a rule of thumb, variables that have missing-data points for over 25% of the total number of cases are not acceptable for social research. Because of its missing data problem, this research project was scaled down from the 1951-1984 period to the 1960-1984 period. However, 66 out of 213 variables still had missing-data points. Three major missing-data treatment techniques were used to cope with their missing-data problems: time-series least-squares trend
estimation, regression analysis, and piecewise interpolation. Each technique has both strengths and weaknesses but they are the most appropriate for use with these variables.


Office of the Prime Minister. 1968. Thailand Official Yearbook for 1968. Bangkok, Thailand. (Published in Thai)


R. Data Set.


CHAPTER IV

DATA ANALYSIS I

Principal Component Analysis Technique

Principal component analysis is a data reduction technique used primarily for reducing the number of observed variables. As Overall and Klett (1983) clearly pointed out:

Principal-component analysis is a method for reducing \( p \) (value) correlated measurement variables to a smaller set of statistically independent linear combinations having certain unique properties with regard to characterizing individual differences. The first principal component is that weighted combination of the several original variables which accounts for a maximum amount of the total variation, or individual differences, represented in the complete set of original variables. The second principal component is that weighted combination of the several original variables which of all possible weighted combinations uncorrelated with the first principal component accounts for a maximum amount of the remaining variation or individual differences. The \( r \)th principal component is that weighted combination which of all possible weighted combinations independent of the first \( r - 1 \) accounts for a maximum amount of the remaining variation among individuals in terms of their original score values. The properties of statistical orthogonality (independence) and maximization of variance uniquely define principal components (p. 57).

The number of principal components varies, and it is dependent upon the common factors of the observed variables. The first principal component always represents the highest covariance of the data. The second principal component represents the next highest covariance orthogonal to the
first. The third and so on always have the lower covariance associated with them. The number of principal components may range from one, when all variables are highly correlated with one another, to as many as the number of observed variables, when no variables relate to any other variables. For the latter case, the principal component analysis is useless because it does not help reduce the number of observed variables.

The factor loadings of the variables on the principal components are the results of a mathematical combination of the observed variables (Kim and Mueller, 1978, p. 17). The observed variable that has the highest co-variation to the principal factor is the most representative variable of that principal component, and can be used for further analysis.

In this research project, the observed variables have been grouped initially into sixteen different conceptual clusters and four conceptual variables to test the twenty hypotheses as follows:

1. The goals and objectives cluster has five variables: total objectives, ratio of objectives stated in quantitative terms to all objectives, ratio of quantitative to qualitative objectives, ratio of total objectives to total goals, and ratio of unverifiable goals to total goals.

2. The resources cluster has twelve variables: total budget appropriation for RSR, number of officers in RSR,
current assets of RSR, budget for administration, number of steam locomotives in service, number of diesel locomotives in service, number of railcars in service, number of passenger cars in service, number of freight cars in service, total railroad vehicles in service, budget for railway renovation, and budget for survey and building new lines.

3. The equipment age cluster has six variables: average age of steam locomotives, average age of diesel locomotives, average age of railcars, ratio of railroad vehicles aged under 10 to 11-20 years, ratio of railroad vehicles aged under 10 to over 10 years, and ratio of railroad vehicles aged 11-20 to over 20 years.

4. The control activities cluster has three variables: number of rules and regulations in RSR, number of rule changes in RSR, and decentralization change.

5. The organizational size cluster has twenty nine variables: total assets of RSR, length of track, number of employees in RSR, total route in kilometers, freight traffic on railways, passenger traffic on railways, number of permanent employees, number of temporary employees, number of officers, number of permanent laborers, maintenance costs, accrued depreciation, pension and welfare reserve, amount of gross pay, special funds, tonnage transported, passenger kilometers, ration of temporary to permanent
employees, ratio of passengers to workers, ratio of freight to workers, repayment of loans by RSR, investment program of RSR, number of steam locomotives on books, number of diesel locomotives on books, number of railcars on books, number of passenger cars on books, number of freight cars on books, ratio of total revenue to workers, and total railroad vehicles on books.

6. The administrative size cluster has four variables: number of officers, ratio of officers to permanent laborers, ratio of officers to all laborers, and ratio of officers to operating revenue.

7. The political involvement cluster has seven variables: career background of chairperson of the board, career background of governors of RSR, number of armed forces officers on the board, number of civil servants on the boards, ratio of armed forces officers to the board, ratio of civil servants to the board, and ratio of armed forces officers to civil servants in the board.

8. The public accountability cluster has three variables: budget appropriation for public enterprises, legislative oversight of public enterprises, and government-labor relations.

9. The political conditions cluster has three variables: governmental change and national election, political protest, state coercive behavior.
10. The market competition cluster has eight variables: motor vehicles in use, merchant ships registered, passenger aviation in kilometers, freight aviation in ton-kilometers, number of domestic flights, length of highways, mail traffic, and telegrams.

11. The economic conditions cluster has seventeen variables: gross national product, gross domestic product, gross national product per capita, gross national saving, gross domestic investment, investment financing, consumer price index, wholesale price index, total national resources, balance of payment, budget standing, total national external debt, total government debt, assets in monetary system, total national labor forces, total national unemployment, and export of goods.

12. The government expenditures cluster has six variables: military expenditures; general public services expenditures; defense, public order, and safety expenditures; education expenditures; health expenditures; and welfare and social security expenditures.

13. The educational conditions cluster has five variables: adult literacy rate, children in primary schools, children in secondary schools, vocational enrollment, and students in universities.

14. The labor movements cluster has eight variables: number of strikes and lockouts, number of workers involved
in strikes and lockouts, number of working days lost, number of days of work stoppages, number of labor disputes, number of workers involved in disputes, number of labor unions, and number of labor union members.

15. The employee conditions cluster has thirteen variables: number of welfare items provided for employees, ratio of wages changes from the previous year, fringe benefits, personnel expenses in RSR, fringe benefits per permanent employee, salary and wages, wage and salary per employee, number of employees training in RSR institute, domestic training programs employees attended, employees trained in Thailand but outside RSR, foreign training programs employees attended, employees trained outside Thailand, and average minimum wage in RSR.

16. The labor relations in organization cluster has five variables: number of labor negotiations in RSR, number of agreements over labor disputes in RSR, number of disagreements over labor disputes in RSR, number of government involvements in labor disputes, and number of strikes and lockouts in RSR.

There are four non-clusters that have one variable for each one: organizational age (YEAR), size of executive board (BOARD), tenure of the board member (TENURE), and concurrent position (CONCUR). Appendix 5 illustrates the results of principal component analysis technique used for data
reduction for the sixteen clusters. Table 4 shows the sixteen representative variables with the value of their factor loadings on the first principal component for the sixteen clusters.

Analysis of Simple Regressions

Time-series data can be greatly affected by time-related processes. First, the value of currency is subject to change from year to year because of either inflation or deflation of the national economy. Second, the value of a time-series variable at one point in time may be affected by its past values (autocorrelation). To cope with the first problem all variables specified in terms of currency were converted into amounts expressed in constant Baht (Thai currency) of the year 1975, thereby taking out the effect of inflation or deflation.

Autocorrelation Problem

Correlation of residuals for a regression model with a time-series response is called "autocorrelation" because it refers to correlation between residuals from the same time-series model at different points in time. Undetected autocorrelation may inflate the regression coefficient when a variable is regressed on another variable. The value of $R^2$ square computed from the regression equation may not be the true value and is uninterpretable (Mendenhall and McClove,
Table 4. The Results of Principal Component Analysis
for Sixteen Cluster Concepts

<table>
<thead>
<tr>
<th>CLUSTER CONCEPTS*</th>
<th>REPRESENTATIVE** VARIABLES</th>
<th>VALUE OF FACTOR SCORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals and Objectives(5)</td>
<td>OBGOAL</td>
<td>.93661</td>
</tr>
<tr>
<td>Resources(12)</td>
<td>SPASSCAR</td>
<td>.96459</td>
</tr>
<tr>
<td>Equipment Age(6)</td>
<td>RAGEMENT</td>
<td>.97788</td>
</tr>
<tr>
<td>Control Activities(3)</td>
<td>RULES</td>
<td>.78905</td>
</tr>
<tr>
<td>Organizational Size(29)</td>
<td>RAILCARB</td>
<td>.96454</td>
</tr>
<tr>
<td>Administrative Size(4)</td>
<td>OFFALLLA</td>
<td>.97590</td>
</tr>
<tr>
<td>Political Involvement(7)</td>
<td>ARMEDBOD</td>
<td>.99093</td>
</tr>
<tr>
<td>Public Accountability(3)</td>
<td>LEGISLAT</td>
<td>.77333</td>
</tr>
<tr>
<td>Political Conditions(3)</td>
<td>POLITEST</td>
<td>.77587</td>
</tr>
<tr>
<td>Market Competition(8)</td>
<td>HIGHWAY</td>
<td>.99368</td>
</tr>
<tr>
<td>Economic Conditions(17)</td>
<td>NATRESX</td>
<td>.99384</td>
</tr>
<tr>
<td>Government Expenditures(6)</td>
<td>MILITARX</td>
<td>.98908</td>
</tr>
<tr>
<td>Educational Conditions(5)</td>
<td>SECOND</td>
<td>.98395</td>
</tr>
<tr>
<td>Labor Movements(8)</td>
<td>DAYSTOP</td>
<td>.96455</td>
</tr>
<tr>
<td>Employee Conditions(13)</td>
<td>RSRWAGEX</td>
<td>.96280</td>
</tr>
<tr>
<td>Labor Relations(5)</td>
<td>NEGOTIAT</td>
<td>.95955</td>
</tr>
</tbody>
</table>

Source: Computed by the author

* indicates number of variables in each cluster

** indicates the variable names

Note:

OBGOAL = ratio of objectives to total goals
SPASSCAR = number of passenger cars in service
RAVERAGE = average age of railcars
RULES = number of rules and regulations
RAILCARB = number of railcars on book
OFFALLLA = ratio of officers to all laborers
ARMEDBOD = ratio of armed forces officers in the board
LEGISLAT = number of legislative oversights
POLITEST = number of political protest
HIGHWAY = length of highways
NATRESX = total national resources in constant currency
MILITARX = military expenditure in constant currency
SECOND = children in secondary schools
DAYSTOP = number of working day stoppages
RSRWAGEX = average minimum wage in RSR in constant currency
NEGOTIAT = number of labor negotiations in RSR
Thus, it is necessary to deal with the possibility of autocorrelation. For this project, theories provided no plausible models of the reasons for autocorrelation. The value of each independent variable is expected to affect the degree of operating efficiency on a year-by-year basis. However, since there is the possibility of autocorrelation on the independent variables, two techniques are used to eliminate the autocorrelation problems: the lagged independent variable model and the first-order autoregressive model.

1. The lagged independent model uses the technique of lagging to eliminate the autocorrelation problem, and the Durbin-Watson test of residual correlation is used to test for it. Lagging, in general, means that observations on a dependent variable and independent variable at two different points in time are paired, with the time corresponding to the independent variable lagging behind the time for the dependent variable (Mendenhall and McClave, p. 465). For the purpose of this project, the independent variable is lagged no more than two lags (two years), so that no more than two degree of freedom are lost by this procedure.

2. The first-order autoregressive model, which is the model for stationary time series, is based on the assumption that positive autocorrelation diminishes rapidly as the
distance between time points increases. Positive autocorrelation can occur when regression residuals have a mean of zero and constant variance, but residuals at consecutive time points tend to have the same sign (Mendenhall and McClave, 1981, p. 461). The effect of positive correlation of regression residuals can be checked through regressing variables on their own past values. This model is suitable for short-term fluctuations (random walk) of a limited range period. It assumes that a future value is a linear function of a past value. Thus, the most recent value is needed to make the best forecast for the next value (SAS, Inc., 1984, pp. 302-304).

In this analysis, the SAS statistical program is used to correct for autocorrelation and to calculate the regression equations (SAS, Inc., 1984). The Durbin-Watson d statistic is checked against the table of critical values at the .01 level of significance. The techniques of checking are as follows:

1. If, without lagging, the Durbin-Watson d statistic exceeds the minimum requirement of critical value on the Durbin-Watson Table, then the statistical results will be accepted.

2. If the Durbin-Watson d statistic shows a value lower than the minimum critical value, a lagged independent variables model will be used. If the critical value
improves within the two lags, the statistical results will be accepted.

3. If the critical value is not improved after taking two lags of independent variable, the lagged independent variable model is inappropriate since further lagging will result in losing more degree of freedoms and thus deteriorate the result of further analysis. In such a case, the first-order autoregressive model will be used. When the residual autocorrelations are successfully modeled, smaller values for both the mean square error (MSE) and the standard error of the estimate for the residuals (Standard Error) of the independent variables are expected.

The lagged independent variable model is used first because it can effectively eliminate the positive autocorrelations. For the models that need more than two lags (years), the analysis cannot be accurately estimated because too many degrees of freedom are lost. In such a case, the first-order autoregressive model is more accurate, since the model loses only one degree of freedom. The autoregressive model is based on the concept that correlation of residuals for a regression model at consecutive time points can be diminished as the distance between time points increases (Mendenhall and McClove, 1981, p. 461). Thus, the correction of the correlated residuals, by changing the distance between time points, will help
solve the autocorrelation problem, without losing too many
degrees of freedom, and almost all of data remain effective
in the regression model. According to this model, positive
autocorrelation will be reduced, but not eliminated. Thus
the autoregressive model is less accurate than the lagged
independent variable model, if the positive autocorrelation
can be eliminated within two lags. If not, the first-order
autoregressive model is the more appropriate.

Major Statistical Results of Simple Regression Analysis

The simple regression equation model used here is the
same as the model used in the regression analysis in the
previous section on missing-data treatments. That is,

\[ Y_c = a + b(X) + e \]

The Coefficient of Determination (R Square) in simple
regression tells the strength or weakness of the
relationship between the independent and the dependent
variables by showing how well the linear regression fits.
For the purposes of this analysis, the following rules of
thumb are used to assess the value of R Square:

- .00 to .50 = no relationship
- .51 to .60 = very low relationship
- .61 to .70 = low relationship
- .71 to .80 = moderately relationship
- .81 to .90 = high relationship
.91 to .99 = very high relationship  
1.00 = perfect relationship

The direction of a relationship can be observed by the value of the slope (b). If there is a negative relationship, a minus (-) will be indicated in front of the B Value.

The significance of a relationship can be observed from the T or F values. The level of probability also tells how statistically significant is the linear relationship between the two variables. Statistical significance does not mean substantive significance, but it is necessary before one can have confidence in the substantive significance of the analysis.

The Durbin-Watson test of autocorrelation (d Statistic) is included in the analysis of each simple regression equation since it clarifies whether or not there is any positive autocorrelation of the variables in the equation. The value of d will be close to 2 if there is no relationship between the residuals of time 1 and time 2. As the value of d nears zero, there will be a positive correlation between the residuals of time 1 and time 2. If the residuals are highly negatively correlated, d will be approximately equal to 4. Thus, d ranges from 0 to 4 (Durbin and Watson, 1951, pp. 159-178).
The Findings for Twenty Hypotheses

A number of scholars of organization theory concentrated on the relationship between a single independent variable and one dependent variable. The results of those studies thus indicated various single factors that influence the organization's performance. This study seeks to examine the effect of multiple factors, both as individual effects when each independent variable is tested, and as a partial effect when more than one independent variable is tested at the same time. The bivariate relationship between one independent and one dependent variable is the first subject of study since it shows how the arguments of the scholars in the literature are confirmed or negated in this study. The multivariate relationships are the next subject of study.

All twenty simple regression equations and the test of the Durbin-Watson d Statistic are computed using the SAS statistical programs. General least squares (GLS) estimations of all equations are computed by the Yule-Walker estimation method. If there is no lagging or if the lagged independent variable model is used, the Ordinary Least Square (OLS) estimates are adequate for the analysis since there is no autocorrelation in the time-series data or the autocorrelation is entirely eliminated. If the autocorrelation cannot be completely eliminated, the Yule-Walker's GLS estimates are used since they are more
efficient and their standard error estimates are less biased than the OLS estimates (SAS/ETS User Guide, 1984, pp. 183-184). Thus, the findings for each model are derived from either the Ordinary Least Square (OLS) or the Yule-Walker's General Least Square (GLS) estimations. Tables of findings are provided along with the hypothesis and an explanation of the statistical results.Abbreviations of statistical terms are used, instead of the whole terms. These abbreviations are used:

- OLS = ordinary least square
- GLS = general least square
- SSE = sum of squared error
- DFE = degrees of freedom for error
- MSE = mean square error
- d Statistic = Durbin-Watson's test of autocorrelation
- a = constant (Y intercept)
- B Value = estimated value of slope for model
- T Ratio = ratio of estimate to standard error
- Y = estimated value of the dependent variable

Goals and Objectives

**Hypothesis.** The clearer goals and/or objectives, the less confused is the operation and the more efficient is the enterprise's performance.

**Model:** \[ Y = a + b(\text{OBGOAL}) \]
Finding: \( \text{EFFICIEN} = 0.92 + 0.02(\text{OBGOAL}) \)

Table 5 illustrates the statistical results for the simple regression between the goals and objectives: ratio of total objectives to total goals variable (OBGOAL) and the degree of operating efficiency (EFFICIEN). Without lagging, the Durbin-Watson test shows a \( d \) Statistic of 1.19, which falls into the region of minimum acceptance of no positive autocorrelation at the .01 level.

Table 5. Goals/Objectives and Efficiency

<table>
<thead>
<tr>
<th>Results of OLS Analysis of Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>0.9247</td>
<td>0.0322</td>
<td>28.68</td>
<td>.0001</td>
</tr>
<tr>
<td>OBGOAL</td>
<td>0.0205</td>
<td>0.0037</td>
<td>5.49</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

The result of regression analysis illustrates that there is a positive relationship between the two variables with regression \( R \) Square = .57, and a positive sign for the regression coefficient of goals and objectives. The relationship is also statistically significant at the .01
These findings support the arguments of Van Meter and Van Horn (1975) and Tierney (1984) that clearer goals and objectives have positive effects on organizational performance. Even though the statistic is significant at the .01 level, the R Square of .57 can be interpreted as a relatively very low relationship between the two variables. Thus, this relationship cannot be considered as being of much substantive significance.

One of the reasons for the relatively very low relationship is probably the nature of the goals and objectives of public enterprises. Objectives are most practical when they are stated in quantitative terms (Koontz and O'Donnell, 1979). Public enterprises are less likely to quantify objectives since their policies are made for political, rather than commercial, reasons. Public enterprises in developing countries, in particular, tend to deal with the government, the politicians, and the labor unions, rather than their clients, because of their government-sponsored status. Goal dissonance often occurs when the enterprise has to deal with political interests. For example, when the old government is replaced by the new government, new policies will frequently be issued. It is not unusual for the new government to expect changes in public organizations that will cause conflicts between old
and new policies. Consequently, the goals and objectives are written with relatively broad and general statements, so that they are flexible enough to change in any situation.

Furthermore, social goals are necessary for public enterprises in developing countries since the purpose of the establishment of most public enterprises is usually to promote national development, particularly the improvement of the national infrastructure. Some public enterprises may be allowed to operate at a financial loss, from time to time, to meet these social goals. It is unlikely that public enterprises can generate profits from their operations when the public cannot afford their goods or services.

The goals of public enterprises must be narrower and more straightforward than those of typical public agencies, since they are expected to pursue business activities to some degree. The government provides public enterprises with a certain degree of autonomy, so that the enterprises can reduce the problem of bureaucracy in their organizations, and be flexible enough to operate like private business enterprises. This special status encourages public enterprises to compete with other similar enterprises in the market. Also, the public enterprises are relieved from the restrictions of the laws and regulations used to control typical public agencies through a civil service commission. As a result, the top management of the public enterprises
can set its own goals and objectives for the enterprises. It is the duty of the board of commissioners and the top-level decision makers of the enterprises to set the goals and objectives clearly enough for them to be successfully implemented by their staffs.

Thus, no matter how precise the goals and objectives of public enterprises, the outcomes are always concerned with social goals or social responsibilities. Consequently, goals are rarely clear, precise and definite like those of private enterprises.

Resources

Hypothesis. The more operating resources the public enterprise has, the more efficient is its performance.

Model: \[ Y = a + b(\text{SPASSCAR}) \]

Finding: \[ \text{EFFICIEN} = 1.82 - 0.0009(\text{SPASSCAR}) \]

Table 6 illustrates the relationship between the operating resources, represented by the number of passenger cars in service (SPASSCAR) and the degree of efficient performance of the RSR. After lagging the independent variable for one year, the \( d \) Statistic is improved from 1.01 to 1.10 and falls into the region of minimum acceptance of no positive autocorrelation at the .01 level. When the two OLS models are compared, the regression coefficient for the independent variable (SPASSCAR) after and before lagging
Table 6. Resources and Efficiency

Results of OLS Analysis of Residuals before Lagging

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1544</td>
<td>23</td>
<td>0.0067</td>
<td>.65</td>
<td>1.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.8489</td>
<td>0.1024</td>
<td>15.35</td>
<td>.0001</td>
</tr>
<tr>
<td>SPASSCAR</td>
<td>-0.0010</td>
<td>0.0001</td>
<td>-6.52</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Results of OLS Analysis of Residuals after lagging

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1510</td>
<td>22</td>
<td>0.0069</td>
<td>.63</td>
<td>1.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
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<td>Intercept (a)</td>
<td>1.8175</td>
<td>0.1229</td>
<td>14.79</td>
<td>.0001</td>
</tr>
<tr>
<td>SPASSCAR</td>
<td>-0.0009</td>
<td>0.0001</td>
<td>-6.19</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

are the same at .0001.

The OLS estimation of the lagged independent variable model shows a minor change of the R Square from .65 to .63. Thus, the R Square still indicates a relatively low relationship between resources and the degree of efficiency. The direction of relationship is negative. The T value
(-6.19) would have been significant at the .01 level (.0001), had the relationships between the two variables not been contrary to the hypothesis.

These findings run counter to the hypothesis and the arguments of McFarland (1958), Yutchman and Seashore (1967), Becker and Neuhauser (1975), and Koontz and O'Donnell (1976). Conventionally, resources are necessary to accomplish goals or objectives. Resources are needed in certain amounts for the operation to take place. Resources can be a significant factor in improving efficient performance if the organization can acquire enough resources before the operation. If the enterprise has to generate resources for itself, resources are not considered an independent factor that can influence the enterprise's performance. On the contrary, resources become the result of the enterprise's performance.

In the case of the Thai state railway, the latter situation may be the case since the railway authority generates most resources from within its organization. Because public enterprises in developing countries are required to generate income from their products or services, their resources come mainly from the ability of that enterprise to compete in the market. Resources in such cases are not dependent upon external factors, but on the enterprise's capacity to generate them.
Age of Major Equipment

Hypothesis. The more old equipment is utilized, the less efficient is the enterprise's performance.

Model: \[ Y = a + b(R_{\text{AVERAGE}}) \]

Finding: \[ \text{EFFICIEN} = 1.18 - 0.02(R_{\text{AVERAGE}}) \]

The use of inanimate energy or mechanization is tested in this hypothesis. Table 7 shows the relationship between age of major equipment, represented by the average age of railcars variable \((R_{\text{AVERAGE}})\), and the degree of operating efficiency. Without lagging the independent variable, the Durbin-Watson test shows a \(d\) Statistic of 1.10, which meets the minimum criterion for no autocorrelation at the .01 level.

Table 7. Age of Equipment and Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept ((a))</td>
<td>1.1802</td>
<td>0.0204</td>
<td>57.95</td>
<td>.0001</td>
</tr>
<tr>
<td>(R_{\text{AVERAGE}})</td>
<td>-0.0243</td>
<td>0.0031</td>
<td>-7.71</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author
The result of the regression computation reveals that $R^2$ is moderately high at .72, and significant at the .01 level (.0001). This statistical result shows the moderately high relationship between the two variables. The negative $B$ Value of the independent variable supports the hypothesis that there is a negative relationship between these two variables.

This finding confirms that industrial efficiency is related to technology. Today, when technology can change drastically, equipment can become obsolete quickly. Obsolescence not only increases maintenance costs (if that equipment is still in usable condition), but also make the industry less competitive. As a result, the industry that utilizes older equipment cannot compete in the market, and its efficiency tends to be lowered.

The statistical result of the simple regression between the average age of railcars and performance efficiency also shows a negative relationship. It thus definitely supports the argument that the older major railroad equipment needs to be eliminated since its use causes a lower degree of operating efficiency.

Control Activities

Hypothesis. The more rigid control over employees, the more efficient is the enterprise's performance.
Model: \[ Y = a + b(RULES) \]

Finding: \[ EFFICIENCY = 1.3402 - 0.0021(RULES) \]

Table 8 illustrates the relationship between control activities, represented by the number of rules and regulations variable (RULES), and the degree of operating efficiency. The statistical results are significant without lagging the independent variable (RULES).

Table 8. Control Activities and Efficiency

<table>
<thead>
<tr>
<th>Results of OLS Analysis of Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>0.1092</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.3402</td>
<td>0.0351</td>
<td>38.18</td>
<td>.0001</td>
</tr>
<tr>
<td>RULES</td>
<td>-0.0021</td>
<td>0.0002</td>
<td>-8.34</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

The OLS analysis of the residuals shows a d Statistic of 1.06, and meets the minimum acceptance requirement of no positive autocorrelation at the .01 level. The OLS regression shows an R Square of .75, corresponding to a moderately high linear relationship between the two variables. The regression coefficient of the RULES variable
shows the negative direction of the relationship. And the T value (-8.34) would have been statistically significant at .01 level (.0001), had a negative relationship been hypothesized.

These statistical results can be interpreted to show that control activities have important effects on the degree of operating efficiency. This finding supports the arguments of Merton (1940), Gouldner (1954), Koontz and O'Donnell (1976), Perrow (1979), Becker and Neuhauser (1975), and Carlisle (1982). However, the argument that there is a positive relationship between control mechanisms and efficiency is not supported. Thus, the classicists such as Weber (1952), who believed in bureaucratic type organization and that the role of control activities such as rules, regulations and procedures is positive, are rejected. The arguments that rules and regulations may have a negative effect on the organization (Merton, 1940; Gouldner, 1954) are validated as a result of this hypothesis testing.

The moderate high R Square (.75) strongly confirms the statements of Merton, Hall, and Gouldner, who argued that more rules and regulations do not always mean efficient performance. Without control activities, the organization may fall into a state of anarchy, working without discipline, which leaves the future uncertain. At the same time, too many control activities may create tension between
labor and management since workers are denied the opportunity to express their feelings. Too many control activities may also create an excessive bureaucracy in the organization, and longer lines of communication may distort communications between workers and management. Thus, too many control activities may have as negative an impact as no control activities at all.

Organizational Age

Hypothesis. The older the enterprise's organization, the more formalized is its behavior, and thus the more efficient is its performance.

Model: \( Y = a + b(YEAR) \)

Finding: \( EFFICIEN = 1.2743 - 0.0156(YEAR) \)

Age of the organization is regressed by the sequence of the time series year, where the first year, 1960, is equal to 1 and the last year, 1984, is equal to 25. Table 9 illustrates the relationship between organization age and the degree of efficiency.

This hypothesis is derived from concepts of organizational structure, which is based on the formalization of organizational behavior from an informal to a more formal level. Without lagging the independent variable (YEAR), the Durbin-Watson test shows a d Statistic of 1.07, which is above the level of minimum acceptance of
Table 9. Organizational Age and Efficiency

Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1215</td>
<td>23</td>
<td>0.0053</td>
<td>.72</td>
<td>1.07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2743</td>
<td>3.9754</td>
<td>8.03</td>
<td>.0001</td>
</tr>
<tr>
<td>YEAR</td>
<td>-0.0156</td>
<td>0.0020</td>
<td>-7.76</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

no positive autocorrelation at the .01 level.

R Square (.72) is considered moderately high. It thus indicates a moderately high relationship between age of organization and degree of operating efficiency. However, the B Value shows a negative relationship between the two variables, contrary to the hypothesis.

If age is the cause of formalization, as well as rules and regulations, it is not surprising that older age is expected to go with more rules and regulations. If rules and regulations have a negative effect on operating efficiency, so does organizational age. Age itself may not have any direct influence on the organization. Nevertheless, age goes with the expansion of the operation and an increasing number of rules and regulations to control the work organization.
and it can become one of the causes that affect the degree of efficiency.

It may be true that older organizations tend to have more rules and regulations, and thus more formalization. All of these factors can lead to more bureaucracy in the organization. But bureaucratic structure does not always insure efficient performance of an enterprise. As Montanari pointed out "The standard bureaucratic model is inappropriate in many contemporary situations and therefore cannot serve as the universally optimal structural configuration as originally proposed" (1978, p. 286). Moreover, the long survival of public enterprises can not be compared to private enterprises. Private enterprises can become bankrupt when they operate at a financial loss, but public enterprises can survive even though they are operating at a loss because they are government-sponsored organizations. Also, the goals of public enterprises are not only profit-making but social-developing as well. As a result, this hypothesis may not apply to public enterprises, which enjoy a special status private enterprises cannot earn. This finding does not support the argument that efficiency increases as the organization ages.
Organizational Size

**Hypothesis.** The larger the size of the enterprise's organization, the more formalized is its behavior, and thus the more efficient is its performance.

**Model:** \( Y = a + b(RAILCARB) \)

**Finding:** \( EFFICIEN = 1.2199 - 0.0052(RAILCARB) \)

Table 10 illustrates another dimension of organizational structure: the size of the organization. The relationship between organizational size, represented by the number of railcars on the books (RAILCARB), and the degree of operating efficiency is shown below.

After lagging the independent variable for one year, the Durbin-Watson d Statistic is improved from 1.01 to 1.18, which meets the minimum acceptance requirement for no autocorrelation at the .01 level. R Square improves from .63 to .67, but the relationship is still interpreted as relatively low. The negative B Value indicates an opposite relationship between the organizational size and degree of operating efficiency to that hypothesized.

Organizational size has been used as an independent variable for testing organizational behavior for a period of time. But most studies concentrate only on the effect of size on the structuring of the organization (Pugh et al., 1969; Blau and Schoenherr, 1971; Child, 1972).

Organizational size is the aspect of organization structure
Table 10. Organizational Size and Efficiency

Results of OLS Analysis of Residuals Before Lagging

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1602</td>
<td>23</td>
<td>0.0070</td>
<td>0.63</td>
<td>1.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2257</td>
<td>0.0296</td>
<td>41.41</td>
<td>.0001</td>
</tr>
<tr>
<td>RAILCARB</td>
<td>-0.0050</td>
<td>0.0008</td>
<td>-6.34</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Results of OLS Analysis of Residuals After Lagging

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1343</td>
<td>22</td>
<td>0.0061</td>
<td>0.67</td>
<td>1.18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2199</td>
<td>0.0280</td>
<td>43.58</td>
<td>.0001</td>
</tr>
<tr>
<td>RAILCARB</td>
<td>-0.0052</td>
<td>0.0008</td>
<td>-6.77</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

to which organization theorists pay the most attention since it relates to the formalization of organizational behavior.

The negative relationship between the size of organization and the degree of efficiency is contradictory to the hypothesis that performance should be improved when size is enlarged. But, interestingly, it supports the study
of Gooding and Wagner (1985, p.481) who found no positive relationship between size and efficiency. This result is similar to those for the other dimensions of organization structure, such as rules and regulations, and age of organization. That is, larger public organizational size can be the result of social fulfillment, rather than profit-making. Public enterprises, as government-sponsored organizations, tend to extend their services to the people on a nationwide basis. It is quite possible that a public enterprise can enlarge its size by extending its area of operation, and the size of organization is increased over time, no matter what happens in the organization.

Size in private industries, along with age, can be considered as sub-factors of the organization structure. They are not directly concerned with the performance of the organization, but drive the organization from the beginning with a small scale of operation, through time to a larger scale of operation. Throughout the process, the activities within the organization are reorganized repeatedly through the introduction of more rules, regulations, and procedures. The aims of the reorganizations are a part of organizational change, so that the organization will be led to the stage of certainty and predictability. At this stage, the organization can operate with greater efficiency, but it is less flexible and more vulnerable to the external
environment. This rigidity is a shortcoming of public enterprises.

Size of Administrative Components

**Hypothesis.** The smaller the size of the administrative component, the more efficient is the enterprise's performance.

**Model:** $Y = a + b(\text{OFFALLLA})$

**Finding:** $\text{EFFICIEN} = 1.6829 - 0.0132(\text{OFFALLLA})$

Table 11 illustrates the relationships between the size of the administrative component (represented by ratio of officers to all workers or OFFALLLA) and the degree of efficiency. Without lagging the independent variable, the Durbin-Watson test shows a $d$ Statistic of 1.08, which meets the minimum acceptance requirement for the autocorrelation test at the .01 level.

The $R^2$ shows a moderately high value of .73. The $B$ Value is negative: the larger the administrative size, the lower the degree of operating efficiency. The $T$ value (-7.84) is statistically significant at the .01 level (.0001). In sum, these statistical results support the hypothesis both substantively and statistically.

This finding supports the arguments of Tsauderos (1955), Rushing (1966), Pondy (1969) and Jackson and Morgan (1978) on administrative size. There is less need for
Table 11. Administrative Size and Efficiency

Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1198</td>
<td>23</td>
<td>0.0052</td>
<td>.73</td>
<td>1.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.6829</td>
<td>0.0794</td>
<td>21.19</td>
<td>.0001</td>
</tr>
<tr>
<td>OFFALLLL</td>
<td>-0.0132</td>
<td>0.0017</td>
<td>-7.84</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

administrative personnel when the organization grows enough since the administration's activities are not directly involved in production and/or services that are routinely operated by the workers or the technical cores. The size of the administrative component is more important to the enterprise's performance than age and size of organization. Since administrative personnel are not directly involved in production, unnecessary personnel are more of a burden to the organization. In other words, any organization needs a substantial number of administrative personnel for paperwork, but the number of officials may not need to keep up with the enlargement of organizational size. At one level, the size of the administrative core must go up hand-in-hand with the size of the organization, but it will
peak at a certain level. After that level, the ratio of administrative personnel to organizational size will decline.

Size of Executive Board

**Hypothesis.** The larger the size of the executive board, the more efficient is the enterprise's performance.

**Model:** \[ Y = a + b(\text{BOARD}) \]

**Finding:** \[ \text{EFFICIENCY} = 1.3324 - 0.0372(\text{BOARD}) \]

Table 12 illustrates the results of using a first-order autoregressive model to reduce the autocorrelation. The lagged independent variable model is inadequate to cope with regression residuals that have a very low value of \(d (.77)\). In this case, the more independent variables are lagged, the greater the degrees of freedom lost.

Table 12 shows the relationship between the size of the government-appointed board of commissioners (BOARD) and operating efficiency. The comparison between the OLS and the GLS estimates reveals that there is no relationship between the two variables at all, even though the standard error is reduced from 0.0237 to 0.0182 and the mean square error (MSE) is reduced from 0.0123 to 0.0061 in the GLS model. For the first-order autoregressive model, with 22 degrees of freedom for error, R Square is changed from .36 to .16, indicating no relationship between the two variables. The T
### Table 12. Size of Board and Efficiency

#### Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.6718</td>
<td>0.1694</td>
<td>9.87</td>
<td>.0001</td>
</tr>
<tr>
<td>BOARD</td>
<td>-0.0849</td>
<td>0.0237</td>
<td>-3.58</td>
<td>.0016</td>
</tr>
</tbody>
</table>

#### Autocorrelation-Corrected Results (Yule-Walker's GLS Estimation)

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.3324</td>
<td>0.1328</td>
<td>10.03</td>
<td>.0001</td>
</tr>
<tr>
<td>BOARD</td>
<td>-0.0372</td>
<td>0.0182</td>
<td>-2.05</td>
<td>.0527</td>
</tr>
</tbody>
</table>

Source: Computed by the author

A value (-2.05) is also statistically insignificant, with a significance level of .0527. Together with the unpredicted negative B Value, all of the statistical results lead to a rejection of the hypothesis.

The role of the executive board is a valid subject of study in the organizational structure of private industry.
But in developing countries, in particular, executive boards of public enterprises are very much concerned with politics, as well as with the business. Thus, boards become the arena of interest conflict for political parties and interest groups.

The rationale behind this hypothesis is that the more commissioners on the board, the more influence the board has to draw resources to the enterprise. This rationale may be true in private enterprise, but in public enterprise, the appointment of the commissioners tends to be political, since the appointees always represent political parties or interest groups. The board of commissioners, instead of bringing or attracting more resources to the enterprise, end up taking resources from the enterprise because of their lump sum pay on the board. As a result, the size of the boards of public enterprises is not really related to the business of the enterprises, but is the result of political selection to represent sectional interests (Prakash, 1963). Thus it has no relationship to the enterprise’s performance.

Political Involvement

Hypothesis. The more armed forces officers appointed to the decision-making positions, the less efficient is the enterprise's performance.

Model: \[ Y = a + b(\text{ARMEDBOD}) \]
Finding: \[ \text{EFFICIEN} = 0.9417 + 0.003(\text{ARMEDBOD}) \]

As in the previous hypothesis, the Durbin-Watson d Statistic (.38) is too low to use the lagged independent variable model; so, the first-order autoregressive model is used here. Table 13 illustrates that there is no relationship between political involvements, represented by the ratio of the armed forces officers on the board (ARMEDBOD) and the operating efficiency of the RSR. The comparison between the OLS and the GLS for the first order autoregressive model shows a decrease in the standard error of the independent variable (ARMEDBOD) from 0.0035 to 0.0016 and an increase in R Square from .01 to .14. But these changes still indicate that no relationship exists between the two variables.

This finding is limited to the analysis of the contributions made by commissioners appointed from the armed forces and those appointed from among the top-rank civil servants since Thai law does not allow either politicians or professional business men to serve as commissioners on public enterprise boards. Also, because the members of the boards in public enterprises in Thailand are appointed by the government, the appointments become more politically oriented rather than business oriented. The purpose of the government appointments is to insure that appointees represent the government and that the public enterprise does
Table 13. Political Involvements and Efficiency

<table>
<thead>
<tr>
<th>Results of OLS Analysis of Residuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE</td>
</tr>
<tr>
<td>0.4361</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.1376</td>
<td>0.1526</td>
<td>7.46</td>
<td>.0001</td>
</tr>
<tr>
<td>ARMEDBOD</td>
<td>-0.0016</td>
<td>0.0035</td>
<td>-0.44</td>
<td>.6603</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Autocorrelation-Corrected Results (Yule-Walker's GLS Estimation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE</td>
</tr>
<tr>
<td>0.1167</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>0.9417</td>
<td>0.0881</td>
<td>10.69</td>
<td>.0001</td>
</tr>
<tr>
<td>ARMEDBOD</td>
<td>0.0030</td>
<td>0.0016</td>
<td>1.87</td>
<td>.0750</td>
</tr>
</tbody>
</table>

Source: Computed by the author

not deviate too far from the government's policies.

In business enterprises, in general, the board members have one thing in common: making the enterprise’s business goals or policies so that management can implement and accomplish them. Board members are appointed based on their professional background, so that they can best contribute
their experience to the enterprise's performance. In contrast, public enterprises are not entitled to do the same thing. As public agencies, the enterprises are required to fulfill social goals to a certain degree, and are required to have only government officials appointed to the board rather than business people or professionals. Consequently, only civil servants and armed forces officers are eligible for selection.

Others from outside those two groups are excluded from the analysis since they are prohibited by the law from serving on the board of commissioners. The simple regression does not show any distinction between the two groups since the regression coefficient is too low. This finding can be interpreted as showing that there is no difference between the military officers and the civil service officers in terms of their contributions to the enterprise's performance.

Tenure of the Board Members

**Hypothesis.** The longer board members serve, the more efficient is the enterprise's performance.

**Model:** \[ Y = a + b(TENURE) \]

**Finding:** \[ EFFICIEN = 0.9722 + 0.0022(TENURE) \]

The first-order autoregressive model is used here because the Durbin-Watson d Statistic is too low (.43) to use a
lagged independent variable model. Table 14 illustrates the relationship between the independent variable, represented by the length of tenure variable (TENURE), and the degree of efficiency. After calculating the first-order autoregressive model, the comparison between the OLS and the GLS models shows little change of the standard error of the independent variable (TENURE) from .0008 to .0011. The value of R Square, which changes from .35 to .15, indicates no relationship between the two variables. Finally, the T value (1.99) is insignificant in the first-order autoregressive model. Thus, even though the positive B Value supports the hypothesis, the hypothesis is rejected.

The high rate of turnover of public enterprise board members in developing countries is the result of political considerations rather than the disability or inability of individual board members. As mentioned earlier, they are politically appointed for a period of time. Their tenures are very vulnerable to a regime change, which frequently happens in developing countries. The prime responsibility of most appointees is overseeing specific interests. In other words, they represent agencies and take care of the interests of the agencies with which they are working. When the new regime is established, all representatives may be dismissed, and new representatives appointed. As a result, the more frequent the changes in the government, the higher
Table 14. Tenure of the Board and Efficiency

Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th></th>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.2863</td>
<td>23</td>
<td>0.0124</td>
<td>.35</td>
<td>.43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>0.9349</td>
<td>0.0447</td>
<td>20.93</td>
<td>.0001</td>
</tr>
<tr>
<td>TENURE</td>
<td>0.0028</td>
<td>0.0008</td>
<td>3.51</td>
<td>.0019</td>
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</tbody>
</table>

Autocorrelation-Corrected Results
(Yule-Walker's GLS Estimation)

<table>
<thead>
<tr>
<th></th>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.1228</td>
<td>22</td>
<td>0.0056</td>
<td>.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>0.9722</td>
<td>0.0665</td>
<td>14.62</td>
<td>.0001</td>
</tr>
<tr>
<td>TENURE</td>
<td>0.0022</td>
<td>0.0011</td>
<td>1.99</td>
<td>.0590</td>
</tr>
</tbody>
</table>

Source: Computed by the author

is the rate of turnover.

This finding does not support the argument of Prakash (1963) that the appointees cannot handle their second job effectively within a short period because they need time to learn before they can take actions seriously on behalf of the enterprise. The vulnerability of political appointments
creates a situation in which no matter how long the board members serve in the enterprise, there is no guarantee for the success of the enterprise. Thus, this hypothesis is rejected.

Concurrent Position

**Hypothesis.** The greater the number of members of the board who hold more than one position, the less efficient is the enterprise’s performance.

**Model:** \( Y = a + b(\text{CONCUR}) \)

**Finding:** \( \text{EFFICIEN} = 1.2498 - 0.4279(\text{CONCUR}) \)

Table 15 illustrates the relationship between the effect of the practice of the concurrent positions of the board members (CONCUR) and the efficient performance of the public enterprise. Without lagging the independent variable, the Durbin-Watson test shows a d Statistic of 1.14, which meets the minimum acceptance requirement at the .01 level. R Square of .75 is considered moderately high.

The negative B Value supports the hypothesis that the greater the number of board members holding more than one position, the lower is the degree of efficiency. T (-8.23) is statistically significant at the .01 level (.0001). The findings support the arguments of Riggs (1966), Scott (1972), Abdulrahman (1979), Garner (1984) and Medhora (1973).
Table 15. Concurrent Positions and Efficiency

Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1115</td>
<td>23</td>
<td>0.0048</td>
<td>.75</td>
<td>1.14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2498</td>
<td>0.0258</td>
<td>48.39</td>
<td>.0001</td>
</tr>
<tr>
<td>CONCUR</td>
<td>-0.4279</td>
<td>0.0520</td>
<td>-8.23</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

This hypothesis is very much related to earlier hypotheses on the tenure of the board's members and political involvement in the appointments of board members. Concurrent position is another factor that should affect the efficient performance of a public enterprise. The practice of secondment is one of the controversial issues in the public enterprises of developing countries. Occasionally, there is a tug-of-war relationship between the agencies the members are working for in their first position, and public enterprises they serve in their second position. Since those members have to return to their agencies someday when their services in public enterprises expire, they always remain under the supervision of their superiors in the first agency. Moreover, they cannot make a policy for the public
enterprise that conflicts with their agency's interest. Thus, it is quite obvious that the more concurrent positions the board members occupy, the less ability the board has to undertake the enterprise's business. Consequently, this situation can lead to inferior performance of public enterprises.

Making things worse, board members have only limited time to devote to each position. They cannot devote time for the enterprise's business because they have to work more than one place at the same time. Consequently, the enterprise has to operate with little or no direction from the board, and the operation may fail.

Public Accountability

**Hypothesis.** The more accountable public enterprises are to the public, the more efficient is the enterprise's performance.

**Model:** \[ Y = a + b(\text{LEGISLAT}) \]

**Finding:** \[ \text{EFFICIEN} = 1.0750 - 0.0055(\text{LEGISLAT}) \]

Table 16 illustrates the relationship between public accountability, represented by the number of legislative oversight exercises by the national parliament over public enterprises through hearings and inspections (LEGISLAT), and the degree of efficiency. Since the critical value of the Durbin-Watson d Statistic for the OLS regression is far
below the minimum requirement (.35), the lagged independent variable model is not appropriate. The first-order autoregressive model is used instead.

Table 16. Public Accountability and Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value (a)</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.0853</td>
<td>0.0304</td>
<td>35.71</td>
<td>.0001</td>
</tr>
<tr>
<td>LEGISLAT</td>
<td>-0.0201</td>
<td>0.0193</td>
<td>-1.04</td>
<td>.3091</td>
</tr>
</tbody>
</table>

Source: Computed by the author

The comparison between the OLS and the GLS estimates shows a decrease of the standard error of the independent
variable (LEGISLAT) from 0.0193 to 0.0115. The mean square error (MSE) is also reduced from 0.0183 to 0.0060. However, R Square, which changes little (from .04 to .01), does not express any relationship between the two variables. The T value (-0.48) also supports the finding of an insignificant relationship with a significance level of .63 for the GLS estimates. Thus, this finding rejects the hypothesis.

Broadly speaking, public accountability can affect public enterprises as a whole since all public enterprises are government-sponsored organizations. Different public enterprise may be affected differently, but on the whole, any public enterprise is expected to be influenced by public opinion to a greater or lesser degree.

This finding does not support the hypothesis. Several reasons may explain why public accountability does not play a key role in the enterprise's performance. As Garner (1984) pointed out, in Thailand, political instability is one of the key factors: the legislature can be dissolved at any time; consumers do not group together to protect their consumer rights; even the courts have never ruled on the accountability of the public enterprises since nobody brings accountability issues to court. Thus, there is almost no influence from the public at all to check and examine the accountability of public enterprises. The legislature, from time to time, gives a slight consideration to the public
enterprises' expenditures, but only in cases where there are some complaints about financial corruption within the enterprise. The enterprises do not regularly report their operational results to the public. Even their reports to the concerned agencies are rarely publicized. Thus, the issue of public accountability is almost irrelevant to the public enterprise's operation.

In any society, accountability can be seen in the obvious support of the government, the legislature, the mass media, and the public when they announce the outstanding performance of the enterprise and in the silence from those institutions when they think that what the enterprises are doing is right. In a relatively passive society like Thailand, the public will not break the silence if the operations of the enterprise are not in bad shape. Thus, the silence of public officials, press, and public will usually be interpreted as public acceptance. In other words, if the public in a passive society is not satisfied with a specific public enterprise, people will cry out, but if they are satisfied, they will remain silent. According to this reasoning the less outcry from the public, the more satisfactorily accountable is that public enterprise. If this is the case, It is not surprising that the relationship between the degree of accountability and the degree of efficiency is essentially nil.
Political Conditions

**Hypothesis.** The more frequent political changes in the nation, the less efficient is the enterprise’s performance.

**Model:** \( Y = a + b(\text{POLITEST}) \)

**Finding:** \( \text{EFFICIEN} = 1.0695 - 0.00004(\text{POLITEST}) \)

Table 17 illustrates the relationship between the political conditions, represented by the number of political protests variable (POLITEST) and the operating efficiency. Since the Durbin-Watson d Statistic has a very low critical value (.33) the first-order autoregressive model is used to reduce the residual correlation.

The statistical results of the OLS and GLS analyses is compared to illustrate improvements after the autocorrelation is reduced. The standard error of the independent variable is reduced from 0.0002 to 0.0001. The mean square error (MSE) is also reduced from 0.0190 to 0.0060. \( R \) square changes from .008 to .005 in the GLS estimate. Thus, even though the \( B \) Value of the independent variable in the GLS shows the predicted positive direction of relationship, it must be ignored because of the low \( R \) Square and the insignificant \( T \) \((p = .7386)\). The hypothesis is not accepted.

Most sources expected a correlation between political changes in the nation (not political involvements in public enterprise) and the performance of the enterprises as a
Table 17. Political Conditions and Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.0791</td>
<td>0.0333</td>
<td>32.43</td>
<td>.0001</td>
</tr>
<tr>
<td>POLITEST</td>
<td>-0.0001</td>
<td>0.0002</td>
<td>-0.44</td>
<td>.6604</td>
</tr>
</tbody>
</table>

Source: Computed by the author

whole. However, it is possible that public enterprises in developing countries will be less affected than private enterprises since they are government-supported organizations. They are not subject to the effects of political changes, as long as the government gives them financial support. In other words, they are less vulnerable.
than private enterprises in terms of political changes. Consequently, political conditions in the nation appear to have virtually no effect on the operation of public enterprises.

Market Competition

Hypothesis. The greater its market competition, the more efficient is the enterprise's performance.

Model: \[ Y = a + b \text{(HIGHWAY)} \]

Finding: \[ \text{EFFICIEN} = 1.3570 - .00002(\text{HIGHWAY}) \]

Table 18 illustrates the relationships between the market competition, represented by the length of highways (HIGHWAY) and the degree of efficient performance. The lagged independent variable model is used here because the Durbin-Watson d Statistic is not far below the minimum acceptance. After the lagging of the independent variable (HIGHWAY) for two years, the degrees of freedom for error are reduced from 23 to 21, but d Statistic is improved from .96 to 1.01 in the second OLS analysis.

The result of the lagging makes no difference in the standard error of the independent variable (0.000002). R Square is changed from .69 to .66, interpreted as a relatively low relationship between the two variables.

However, the negative relationship between the two variables is contrary to the hypothesis. Thus, this finding
Table 18. Market Competition and Efficiency

Results of OLS Analysis of Residuals Before Lagging

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.3586</td>
<td>0.0434</td>
<td>31.27</td>
<td>.0001</td>
</tr>
<tr>
<td>HIGHWAY</td>
<td>-0.000015</td>
<td>0.000002</td>
<td>-7.09</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Results of OLS Analysis of Residuals After Lagging

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.3571</td>
<td>0.0498</td>
<td>27.26</td>
<td>.0001</td>
</tr>
<tr>
<td>HIGHWAY</td>
<td>-0.00002</td>
<td>0.000003</td>
<td>-6.39</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

rejects the arguments of Reid and Allen (1970), Jones (1975) and the World Bank (1983) that there is a positive relationship between market competition and the enterprise's performance. In contrast, the finding shows that the more competitors the enterprises have, the less efficient they are. More competitors in the same market can reduce the
market share of that enterprise. That enterprise will experience a decline of customers or clients, less revenue, and finally, less efficiency because the enterprise does not scale back its expenditures to match its market share.

Another reason for the failure of public enterprises is their inferiority to private enterprises in the market place. Market competition is recognized in developed capitalist societies as a factor that will reinforce the enterprise's operation and induce improvements, so that it can survive and improve its products and/or services. But the findings of this analysis contradict the hypothesis.

In the transportation arena, there are several competitors in the market. The specific measure used here --HIGHWAY-- subsumes the notion that both individuals and businesses use conveyances that move on the highways (trucks, cars, buses) and that compete directly with the railway. It may true in the business enterprise community that the one that operates most efficiently and effectively will have the best chance of survival. Those that are less efficient may go bankrupt. But, this is not the case of public enterprises. As a government-sponsored agency, a public enterprise may stay in business, even operating at a financial loss, since it has to fulfill the social goals set by the government.
Market competition is thus a major factor in a public enterprise's performance. The degree of its efficiency is very much dependent upon how well it can compete in the marketplace.

Economic Conditions

**Hypothesis.** The better national economic conditions, the more efficient is the public enterprise's performance.

**Model:** \( Y = a + b(NATRESX) \)

**Finding:** \( EFFICIEN = 1.3194 - 0.00166(NATRESX) \)

Table 19 illustrates the relationships between national economic conditions, represented by the resources variable (NATRESX) in billion Thai Baht, and the degree of efficiency. Without lagging the independent variable, the Durbin-Watson test shows a d Statistic of 1.04, which is close to the minimum acceptance requirement at the .01 level. The OLS analysis of residuals shows a standard error of -0.0002 of the independent variable (NATRESX) and an R Square of .71, indicating the moderately high relationship between the two variables. But, again, the negative B Value is contrary to the hypothesis.

The statistical results show a moderately high but negative relationship between the two variables. Most researchers expected the opposite, a positive correlation. As an economic institution, a public enterprise is expected
Table 19. Economic Conditions and Efficiency

Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1274</td>
<td>23</td>
<td>0.0055</td>
<td>.71</td>
<td>1.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.31940</td>
<td>0.0363</td>
<td>36.36</td>
<td>.0001</td>
</tr>
<tr>
<td>NATRESX</td>
<td>-0.00166</td>
<td>-0.0002</td>
<td>-7.51</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

to be conditioned by the national economy.

Economic conditions are recognized as general factors that affect all kinds of economic enterprises in the nation. All enterprises, either public or private, are expected to keep themselves abreast of developments in the national economy; otherwise their operations will be limited. It is true that while economic conditions are the nationwide factors that can affect all enterprises in general, each enterprise will feel this impact in varying degrees. The enterprises, public and private, that can adapt themselves best to the changing economic environment will survive.

However, the negative direction of the relationship entirely contradicts the relationship stated in the hypothesis. The negative relationship may be explained in
terms of the inferiority of public enterprises to private competitors in the market. Better economic conditions mean the improvement of all economic enterprises in the nation, including those enterprises in the transportation and communication arena. The equipment that private enterprises use is much more sophisticated and advanced than those of public enterprises. Thus, it is not impossible that the public enterprise, having more advanced competitors, will lose customers, have a financial downturn, and suffer a loss of efficiency when economic conditions are good.

Government Expenditures

**Hypothesis.** The higher government expenditures on behalf of the public, the more efficient is the enterprise's performance.

**Model:** \( Y = a + b(MILITARX) \)

**Finding:** \( EFFICIEN = 1.2390 - 0.0404(MILITARX) \)

Table 20 illustrates the relationships between government expenditures, represented by military expenditures in billion Thai Baht (MILITARX), and the degree of operating efficiency. After the lagging of the independent variable for two years, the Durbin-Watson test shows an improvement from 0.86 to 1.07 in the second OLS analysis, which meets the minimum acceptance requirement at the .01 level. The standard error of the independent variable of the two OLS is
no different, but R Square is increased from .59 to .68, which can be interpreted as a relatively low relationship between the two variables. However, the negative B Value is, again, contrary to the hypothesis.

Table 20. Governmental Expenditures and Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2357</td>
<td>0.0338</td>
<td>36.60</td>
<td>.0001</td>
</tr>
<tr>
<td>MILITARX</td>
<td>-0.0326</td>
<td>0.0057</td>
<td>-5.74</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Results of OLS Analysis of Residuals After Lagging

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2390</td>
<td>0.0315</td>
<td>39.38</td>
<td>.0001</td>
</tr>
<tr>
<td>MILITARX</td>
<td>-0.0404</td>
<td>0.0057</td>
<td>-6.71</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

A government's annual budget is generally used for national development. The national development plan usually
aims to improve social and economic conditions both in general and in specific sectors of the economy. A higher budget can be interpreted as a higher expectation for positive change in social and economic conditions as a whole. Greater government expenditures should mean better economic and social conditions.

This hypothesis is stated to test the influence of government expenditures on the performance of the public enterprises. As an external factor, public expenditures are expected to influence all public agencies. And, as one of the public agencies, the state railway is expected to be influenced as well.

The unpredicted negative relationship could be the result of government policies that reduce the budget appropriations to public enterprises and request the enterprises to assume responsibility for their own debts and financial loss. The government cuts costs, but in so doing, burdens many public enterprises that generate revenue within themselves. Without the subsidies from the government, the public enterprises have to deal with all kinds of financial problems. This may produce low efficiency in the public enterprises, while the government's expenditures for the public are increasing.
Educational Condition

**Hypothesis.** The more highly educated the population, the more efficient is the public enterprise's performance.

**Model:** \( Y = a + b(SECOND) \)

**Finding:** \( EFFICIEN = 1.2398 - 0.00017(SECOND) \)

Table 21 illustrates the relationships between the educational conditions of the nation, represented by the number of students in secondary schools (in thousands) \( (SECOND) \) and the degree of operating efficiency. The Durbin-Watson test, without lagging the independent variable, shows a \( d \) Statistic of 1.02 which is close to the minimum acceptance criterion at the .01 level.

The R Square of .72 means a moderately high relationship exists between the two variables. However, the negative B Value is, once again, contrary to the hypothesis.

Stinchcombe (1965) argues that the population's literacy or education is an important condition for national development. Education is the major basic element for social and economic development. Nationwide educational improvement should promote better social and economic conditions. All economic entities, including public enterprises, will be expected to be better-off as a result. The studies of the World Bank (1983, 1985) argue that the underdeveloped and some developing countries will have trouble improving public enterprises' performance and lifting up the standard of
Table 21. Educational Conditions and Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2398</td>
<td>0.0263</td>
<td>47.09</td>
<td>.0001</td>
</tr>
<tr>
<td>SECOND</td>
<td>-0.00017</td>
<td>0.00002</td>
<td>-7.71</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

living as long as their people are not well enough educated.

In private enterprise, management has the ultimate authority to hire and fire employees according to qualifications and performance. They can hire new and better-trained personnel to replace less able ones. But in a public enterprise, the bureaucratic system remains so powerful that hiring and firing becomes a formidable process. It is possible that one of the reasons that the RSR's performance has not improved in recent years is the enterprise's policy of maintaining the same level of employees, and transferring the temporary employees to permanent positions. From the middle of the 1970s, the labor unions at the RSR have been so strong that they requested the cancellation of the temporary workers' status, and
transferred all of them to permanent status. This transference caused a big financial burden for the RSR's management since RSR had to pay all kinds of fringe benefits; operating costs increased dramatically. The labor transfer also caused management to stop hiring the new and more highly educated employees to replace the retired ones. Because of these reasons, the nationwide increase of education does not positively relate to the RSR's performance, but negatively, as shown in these findings.

Labor Movements

**Hypothesis.** The more active labor movements are, the more efficient is the enterprise's performance.

**Model:** \[ Y = a + b(DAYSTOP) \]

**Finding:** \[ EFFICIEN = 1.1008 - 0.0001(DAYSTOP) \]

Table 22 illustrates the relationships between the labor movements in the nation, represented by the number of days of work stoppages (DAYSTOP), and the degree of efficiency. Since the Durbin-Watson d Statistic for the OLS model is far below the minimum acceptance criterion (.33), the first-order autoregressive model is used to reduce the residual correlation in the regression equation.

The GLS estimates show a minor change in R Square from .29 to .26, indicating no relationship. Thus, the hypothesis must be rejected.
transferred all of them to permanent status. This transference caused a big financial burden for the RSR's management since RSR had to pay all kinds of fringe benefits; operating costs increased dramatically. The labor transfer also caused management to stop hiring the new and more highly educated employees to replace the retired ones. Because of these reasons, the nationwide increase of education does not positively relate to the RSR's performance, but negatively, as shown in these findings.

Labor Movements

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**Finding:** \[ \text{EFFICIEN} = 1.1008 - 0.0001(DAYSTOP) \]

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The GLS estimates show a minor change in R Square from .29 to .26, indicating no relationship. Thus, the hypothesis must be rejected.
### Table 22. Labor Movements and Efficiency

#### Results of OLS Analysis of Residuals

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
<th>d Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3115</td>
<td>23</td>
<td>0.0135</td>
<td>.29</td>
<td>.33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.1127</td>
<td>0.0269</td>
<td>41.27</td>
<td>.0001</td>
</tr>
<tr>
<td>DAYSTOP</td>
<td>-0.0002</td>
<td>0.00005</td>
<td>-3.08</td>
<td>.0053</td>
</tr>
</tbody>
</table>

#### Autocorrelation-Corrected Results (Yule-Walker's GLS Estimation)

<table>
<thead>
<tr>
<th>SSE</th>
<th>DFE</th>
<th>MSE</th>
<th>R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0983</td>
<td>22</td>
<td>0.0045</td>
<td>.26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.1008</td>
<td>0.0543</td>
<td>20.25</td>
<td>.0001</td>
</tr>
<tr>
<td>DAYSTOP</td>
<td>-0.0001</td>
<td>0.00004</td>
<td>-2.80</td>
<td>.0103</td>
</tr>
</tbody>
</table>

Source: Computed by the author

What the statistical results show is that the performance of the public enterprises is not affected by the activities of labor movements on the national level. This is particularly surprising since the RSR itself houses the largest number of union members in the nation.
In a capitalist society, active labor unions usually mean a struggle for better working conditions, higher wages, with a loss of productivity during the period of struggle. However, after negotiation and agreements are reached, the workers are normally assured better treatment from management. In a developing society, particularly the countries that have authoritarian governments, labor movements usually mean a violation of the law.

More importantly, the labor unions' target is not management, but the government. The power of labor unions in Thailand, since the labor law was issued in 1972, has been increasingly important in the politics of the national administration. When labor unions cannot make an agreement with management, they always move to the government. The management of the enterprise does not always deal with labor directly, but through the government. This indirect relationship may explain why this finding does not confirm the hypothesis.

Conditions of Employees

**Hypothesis.** The better rewarded employees are, the more efficient is the public enterprise's performance.

**Model:** \[ Y = a + b(RSRWAGX) \]

**Finding:** \[ EFFICIEN = 1.2683 - 0.0259(RSRWAGEX) \]
Table 23 illustrates the relationships between aspects of the employee reward system, represented by the average minimum wage in RSR (RSRWAGE), and the degree of efficiency. The Durbin-Watson test, after lagging the independent variable for two years, shows the d Statistic which improves from 0.86 to 1.07 and meets the minimum acceptance requirement at the .01 level.

The comparison between the OLS and the GLS estimates shows a change of the standard error of the independent variable (RSRWAGE) from 0.0034 to 0.0053, and a decrease of R Square also from .76 to .53, indicating a very low relationship between the two variables. But the negative direction of relationship between the two variables is contrary to the hypothesis.

Working conditions are expressed in terms of the standard of living of the employees. In the context of industrial relations, management-labor relations are seen as improving the living conditions of all employees, producing greater job satisfaction, and causing greater efficiency on the job.

The negative relationship may be simply explained in terms of increased expenditures for the improvement of employees' standard of living with no return. This cost leads to a lower ratio of output to input, and thus lower efficiency.
Table 23. Conditions of Employees and Efficiency

Results of OLS Analysis of Residuals Before Lagging

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.3281</td>
<td>0.0325</td>
<td>40.82</td>
<td>.0001</td>
</tr>
<tr>
<td>RSRWAGEX</td>
<td>-0.0295</td>
<td>0.0034</td>
<td>-8.68</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Results of OLS Analysis of Residuals After Lagging

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.2683</td>
<td>0.0478</td>
<td>26.52</td>
<td>.0001</td>
</tr>
<tr>
<td>RSRWAGEX</td>
<td>-0.0259</td>
<td>0.0053</td>
<td>-4.84</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Source: Computed by the author

Improvement in the living conditions of employees is not only a management-labor issue, but also a political issue, occasionally. The labor movements are mostly the result of disagreement between labor and management. In such cases, labor brings the issue to the government. In several cases, the government has requested the management of the
enterprise to raise wages for political reasons. It is inevitable that the management of public enterprises has to meet higher expenses from the same amount of revenue.

Labor-Management Relations

Hypothesis. The more frequently labor-management frictions occur, the less efficient is the enterprise's performance.

Model: \( Y = a + b(\text{NEGOTIAT}) \)

Finding: \( \text{EFFICIEN} = 1.1158 - 0.0039(\text{NEGOTIAT}) \)

Table 24 illustrates the relationships between the labor-management relations, represented by the number of labor negotiations in RSR (NEGOTIAT), and the degree of operating efficiency. Without lagging the independent variable, the Durbin-Watson d Statistic shows a value of 1.23 which meets the minimum acceptance criterion at the .01 level.

The results of OLS analysis of residuals show an R Square of .32 indicating no relationship between the two variables. Thus, it is not necessary to take the B Value and its significance into consideration.

Labor-management relations in the organization have been a subject of study in industrial relations for a long time. Labor-management relations in the RSR organization have dramatically deteriorated since the labor law was issued in
Table 24. Labor-Management Relations and Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>B Value</th>
<th>Standard Error</th>
<th>T Ratio</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.1158</td>
<td>0.0267</td>
<td>41.77</td>
<td>.0001</td>
</tr>
<tr>
<td>NEGOTIAT</td>
<td>-0.0039</td>
<td>0.0012</td>
<td>-3.26</td>
<td>.0034</td>
</tr>
</tbody>
</table>

Source: Computed by the author

1972. On one side of the coin, a period of adjustment produces better relations and promises a better standard of living in the future. On the other side, it has created conflict between the two parties.

Conventionally, conflict between labor and management tends to worsen relations in the short run. But in the long run, it is expected that both sides work together more satisfactorily if they can agree upon the basic issues.

At any rate, the statistical result does not support the hypothesis. The relationship is thus subject to the effect of other factors.
Chapter Summary

This chapter focuses on the findings of the twenty hypothesis testings. It starts with grouping and categorizing all variables into sixteen conceptual clusters and four conceptual variables. The principal component analysis technique is used for data reduction for the sixteen clusters. Also, since all data are time-series in nature, the twenty simple regression equations used for the analysis detect the possible positive autocorrelation by applying the Durbin-Watson test of the d statistic. The autocorrelation problems are solved by using the two instruments: the lagged independent variable model and the first-order autoregressive model. All hypotheses are stated with tables of statistical results. All arguments concerned with each hypothesis are restated whether they support or reject the findings.
CHAPTER BIBLIOGRAPHY


CHAPTER V

DATA ANALYSIS II

Factors Affecting Efficient Performance:

Model Building

The previous chapter provides findings from the twenty hypothesis tests, using simple regression models. This chapter attempts to identify a multivariate model of the factors that affect the efficient performance of the Thai State Railway.

The social sciences are one of the most flexible fields of study because social phenomena are affected by numerous conditions. Moreover, the independent variables used in social research are hard to control. Research in behavioral science, physical science, or bioscience can be done by laboratory experiment with a precisely controlled experiment group. This control is not possible in social research. Consequently, social research that concentrates on only one control group or one independent variable is subject to criticism based on its contingent relationship. In other words, one independent variable usually explains only a certain amount of the variation in the dependent variable, and more independent variables have to be introduced in
order to explain more variation (Nachmias and Nachmias, 1981, p. 59).

A multivariate approach (multiple regression analysis) is used here because the conceptual framework of Van Meter and Van Horn identifies at least six factors that affect the policy implementation of the public agency: goals and/or objectives, resources, organization structure, political conditions, economic conditions, and social conditions. This research study follows Van Meter and Van Horn's framework but modifies their concepts, particularly, the political, economic, and social conditions to be more appropriate for the explanation of public enterprises in developing society. These six factors may simultaneously affect the dependent variable.

In social science research rarely does one independent variable fully explain the dependent variable. Instead, one needs to use a technique that allows exploration of what proportion of the variance in the behavior of a dependent variable is attributable to each of several independent variables. The appropriate technique is multiple regression analysis, which allows the inclusion of multiple independent variables in the regression equation. The percentages of variance explained by each independent variable can be added together to achieve a total percentage of variance explained by each equation. An important assumption of the multiple
The Formal Procedures of Model Building

One of the characteristics of a good multiple regression equation is that the number of independent variables should not be too many, say five or six, for the optimum result in the equation. Too many variables create problems of interpretation. Moreover, if those independent variables do not really contribute to the relationship with the dependent variable, the problem of "trash in - trash out" may produce a useless analysis. Thus, the first procedure of model building is setting up the equation, and then deleting or reorganizing the independent variables in a logical way. As before, principal components analysis is used to reduce the number of variables for use in a suitable multiple regression equation.

The first procedure of model building is the use of the principal components technique to extract the factors that have the highest covariance (factor loadings) from each cluster. According to the conceptual framework of this study, there are six independent variables: three for the internal (goals and objectives, resources, and organization
structure) and three for the external (political, economic, and social and industrial relations) factors. Thus the twenty variables that represented the independent variables in the twenty hypotheses are grouped into six clusters, according to the framework of analysis. Since there are six clusters, there should be six representative variables. However, since there is only one representative variable for the goals/objectives cluster, only five clusters must be analyzed in this data-reduction process (see Appendix 6 for the complete results).

Table 25 shows the six variables representing the cluster concepts: OBGOAL, SPASSCAR, RULES, CONCUR, HIGHWAY and SECOND. Two cluster concepts: resources and economic conditions have only two highly correlated variables. The resource cluster is composed of number of passenger cars in service variable (SPASSCAR) and the average age of railcars variable (RAVERAGE) and their correlation coefficient is .97697. The economic conditions cluster is composed of the length of highway variable (HIGHWAY) and the total national resource (NATRESX), and their correlation coefficient is .99609. Either of the two variables in each cluster could serve as cluster representative. Thus, the number of passenger cars in service (SPASSCAR) and the length of highways (HIGHWAY) are chosen to represent the resource cluster and the economic conditions cluster.
Table 25. Cluster Representatives

<table>
<thead>
<tr>
<th>Type of Factors</th>
<th>Cluster Concepts</th>
<th>Representative</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>Goals and Objectives</td>
<td>OBGOAL</td>
<td>- (1)</td>
</tr>
<tr>
<td>Resources</td>
<td>SPASSCAR</td>
<td>.97697 (2)</td>
<td></td>
</tr>
<tr>
<td>Organization Structure</td>
<td>RULES</td>
<td>.98618 (3)</td>
<td></td>
</tr>
<tr>
<td>External</td>
<td>Political Conditions</td>
<td>CONCUR</td>
<td>.87415 (4)</td>
</tr>
<tr>
<td>Economic Conditions</td>
<td>HIGHWAY</td>
<td>.99609 (5)</td>
<td></td>
</tr>
<tr>
<td>Social &amp; Industrial Conditions</td>
<td>SECOND</td>
<td>.96598 (6)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed by the author

Note:
(1) only one variable (no cluster)
(2) two variables: SPASSCAR (Number of passenger cars in service) and RAVEAGE (Average age of railcars)
(3) four variables: RULES (Number of rules and regulations in RSR), YEAR (Year identification), ASSET (Total assets of State Railway), and OFALLLA (Ratio of officers to all laborers)
(4) six variables: ARMEDBOD (Ratio of armed forces officers in the board), BOARD (Number of board members in RSR), TENURE (Average tenure of board member), CONCUR (Ratio of concurrent positions of the board members), APPROP (Budget appropriation for public enterprises), and GOVCHANG (Governmental change and national election)
(5) two variables: HIGHWAY (Length of highway) and GDP (Gross domestic product)
(6) five variables: EDUCAT (Education expenditure), SECOND (Children in secondary school), DAYSTOP (Number of working days stoppages), RSRWAGE (Average minimum wage in RSR), and NEGOTIAT (Number of labor negotiations in RSR).
The next procedure is to produce the appropriate multiple regression equation. The multiple regression model of the current study is as follows:

\[ Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + e \]

where

- \( Y \) = degree of efficient performance
- \( b \) = slope or estimate
- \( a \) = constant (Y intercept)
- \( x_1 \) = Goals and objectives (represented by OBGOAL variable)
- \( x_2 \) = Resources (represented by SPASSCAR variable)
- \( x_3 \) = Organization structure (represented by RULES variable)
- \( x_4 \) = Political conditions (represented by CONCUR variable)
- \( x_5 \) = Economic conditions (represented by HIGHWAY variable)
- \( x_6 \) = Social and industrial relation conditions (represented by SECOND variable)
- \( e \) = residual (what is left after the model is fit)

An analysis of variance is also used to test the hypothesis of no linear relationship between variables. If the probability associated with the F statistic is small, the null hypothesis of no linear relationship between variables is rejected.

The multiple regression equation was computed by the SPSS-X statistical program. The resulting model can be
written as follows:

\[ Y = 1.0315 - 0.0063(\text{OBGOAL}) + 0.0003(\text{SPASSCAR}) \\
- 0.0057(\text{RULES}) - 0.0634(\text{CONCUR}) \\
+ 0.00004(\text{HIGHWAY}) - 0.000002(\text{SECOND}) \]

Table 26 illustrates the results of the multiple regression equation. The Durbin-Watson d Statistic of 1.32 shows no positive autocorrelation. The Coefficient of Determination (R Square) shows the proportion of variation in the dependent variable explained by the model to be 83%. This R Square also means that the linear model of this multiple regression equation fits the data well. The adjusted R Square shows that after correcting R Square for limited degrees of freedom, the value is only reduced to .78. The analysis of variance shows an F value of 14.96, significant beyond the .0001 level.

The overall model seems to show a relatively high relationships between the efficiency variable and the six Van Meter and Van Horn concepts since R Square is .83 and the model is significant at the .0001 level. But the individual independent variables are not, for the most part, statistically significant. Only the RULES and the HIGHWAY variables show a significant linear relationship at the .05 level. Another variable, SECOND, has a relatively high T Score, significant at the .09 level. The remainder of the variables have very low T scores, and are not significant at the .10 level.
Table 26. Factors Affecting the Efficiency of RSR

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Durbin-Watson d Statistic</td>
<td>1.32</td>
</tr>
<tr>
<td>Multiple R</td>
<td>.91</td>
</tr>
<tr>
<td>R Square</td>
<td>.83</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>.78</td>
</tr>
<tr>
<td>Standard Error</td>
<td>.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of Variance</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of Squares</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Square</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|                                |       |       |       |       |
| Regression                   | 6     | 0.37  | 0.06  |
| Residual                    | 18    | 0.07  | 0.004 |
| F = 14.96                   |       |       |       |
| Signif F = .0000            |       |       |       |

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>Beta</th>
<th>T</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (a)</td>
<td>1.0315</td>
<td>0.2452</td>
<td></td>
<td>4.21</td>
<td>.0005</td>
</tr>
<tr>
<td>OBGOAL</td>
<td>0.0063</td>
<td>0.0065</td>
<td>-.2312</td>
<td>-0.97</td>
<td>.3460</td>
</tr>
<tr>
<td>SPASSCAR</td>
<td>0.0003</td>
<td>0.0004</td>
<td>.2771</td>
<td>0.805</td>
<td>.4314</td>
</tr>
<tr>
<td>RULES</td>
<td>-0.0057</td>
<td>0.0025</td>
<td>-2.3281</td>
<td>-2.277</td>
<td>.0352</td>
</tr>
<tr>
<td>CONCUR</td>
<td>-0.0634</td>
<td>0.2064</td>
<td>-.1279</td>
<td>-0.307</td>
<td>.7623</td>
</tr>
<tr>
<td>HIGHWAY</td>
<td>0.00004</td>
<td>0.00002</td>
<td>2.3208</td>
<td>2.371</td>
<td>.0291</td>
</tr>
<tr>
<td>SECOND</td>
<td>-0.0000002</td>
<td>0.0000001</td>
<td>-1.2054</td>
<td>-1.781</td>
<td>.0918</td>
</tr>
</tbody>
</table>

Source: Computed by the author

Table 27 illustrates the correlation matrix of all independent variables, and reveals the high correlation between pairs of independent variables. The high correlations between the independent variables suggest that the effects of multicollinearity inflate the correlations of all variables towards the dependent variable. This situation brings into doubt the statistical significance of
the entire set of equations and the statistical significance of the individual independent variables.

Table 27. Correlation Matrix of Independent Variables

<table>
<thead>
<tr>
<th></th>
<th>OBGOAL</th>
<th>SPASSCAR</th>
<th>RULES</th>
<th>CONCUR</th>
<th>HIGHWAY</th>
<th>SECOND</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBGOAL</td>
<td>1.000</td>
<td>-.814</td>
<td>-.880</td>
<td>-.907</td>
<td>-.869</td>
<td>-.882</td>
</tr>
<tr>
<td>SPASSCAR</td>
<td>-.814</td>
<td>1.000</td>
<td>.953</td>
<td>.904</td>
<td>.930</td>
<td>.907</td>
</tr>
<tr>
<td>RULES</td>
<td>-.880</td>
<td>.953</td>
<td>1.000</td>
<td>.954</td>
<td>.988</td>
<td>.976</td>
</tr>
<tr>
<td>CONCUR</td>
<td>-.907</td>
<td>.904</td>
<td>.954</td>
<td>1.000</td>
<td>.925</td>
<td>.930</td>
</tr>
<tr>
<td>HIGHWAY</td>
<td>-.869</td>
<td>.930</td>
<td>.988</td>
<td>.925</td>
<td>1.000</td>
<td>.987</td>
</tr>
<tr>
<td>SECOND</td>
<td>-.882</td>
<td>.907</td>
<td>.976</td>
<td>.930</td>
<td>.987</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Source: Computed by the author

The multicollinearity that causes the multiple regression equation of the six cluster concepts to be questionable can be explained by time-related effects. First of all, the three external factors: the political, economic, and social conditions always complement one another. In other words, development in one of the three factors over time will result in the development of the other in a lesser or greater degree. And, on the whole, all three factors are subject to positive change over time. This could be a reason why the political condition (CONCUR), the economic condition (HIGHWAY), and the social and industrial relations (SECOND) are highly correlated with each other.

Time-relatedness issues can also explain the high correlation for another three internal factors: goals and
objective (OBGOAL), resources (SPASSCAR), and organization structure (RULES). Any enterprise must do more than maintain the same size of operation in order to survive. In the competitive market any enterprise that never adapts to new ideas will be left behind by its competitors, eventually losing profits, revenue, intellectual personnel and finally control of its own organization. Enterprises must grow and expand their operations, and increase efficiency in planning and production in order to survive. Management needs to change abstract goals into manageable objectives, resulting in the increase of the ratio of objectives to goals over time. To fulfill the projected goals and objectives, the enterprise has to increase its resources for the operation. Finally, proper rules and regulations are needed for personnel to work more effectively, and to make the operation more efficient and predictable.

If time is relevant to both internal and external factors, there is no doubt that those six factors will positively change over time. The increasing values of these six factors causes the high correlation among them. Narrowly speaking, time is the major reason for the positive changes in all factors. The effect of time causes the very high associations among them, even though they do not have any cause-effect relationship to each other at all.
Model Building Through Factor Analysis Techniques

The basic concept of factor analysis is data reduction (Overall and Klett, 1983, p. 89; Kim and Mueller, 1982, p. 9), just as with principal components analysis. Two major elements of factor analysis are the extraction and the rotation of factors. The extraction brings about the reduction of a large number of variables to a smaller number. Extraction procedures search for the observed variables that have the highest co-variation and locate them in the first factor structure. Then, the procedure continues to search for the second highest co-variation pattern from all observed variables again and locate them as the second factor structure. The process will continue until no more factors can be extracted. As a result, the number of factors extracted depends upon the number of observed variables and which particular technique of extraction is used (Kim and Mueller, 1982, pp. 46-48).

Rotation is ordinarily the next step in factor analysis. At this stage, these initial factors in the factor matrix are rotated according to the criteria of a particular technique of rotation. The result will be the simplification of the original factor structures into a new one which is obvious and more interpretable than the initial structure (Kim and Mueller, 1982, pp. 49-50).
In this study, as in most factor studies, principal components analysis is used to extract the factors to be rotated. The principal components factors are uncorrelated or orthogonal. After the original factors are extracted by the principal components technique, the varimax rotation is used to rotate the axes so that the factor scores will be simplified for further analysis.

Varimax rotation is based on the concept that the variance of variables in the initial structure can be maximized by rotating the axis, and leaving the factors independent from each other. The objective of varimax rotation is the rotational transformation of the individual variables' covariance, by defining new (rotated) factors as a weighted combination of the original unrotated factors, until the objective is met when some loadings are large and the others are near zero, as Overall and Klett explain this rotation process will go on until the objective criterion is achieved; that is, when the value of the objective criterion function stabilizes and cannot be further increased, the rotation is complete (1983, p. 129).

For the purpose of model building, the representative variables from the sixteen clusters and the four single variables are analyzed again by using a principal components extraction and varimax rotation. The factor scores for each factor are computed for use in multiple regression analysis later on. The results of the principal components analysis
are reported in Table 28.

Table 29 presents the result of the varimax rotation to simplify the initial principal components matrix. The varimax rotation maximizes the variance on a single factor of all variables in the prior factor solutions. It is now more obvious that Factor 1 contains the highest loadings for all but four variables (POLITEST, DAYSTOP, ARMEDBOD, and LEGISLAT). Factor 2 has the highest loadings for three variables (POLITEST, DAYSTOP, and ARMEDBOD), while the rest of them are not highly loaded at all. Factor 3 shows a high loading only for the LEGISLAT variable.

The problem of this factor matrix is interpretability. Since sixteen out of the twenty variables are loaded highest on Factor 1, it becomes a mixing pot of all kinds of variables. It is impossible to label them because they are not logically and theoretically related. These uninterpretable factor loadings are thus considered unacceptable for the analysis.

One of the techniques used to solve the above problem is introduced here: the discrimination of the independent variables into distant (predetermined or indirect) variables and proximate (direct) variables. The distant variables are those that have indirect effect on the dependent variable and the proximate variables are those that have direct effect on the dependent variable. In other words, in the
Table 28. Principal Components Factor Matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>RULES</td>
<td>.99475</td>
<td>.00815</td>
<td>.04388</td>
</tr>
<tr>
<td>NATRESX</td>
<td>.99284</td>
<td>-.02136</td>
<td>.02931</td>
</tr>
<tr>
<td>HIGHWAY</td>
<td>.98519</td>
<td>-.07980</td>
<td>.01434</td>
</tr>
<tr>
<td>SECOND</td>
<td>.98400</td>
<td>-.04654</td>
<td>-.06395</td>
</tr>
<tr>
<td>YEAR</td>
<td>.98370</td>
<td>.02211</td>
<td>.13061</td>
</tr>
<tr>
<td>RAVERAGE</td>
<td>.98049</td>
<td>-.02595</td>
<td>.07801</td>
</tr>
<tr>
<td>CONCUR</td>
<td>.96004</td>
<td>.05158</td>
<td>-.12013</td>
</tr>
<tr>
<td>MILITARX</td>
<td>.95817</td>
<td>-.14987</td>
<td>.03719</td>
</tr>
<tr>
<td>SPASSCAR</td>
<td>.94678</td>
<td>-.10357</td>
<td>.17722</td>
</tr>
<tr>
<td>RSRWAGEX</td>
<td>.94518</td>
<td>.01087</td>
<td>.23855</td>
</tr>
<tr>
<td>OFFALLLA</td>
<td>.92523</td>
<td>.13079</td>
<td>-.19672</td>
</tr>
<tr>
<td>RAILCARB</td>
<td>.92198</td>
<td>.11285</td>
<td>.18501</td>
</tr>
<tr>
<td>OBGOAL</td>
<td>-.89328</td>
<td>-.00865</td>
<td>.22135</td>
</tr>
<tr>
<td>BOARD</td>
<td>.59929</td>
<td>-.26903</td>
<td>.34486</td>
</tr>
<tr>
<td>NEGOTIAT</td>
<td>.59430</td>
<td>.38781</td>
<td>-.11106</td>
</tr>
<tr>
<td>POLITEST</td>
<td>.01748</td>
<td>.80093</td>
<td>.24835</td>
</tr>
<tr>
<td>DAYSTOP</td>
<td>.27459</td>
<td>.80043</td>
<td>.15461</td>
</tr>
<tr>
<td>ARMEDBOD</td>
<td>.41540</td>
<td>-.62003</td>
<td>-.20924</td>
</tr>
<tr>
<td>LEGISLAT</td>
<td>.19384</td>
<td>-.31474</td>
<td>.66087</td>
</tr>
<tr>
<td>TENURE</td>
<td>-.63977</td>
<td>-.11519</td>
<td>.64104</td>
</tr>
</tbody>
</table>

Source: Computed by the author

Note:
- RULES = Number of rules and regulations in RSR
- NATRESX = Total national resources
- HIGHWAY = Length of highway
- SECOND = Children in secondary school
- YEAR = Year identification
- RAVERAGE = Average age of railcars
- CONCUR = Ratio of concurrent positions of the board members
- MILITARX = Military expenditure in constant currency
- SPASSCAR = Number of passenger cars in service
- RSRWAGEX = Average minimum wage in RSR in constant currency
- OFFALLLA = Ratio of officers to all laborers
- RAILCARB = Number of railcars on book
- OBGOAL = Ratio of total goals to total objectives
- BOARD = Number of board members in RSR
NEGOTIAT = Number of labor negotiations in RSR
POLITEST = Political protest
DAYSTOP = Number of working days stoppages
ARMEDBOD = Ratio of armed forces officer in the board
LEGISLAT = Legislative oversight
TENURE = Average tenure of board members

Table 29. Varimax Rotation for Twenty Variable Concepts

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<th>Factor 3</th>
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| LEGISLAT          | .15581    | -.09059   | .74085    |

Source: Computed by the author
Note: Abbreviations are the same as in Table 28

causal model, the distant variable is the variable that connects the dependent variable through an intervening third variable, and the proximate variable is the variable that
connects the dependent variable directly without an intervening third variable (Bohrnstedt and Knoke, 1982, p. 414).

The distant variables can be found from checking the time order, covariation, and spuriouness between the independent and the dependent variables (Bohrnstedt and Knoke, p. 411). That is, the distant variables must be both the preceding phenomenon for the other factors and have high correlation with them. Table 30 gives the covariation of all twenty variable concepts.

Five variable concepts can be specified as distant variables (YEAR, HIGHWAY, NATRESX, MILITARX, AND SECOND) because of their time-order when compared to the rest of variables. These five distant variables can affect all organizations in the country. The vulnerability of each organization is dependent upon its capability to adapt itself to the changing conditions of these distant or predetermined factors.

Some other variables such as OBGOAL, SPASSCAR, RAVERAGE, RULES, RAILCARB, OFFALLLA, CONCUR, and RSRWAGE have only high covariations with the other variables but no indications of time order over the other variables. They are not considered to be distant or predetermined but proximate variables for the analysis. The rest of these variables --BOARD, ARMEDBOD, TENURE, LEGISLAT, POLITEST, DAYSTOP, and
### Table 30. Correlation Matrix of Twenty Variable Concepts

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NEGOTIAT—do not show both time order and covariation with any other variables. They are considered the proximate or (direct) variables as well.

The five distant variables can be excluded from the analysis because their influences do not directly affect the organization's performance, leaving the other fifteen proximate variables as the subject of the study. Factor analysis is used again for the extraction and rotation of the factors. The results of the principal components extraction and the varimax rotation are given in Table 31 and Table 32.

The result of the principal components extraction creates three initial factor structures. As illustrated in Table 31, Factor 1 shows the highest regression coefficient (at 0.5 or over) in all but four variables: POLITEST, DAYSTOP, ARMEDBOD, and LEGISLAT. Factor 2 shows the highest regression coefficient on the three variables: POLITEST, DAYSTOP, and ARMEDBOD. And Factor 3 shows the highest regression coefficient only on the LEGISLAT variable. When the variance of all variables are maximized by the varimax
Table 31. Factor Structure Matrix of Fifteen Proximate Variables: Principal Components Extraction Results

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Source: Computed by the author

Note:
- RULES = Number of rules and regulations in RSR
- RAVERAGE = Average age of railcars
- CONCUR = Ratio of concurrent positions of the board members
- SPASSCAR = Number of passenger cars in service
- RSRWAGEX = Average minimum wage in RSR in constant currency
- OFALLLA = Ratio of officers to all laborers
- RAILCARE = Number of railcars on books
- OBGOAL = Ratio of total objectives to total goals
- TENURE = Average tenure of board members
- NEGOTIAT = Number of labor negotiations in RSR
- BOARD = Number of board members in RSR
- POLITEST = Number of political protest
- DAYSTOP = Number of working days stoppages
- ARMEDBOD = Ratio of armed forces officers in the board
- LEGISLAT = Number of legislative oversights
Table 32. Factor Structure Matrix of Fifteen Proximate Variables: Varimax Rotation Results

<table>
<thead>
<tr>
<th>Variable Concepts</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Organizational</td>
<td>Socio-Political</td>
<td>Public</td>
</tr>
<tr>
<td></td>
<td>Pressures</td>
<td>Downturn</td>
<td>Criticisms</td>
</tr>
<tr>
<td>RAVERAGE</td>
<td>.97407</td>
<td>-.06139</td>
<td>.13684</td>
</tr>
<tr>
<td>CONCUR</td>
<td>.97340</td>
<td>.03287</td>
<td>.05569</td>
</tr>
<tr>
<td>RULES</td>
<td>.96173</td>
<td>.00548</td>
<td>.23700</td>
</tr>
<tr>
<td>OFFALLLA</td>
<td>.95330</td>
<td>.04931</td>
<td>-.03435</td>
</tr>
<tr>
<td>OBGOMAAL</td>
<td>-.91823</td>
<td>.07640</td>
<td>.02699</td>
</tr>
<tr>
<td>SPASSCAR</td>
<td>.88706</td>
<td>-.05270</td>
<td>.38673</td>
</tr>
<tr>
<td>RAILCARB</td>
<td>.87749</td>
<td>.15554</td>
<td>.31977</td>
</tr>
<tr>
<td>RSRWAGEX</td>
<td>.87696</td>
<td>.07956</td>
<td>.40416</td>
</tr>
<tr>
<td>TENURE</td>
<td>-.76565</td>
<td>.11200</td>
<td>.48807</td>
</tr>
<tr>
<td>NEGOTIAT</td>
<td>.62473</td>
<td>.33114</td>
<td>-.11066</td>
</tr>
<tr>
<td>-politest</td>
<td>.03012</td>
<td>.83640</td>
<td>-.02815</td>
</tr>
<tr>
<td>DAYSTOP</td>
<td>.31766</td>
<td>.79472</td>
<td>-.04157</td>
</tr>
<tr>
<td>ARMEDBOD</td>
<td>.40729</td>
<td>-.66691</td>
<td>.09159</td>
</tr>
<tr>
<td>LEGISLAT</td>
<td>.04921</td>
<td>-.08034</td>
<td>.77229</td>
</tr>
<tr>
<td>BOARD</td>
<td>.50768</td>
<td>-.15346</td>
<td>.52885</td>
</tr>
</tbody>
</table>

Source: Computed by the author

Note:
RAVERAGE = Average age of railcars
CONCUR = Ratio of concurrent positions of the board members
RULES = Number of rules and regulations in RSR
OFFALLLA = Ratio of officers to all laborers
OBGOMAAL = Ratio of total objectives to total goals
SPASSCAR = Number of passenger cars in service
RAILCARB = Number of railcars on book
RSRWAGEX = Average minimum wage in RSR in constant currency
TENURE = Average tenure of board members
NEGOTIAT = Number of labor negotiations in RSR
POLITEST = Number of political protest
DAYSTOP = Number of working days stoppages
ARMEDBOD = Ratio of armed forces officers in the board
LEGISLAT = Number of legislative oversights
BOARD = Number of board members in RSR
rotation, as illustrated in Table 32, there is almost no difference from the initial factor structures except the BOARD variable is located in between Factor 1 and Factor 3. In such case, the importance of the BOARD variable declines, only the LEGISLAT variable is counted as the sole significant variable for factor 3.

Thurstone (1947) recommended a rule of thumb that at least three variables are needed for each hypothesized factor, so that they will be sufficient for the analysis. Thus, Factor 1 and Factor 2 are definitely appropriate for the purpose of the next analysis. The LEGISLAT variable, however, cannot be discarded at this stage because its presence may cause significant impact on the dependent variable in the further analysis.

To find out these three factor structures that influence the degree of efficient performance of the RSR, the multiple regression analysis technique will be used again. At this stage, the independent variables are composed of the three factor structures, which are also the composite variables of the fifteen variable concepts.

Table 32 shows that all ten variables in Factor 1 tend to represent various pressures on the public enterprise's organization. The three high loading variables in Factor 2 tend to be negative changes in political and industrial relations conditions. The only variable loading on Factor 3
represents public accountability. Thus, the three factor structures can be identified and labeled as follows:

1. The first structure, Factor 1, is labeled the "Organizational Pressures Factor" since the majority of the concepts represented on it are various pressures over organizational operation. The organizational pressures are not only those reflecting internal environments, but also some measuring external environments. These variables are as follows: age of major transportation equipment (RAVERAGE), concurrent positions of the board members (CONCUR), control activities (RULES), size of administrative components (OFFALLLA), goals and objectives of the organization (OBGOAL), operation resources (SPASSCAR), organizational size (RAILCARB), employees' conditions (RSRWAGEX), length of tenure (TENURE), and labor-management relations in the organization (NEGOTIAT).

2. The second factor is labeled the Socio-Political Downturn Factor." There are three variables which have high loadings on this factor: political conditions (POLITEST), labor movements in the nation (DAYSTOP), and the political involvement in the organization (ARMEDBOD). The three significant concepts that are the major contributions of this factor are very much out of the control of the management of public enterprises. They are the national level phenomena (for political conditions and labor
movements) and the effect of the government's intention to control the public enterprise (political involvement in the appointment of members of the executive board). Thus this factor is defined as "Socio-Political Downturn" to represent the role of external conditions outside the control of the administration of the public enterprise.

3. The third structure, Factor 3, has only one concept that has a significant loading: public accountability (LEGISLAT). Thus, this factor is labeled the "Public Criticisms Factor".

It should be pointed out that the signs of the factor loadings, either positive or negative, have no intrinsic meaning. The different signs simply indicate the direction in which the variables are related to that factor. Thus, in Factor 1 (Organizational pressures factors), the goals and objectives of the organization (OBGOAL) and the tenure of the board members (TENURE) have a negative correlation, while the rest of variables in Factor 1 have a positive correlation to Factor 1. By the same token, national labor movements (DAYSTOP) and political changes (POLITEST) are positively correlated to Factor 2 (Socio-political downturn factors), while political involvement in the appointment of the executive board of the public enterprise (ARMEDBOD) is negatively correlated.
Model Building Through Multiple Regression Equations

Since there are three factors in the analysis, the new multiple regression equation model is as follows:

\[ Y = a + b_1(\text{Factor 1}) + b_2(\text{Factor 2}) + b_3(\text{Factor 3}) + e \]

or

\[ Y = a + b_1(\text{PRESSURES}) + b_2(\text{DOWNTURN}) + b_3(\text{CRITICISMS}) \]

The statistical results of this multiple regression are shown on Table 33.

Table 33 illustrates three factors that affect the efficient performance of the Thai state railway. The Durbin-Watson test of the d Statistic of 1.42 shows no positive autocorrelation at the .01 level. The entire set of independent variables has a high relationship to the dependent variable since the R Square is .84 and the adjusted R Square is .82. In other words, the three factors account for 84% of the variance in the efficient performance of the Thai state railway. The results of the analysis of variance also show an F (37.15) to be relatively high and significant beyond the .01 level.

The individual factors also show very impressive relationships. Organizational pressures has a B Value of -0.12 with a T score -9.89, significant beyond the .05 level (.0000). Socio-political downturn also has a negative B Value (-0.03), with a T score -2.77 and significant at the
Table 33. Factors Affecting Efficient Performance

<table>
<thead>
<tr>
<th>Durbin-Watson d Statistic</th>
<th>1.42</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple R</td>
<td>.92</td>
</tr>
<tr>
<td>R Square</td>
<td>.84</td>
</tr>
<tr>
<td>Adjusted R Square</td>
<td>.82</td>
</tr>
<tr>
<td>Standard Error</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Analysis of Variance

<table>
<thead>
<tr>
<th></th>
<th>DF</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>3</td>
<td>0.37</td>
<td>0.12</td>
</tr>
<tr>
<td>Residual</td>
<td>21</td>
<td>0.07</td>
<td>0.003</td>
</tr>
<tr>
<td><em>F = 37.15</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Signif F = .0000</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Standard Error B</th>
<th>BETA</th>
<th>T</th>
<th>Sig T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Pressures</td>
<td>-0.12</td>
<td>0.01</td>
<td>-0.86</td>
<td>-9.89</td>
<td>.0000</td>
</tr>
<tr>
<td>Socio-Political Downturn</td>
<td>-0.03</td>
<td>0.01</td>
<td>-0.24</td>
<td>-2.77</td>
<td>.0114</td>
</tr>
<tr>
<td>Public Criticisms</td>
<td>-0.03</td>
<td>0.01</td>
<td>-0.21</td>
<td>-2.45</td>
<td>.0232</td>
</tr>
<tr>
<td>Constant (α)</td>
<td>1.07</td>
<td>0.01</td>
<td>92.90</td>
<td>.0000</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed by the author

.0114 level. Finally, public criticisms has a B Value of -0.03, and a T of -2.45, and significant beyond the .05 level (.0232). After standardizing the partial regression coefficient of each factor, the BETA shows the standardized scores to be: organizational pressures, -.86, socio-political downturn, -.24, and public criticisms, -.21. These BETA scores can be interpreted to mean that
organizational pressures is the most important factor, while socio-political downturn and public criticisms are equal in importance. Thus, the new multiple regression equation is as follows:

\[ Y = 1.07 - 0.12(\text{PRESSURES}) - 0.03(\text{DOWNTURN}) - 0.03(\text{CRITICISMS}) \]

or

\[ \text{EFFICIEN} = 1.07 - 0.12(\text{PRESSURES}) - 0.03(\text{DOWNTURN}) - 0.03(\text{CRITICISMS}) \]

The results show that three factors, organizational pressures, socio-political downturn, and public criticisms, are the major factors that affect the efficient performance of the Thai state railway. The changes in those three factors have a negative impact, and the effects of these two factors are statistically significant.

The negative relationships between the three factors and the degree of operating efficiency are not only statistically significant, but also substantively significant. That is, all three factors are understood as the negative side of the public enterprise in general. The organizational pressures factor contains all factors that can deteriorate organizational performance. Old equipment, the practice of secondment, excessive rules and control activities, politics of resource allocation, increasing welfare expenditures, unsuitable appointments of military officers on the commissioner boards, the excessive size of
the enterprise, uncertain goals and objectives, the high rate turnover of board members, and frictions between labor and management can definitely have negative effects on the degree of operating efficiency of public enterprises. The second factor, socio-political downturn, can also hurt the enterprise's performance through political uprising and social unrest and political involvement in the board's appointments. Lastly, public criticism of the enterprise's operations can discourage management and hinder efficient performance as well. Essentially, all three factors substantially influence the operating efficiency of public enterprises.

Chapter Summary

This chapter concentrates on the two multiple regression equations. The first equation has six independent variables according to the theoretical framework proposed by Van Meter and Van Horn. The second equation has only two independent variables. The first equation shows an unsatisfied model because of a lack of significance when each independent variable is assessed. The second equation applies the factor analysis techniques to find out the new structures of independent variables. The result is that two new factors are significantly related to the degree of operating efficiency. Thus, the model can be built according to this
second multiple regression equation.


Summary of the Analysis

The overall findings can be summarized by examining the results of the hypothesis testing and the model building data analyses.

Hypothesis Testing

Table 34 summarizes the testing of the twenty hypotheses according to the degree of influence of the independent variables on the dependent variable.

Table 34. Categorization of Relationships

<table>
<thead>
<tr>
<th>Level of Influence</th>
<th>Negative Effect</th>
<th>Positive Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>no influence</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>very low influence</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>low influence</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>moderately high influence</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>high influence</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>very high influence</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>perfect influence</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Negative Effects. Sixteen concepts showed a negative direction of relationship across four levels of influence on operating efficiency. These can be categorized as follows:
1. No relationship. Four concepts fall into this category: size of executive board (BOARD), public accountability (LEGISLAT), labor movements in the nation (DAYSTOP), and the labor-management relations in the organization (NEGOTIAT).

2. Very low relationship. Only one concept falls into this category: the employee’s condition in the organization (RSRWAGEX)

3. Low relationship. Four concepts fall into this category: operation resources (SPASSCAR), size of organization (RAILCARB), market competition (HIGHWAY), and government expenditures (MILITARX).

4. Moderate relationship. Seven concepts fall into this category: age of major equipment (RAVERAGE), control activities (RULES), organization age (YEAR), administrative component (OFFALLLA), concurrent positions (CONCUR), economic condition (NATRESX), and social and educational conditions (SECOND).

Positive Effects. Only four concepts showed a positive direction of relationship to operating efficiency. They can be categorized into two levels of influence as follow:

1. No relationship. Three concepts fall into this category: political involvement in the organization (ARMEDBOD), tenure of the board member (TENURE), and
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political condition (POLITEST).

2. Very low relationship. One concept falls into this category: goals and objectives (OBGOAL).

Model Building

The multiple regression equation was introduced to find the relationships between the set of independent variables and the degree of operating efficiency of the Thai state railway. The first model, following the conceptual framework of Van Meter and Van Horn, was not successful because of the statistical insignificance of the relationships between most of the individual independent variables and the dependent variable. The second model abandoned the conceptual framework and was created using factor analysis. The independent variables in the second model were those variables derived from the principal component analysis techniques used earlier. Thus, there were twenty independent variables for the analysis. The principal component technique was applied to reduce the number of variables. The result was that there were three factors.

However, the three new factors had a problem of interpretability. Five variables were eliminated from the analysis since they are distant variables that do not directly affect the degree of operating efficiency. The fifteen remaining variables were analyzed again to reduce
the number of variables by using principal component extraction and a varimax rotation. The result was again three major factor structures, or three composite variables (see Table 31 and 32) as follows:

1. Organizational Pressures Factor. This factor is composed of ten major concepts: goals and/or objectives, enterprise's resources, equipment age, control mechanisms, organization's size, administrative component, tenure of the board members, concurrent position of the board's members, labor-management relations and employees' conditions.

2. Socio-Political Downturn Factor: This factor is composed of three major concepts: political involvement in the board's appointment, national political condition, and labor movements in the nation.

3. Public Criticisms Factor. This factor derives mainly from the public accountability concept.

All these three factors were negatively related to operating efficiency in a new regression equation. Since the R Square for this equation was .84, three factors have a significant effect on the Thai state railway. The unexplained variation indicates that there are some other factors besides those in the multiple regression equation that account for the other 16%.
Conclusions

The results of the study contradicted expectation in that seven variables show no relationships or no associations with efficient performance at all: political involvements (ARMEDBOD), tenure of the board member (TENURE), political conditions (POLITEST), executive board (BOARD), labor relations in RSR (NEGOTIAT), labor movements (DAYSTOP) and public accountability (LEGISLAT). These seven variable concepts were seen in the literature reviewed as the major forces affecting public enterprise's performance in developing countries. The findings of this study reject the conclusions of that literature.

In contingency theory, the environment of each organization is dependent upon several factors. Certainly, there is no public enterprise that absolutely falls into the same situation as the Thai state railway. Especially, public enterprises in developed countries will have different political, social and economic environments from those in developing countries. Even public enterprises in developing countries do not always operate in the same environment, but vary according to time and circumstance. India, for example, is a developing country but more democratized than Thailand. But the standard of living of the Thais is higher than of the Indians. Countries such as Malaysia and Singapore, for other examples, are not subject
to military influences as much as countries like Thailand, Pakistan, Indonesia, and the Philippines. Thus, the different environments may play a major role in the business of domestic enterprises since they can create different effects on the political, social and economic conditions of the society.

Six concepts show associations with operating efficiency, ranging from very low to low in degree: organizational size (RAILCAB), operation resources (SPASSCAR), market competition (HIGHWAY), government expenditure (MILITARX), organizational goals/objectives (CEGOAL), and the employees' conditions (RSRWAGEX). With the exception of the goals and objectives variable concept, the rest show a negative direction of association with organizational performance. Moreover, six concepts have results contrary to hypotheses. These findings contradict the literature since these six variables were all expected to have positive associations with operating efficiency. The results led to the suspicion that these six variable concepts may negatively influence the efficient performance of the RSR.

More interesting are those seven concepts that have moderately high relationships—equipment age (RANGE), control mechanisms (RULES), administrative size (OFFALLLA), economic conditions (NATRESX), organizational age (YEAR), educational condition (SECOND), and concurrent position
(CONCUR)--with the RSR's performance. However, not all these variables have the direction of relationship to operating efficiency predicted in their hypotheses. While equipment age and concurrent positions confirmed hypotheses predicting negative relationships, the remainder have relationships opposite the stated hypotheses, which also contradict to the literature. Thus, the results of the tests, again, support the theory that the cause-effect relationships of the two variables are always contingent.

There are no concepts that show associations with the degree of operating efficiency higher than the moderately high level. The association of two variables in social science is always the subject of arguments.

Thus, multivariate analysis is introduced to predict efficient performance. When more independent variables are included in the equation at the same time, the regression coefficients of those individual independent variables vary from the previous simple regression results. The principal component extraction and the varimax rotation techniques help reduce the variables to a smaller number of new factors. The result is the three new major factor structures that are composed of many variables. When all three factor structures are included in the same equation the results provide a much more satisfactory explanation of efficiency than the previous bivariate testings.
The three factor structures (composite variables), labeled as organizational pressures, socio-political downturn and public criticisms, seem to fit best in the model. The organizational pressures are mainly those variables that can put pressures to the enterprise's performance. These variables are goals/objectives, enterprise's resources, equipment age, control mechanisms, organizational size, administrative component, tenure of the board's member, concurrent position of the board's members, labor-management relations, and employees' conditions. The second factor is composed of political involvement in the board's appointment, national political condition, and labor movements in the nation. The third factor is mainly public accountability.

These three factor structures disclose that the operating efficiency of the RSR’s enterprise is influenced by changes in those variables that comprise the three factors. In other words, the prediction of the RSR's performance is not subject to a specific variable, but many variables are concurrently needed for the consideration. The changes in those variables must be taken into account simultaneously, and as a whole, to predict change in the RSR's performance.

The three new factor structures obviously have a negative influence on operating efficiency. The final multiple regression model (Table 33) shows a negative B Value for all
three factors. Since the model is not bivariate, it is less subject to the contingent problem. That is, the relationship between the three factor structures and the efficiency variable is more cause-effect than those simple bivariate relationships.

Thus, two points of view emerge as the conclusions of this study. One is that the literature falls short in suggesting the variables, and especially the direction of those variables, that influence performance of the Thai State Railway. The second is that the composite variables made possible through the use of factor analysis provide a more workable model for analyzing the RSR.

Implications of the Study: General Comments

Theory building in any field of study derives from one of two approaches: either a deductive approach (which implies empirical consequences and controls situational events in order to observe the validity of empirical deduction) or inductive approach (which reasons from individual and naturally occurring but largely uncontrollable observations toward generalizable in deductive principles) (Bonoma, 1985, p. 199). Both approaches are equally valid and hold both advantages and disadvantages.

The case study is a technique aimed toward theory building in the inductive approach. Its disadvantage is the
lack of generalizability since the solution derives from a single instance. Yet its advantages are plentiful. As La Palombar pointed out what distinguishes the case-study method is that it involves exploring a hunch or theory or hypothesis . . . in a single situation or perhaps in a few of them. Then analyses, presumably will permit careful observation in great depth. They will also permit the analyst to pay attention to a great number of variables, if perhaps a subtle nature, that often defy precise measurement but that is nevertheless important (1979, p. 21).

Moreover, in a certain circumstances, a single case can be of benefit of theory builders if it is a critical case since it saves time and expenses (La Palombara, 1979, p. 23).

As a case study, this project can be considered as a new step in the study of public enterprise in a developing environment. It partly corrects, and partly supports, the findings of previous studies that concentrated on individual and/or a small number of variables. With over two hundred variables, this study is comprehensive. However, it still has a number of shortcomings, particularly the exclusion of management skills variables from the analysis.

Since this study is based on contingency theory, and within the confines of system analysis, it supports the major thesis of contingency theory that change in one variable is reflective of changes in other variables. In the context of organization theory, there are many factors that surround and influence the performance of an organization.
Many of these factors are not static but dynamic. These factors are either direct or indirect inputs to the organization, and subject to conversion into organizational outputs or an organization's performance. Because of their dynamic status, they always change when time and circumstance change.

In a developing society, the environmental changes in political, social and economic conditions are rapid. From time to time, the changes can happen overnight as, for example, is the case when a military coup, a frequent happening in many developing countries, occurs. Rapid change comes about even though most governments of developing countries aim to improve political, social and economic situations. Moreover, these changes, involve conflicts; thus, the policies of the governments fluctuate and vacillate dependent upon the situation. The case of the Thai state railway is a good example. In general, this study points out several problems that public enterprises in developing countries may encounter within a period of performance.

It should be noted, however, that the accomplishments of public enterprises in developing countries also depend on the goals of government as well. An inefficient public enterprise may fulfill the goals of the government more than the more efficient enterprises. In this context, it is
necessary to separate those public enterprises that have predominantly political goals from those that are set up predominantly for economic goals. The comparison of public enterprises that do not have the same predominant goals will lead to misunderstanding and misinterpretation of their performances. Only those public enterprises with predominantly economic goals can be evaluated and predicted by the methods used in this study.

The importance of this study is thus limited to public enterprises in developing societies and only those that have substantial economic purposes. Based on contingency theory, the variables in the composite variables may vary according to the circumstances of each environment. However, whether the circumstances are changed, those variables will always be the major inputs of the enterprise. In the language of system theory, the contributions of the enterprises will be the outputs which may trickle down to the changing environments. These changing environments will later be fed back and become the inputs of the enterprises on the next round. This process will be present continuously. Furthermore, the management of the enterprise may not be able to resist change since many factors are not subject to management's control.

Since this study concentrates on a developing society's environment, the factors that affect efficient performance
may be different from those influencing state enterprises in a developed society. One of the major points drawn from this project is that some of those factors that affect the state enterprise's performance are beyond the control of the enterprise itself. In other words, they are not subject to the internal control of the administration of that particular state enterprise. In a developing society, political, economic and social conditions, as well as organizational pressures, are the major forces of change in state enterprises. It is, consequently, hard to control the enterprise's performance. On the contrary, the state enterprises in a developed society tend to be separated from those political, economic, and social changes. When there are some changes in those environments, the state enterprise adapts to changing conditions with greater efficiency. Thus, they have fewer problems than those state enterprises in developing countries.

Further Research

This study successfully tested several hypotheses based on the arguments of the organization theorists mentioned in the literature review chapter. The confirmations and rejections of the hypothesis testings can be considered as the major theme of this study since the hypotheses are tested with a more sophisticated method than that reflected
in the literature. On the whole, this project can be considered as a case study for all who are operating or planning to operate a state enterprise in a developing society environment.

Further research is encouraged using both longitudinal and cross-sectional data and utilizing organizational pressures, socio-political downturn, and public criticisms variables to measure public enterprise's efficient performance. Case studies over time will help prove theory. As Child points out, both longitudinal and cross-sectional studies are critical to the classification of methodological issues (Child, 1977). Moreover, the study of changes in organization structure desperately needs time-series analysis since organizational change is a time-related issue. Case research, which is composed of many case studies over similar subjects, can be explored as one useful alternative research. As Bonoma concludes "case research may be viewed as a metaphor for the general utility of the varied inductive research methods in expanding our perspectives on research problems" (Bonoma, 1985, p. 207).

This study, however, is not perfect in many aspects:

1. It is an ethnocentric study, focusing on only one society: Thailand. Thus, the data for this study may be different from those of other societies.
2. Since it tests only one enterprise, this case study may have biased results because it cannot compare data with other organizations.

3. Several factors are omitted from the analysis and are not brought into the consideration, such as management competency in accounting, production, marketing, financing, and personnel administration.

It is recommended that further study on this subject consider these three loopholes. The most important one is the effect of management skills on all kinds of operation: accounting, marketing, financing, production and personnel administration. All of these management skills are omitted from this study. Since 84% of the operating efficiency is the contribution of only three factors (composite variables), the other 16% may be the result of management skills. Thus, any future study should include management skills so that that study will be more comprehensive.

Chapter Summary

This last chapter starts with the summary of the findings from the two data analysis chapters. The conclusion points out the merits of this study. Comments are provided as how this case study can be generalized to the practice of management of public enterprises in developing societies. The merit of case research is also discussed. Finally,
proposal for further research are made.
CHAPTER BIBLIOGRAPHY


APPENDIX A
Appendix A. Original Project Data


3. Whole Sale Price Index (WPI) 1983-1984


1. Population of Thailand (POPULA) 1957-1959


1. Population of Thailand (POPULA) 1951-1953

2. Adult Literacy Rate (LITERACY) 1951-1966

3. Budget Standing (BUDGET) 1951-1961

4. Motor Vehicles in Use (MOTOR) 1951, 1952

5. Mail Traffic (MAIL) 1951


1. Consumer Price Index (CPI) 1951-1975
2. Whole Sale Price Index (WPI) 1951-1975
4. Children in Primary Schools (PRIMARY) 1951-1953
6. Students in Universities (UNIVERSI) 1951-1972
8. Passenger Aviation in Kilometers (PASAVIA) 1951-1975
10. Number of Strikes and Lockouts (STRIKES) 1951-1954
11. Number of Workers involved in Strikes and Lockouts (INVOLVED) 1951-1954
12. Number of Working Days Lost (DAYLOST) 1951-1954


1. Whole Sale Price Index (WPI) 1976-1982


1. Children in Primary Schools (PRIMARY) 1954-1984
3. Vocational Enrollment (VOCAT) 1952-1984


1. Number of Domestic Flight (FLIGHT) 1970-1984


1. Number of Strikes and Lockouts (STRIKES) 1956-1984
2. Number of Workers Involved in Strikes (INVOLVED) 1956-1984
4. Number of Working Days Lost (DAYLOST) 1956-1984


1. Number of Labor Unions (UNIONS) 1972-1984


1. Depreciation (DEPRE) 1961-1965
2. Net Railway Operating Income or Lost (NETINLOS) 1951-1984
3. Number of Permanent Employees (PERMEMP) 1951-1984
5. Number of Officers (OFFICER) 1951-1984
6. Number of Permanent Laborers (PERMLA) 1951-1984
7. Total Assets of the RSR (ASSET) 1951-1984
9. Number of Board Members in BOD (BOARD) 1951-1984
10. Domestic Training Programs Employees Attended (DOMESTIC) 1961-1984
11. Employees Trained in Thailand (INTHAI) 1961-1984
12. Foreign Training Programs Employees Attended (FOREIGN) 1951-1984
13. Employees Trained Outside Thailand (OUTTHAI) 1951-1984
14. Number of Rules and Regulations in RSR (RULES) 1951-1984
15. Fringe Benefits (FRINGE) 1952-1984
17. Number of Cases of Lawsuits in RSR (LAWSUIT) 1951-1984
18. Number of Armed Forces Officers on the Board (ARMEDOFF) 1951-1984
19. Number of Civil Servants on the Board (CIVILSER) 1951-1984
20. Background of Chairperson of the Board (CHAIR) 1951-1984
21. Background of Governor of the RSR (GOVERNOR) 1951-1984
22. Fringe Benefits per Permanent Employee (BENEFIT) 1952-1984
23. Salary and Wages (SALARY) 1952-1984
24. Budget for Survey and Building New Lines (SURVEY) 1951-1984
25. Budget for Railway Renovation (RENOVATE) 1951-1984
26. Budget for Administration (ADMIN) 1951-1984
27. Total Budget Appropriation of RSR Annually (RSRBUDGT) 1951-1984
29. Number of Labor Negotiations in RSR (NEGOTIAT) 1951-1984
30. Number of Agreements over Labor Disputes in RSR (AGREEMENT) 1951-1984
31. Number of Disagreements over Labor Dispute in RSR (DISAGREE) 1951-1984
32. Number of Government Involvement in Labor Dispute in RSR (GOVINVOL) 1951-1984
33. Number of Strikes and Lockouts in RSR (RSRSTRIK) 1951-1984
34. Repayments of Loans by RSR (REPAY) 1961-1984


Hongsanun, Kesinee, The Relationships Between the Legislature and Public Enterprises in Thailand, Bangkok, Thailand, the Social Science Association Press, 1986. (Published in Thai)
1. Legislative Oversight (LEGISLAT) 1969-1984


Pongpitsanupichit, Jirasak, Direct Foreign Investment and Thai Investment Promotion Policy, Bangkok, Thailand, The Social Science Association Press, 1985. (Published in Thai)

2. Gross Domestic Investment (GDI) 1960-1984
3. Private Transfer Payment (PRITRAN) 1960-1984
4. Governmental Transfer Payments (GOVTRAN) 1960-1984
5. Direct Investment (DIRECTIN) 1960-1984
6. Portfolio Investment (PORTFOLI) 1960-1984
7. Private Long Term Loans (LONGLOAN) 1960-1984
8. Other Long Term Loan (OTLOAN) 1960-1984


1. Number of National Election (ELECTION) 1951-1977

2. Unsuccessful Regular Executive Transfer (UNREGU) 1951-1977

3. Unsuccessful Irregular Executive Transfer (UNIRREGU)
1951-1977
4. Irregular Executives Transfer (IRRETRAN) 1951-1977
5. Executive Adjustments (EXADJUST) 1951-1977
6. Regular Executive Transfers (REGUTRAN) 1951-1977
7. Protest Demonstration (PROTEST) 1951-1977
8. Regime Support Demonstration (REGIME) 1951-1977
9. Political Strikes (POSTRIKE) 1951-1977
10. Riots (RIOTS) 1951-1977
11. Armed Attacks (ARMEDAT) 1951-1977
12. Assassinations (ASSASSIN) 1951-1977
15. Relaxation of Sanctions (RELAX) 1951-1977
16. Political Execution (POEXECUT) 1951-1977


1. Number of National Election (ELECTION) 1978-1984
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1. Total Route in Kilometers (TOTROUTE) 1951-1984
2. Length of Track (TRACK) 1955, 1960-1984
3. Number of Training Employees (TRAINEMP) 1963-1984
4. Operating Revenue (OREV) 1951-1984
5. Operating Expenditure (OEXP) 1951-1984
7. Equipment Costs (EQCOST) 1971-1984
10. Change on Rate of Fare (RATEFARE) 1951-1984
22. Number of Steam Locomotives in Services (STEAMS) 1963-1984
24. Number of Diesel Locomotives in Service (DIESELS) 1967-1984
25. Number of Railcars on Book (RAILCARB) 1962-1984
27. Number of Steam Locomotives Under 20 Years (SUNDER20) 1963-1964, 1966-1984
31. Age of Railcars Under 10 Years (RUNDER10) 1962-1984
32. Age of Railcars Over 10 Years (ROVER10) 1972-1984
33. Number of Passenger Cars on Book (BPASSCAR) 1955, 1960-1984
34. Number of Passenger Cars in Service (SPASSCAR) 1963-1984
36. Age of Passenger Cars Between 11 to 20 Years (P11TO20) 1963-1964, 1966-1984
37. Age of Passenger Cars Between 21 to 30 Years (P21TO30) 1963-1964, 1966-1984
38. Age of Passenger Cars Between 31 to 40 Years (P31TO40) 1963-1964, 1966-1984
40. Number of Freight Cars on Book (BFREIGHT) 1955, 1960-1984
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45. Age of Freight Cars between 31 to 40 Years (F31TO40) 1963-1964, 1966-1984


1. GNP Per Capita (GNPCAP) 1951-1963


2. Budget Standing (BUDGET) 1962-1984
3. Change of Export and Nonfactor Services (EXPONFS) 1961-1984
6. Total National External Debt (DEBT) 1965-1983
8. Assets in Monetary System (MONETARY) 1963-1984

Data from Computation and Tallying.


4. Number of Motor Vehicles in Use (MOTOR) combined from two divisions in Police Department 1951-1952.

6. Total Government Debt (GOVDEBT) combined domestic and foreign debt 1951-1961
7. Change of Government Expenditures (GOVEXPEN) calculated from government expenses 1951-1961
8. Ratio of Officers to Permanent Laborers (OFFPERM) 1951-1984
9. Ratio of Officers to all Laborers (OFFALLLA) 1951-1984
10. Ratio of Temporary to Permanent Employees (TEMPPERM) 1951-1984
11. Ratio of Passenger Productivity (PAPRODUC) 1951-1984
12. Ratio of Freight Productivity (FPRODUC) 1951-1984
13. Number of Rules Changed in RSR (RULECHAN) 1951-1984
15. Average Tenure of Board Members (TENURE) 1951-1984
17. Ratio of Armed Forces Officers on the Board (ARMEDBOD) 1951-1984
18. Ratio of Civil Servants on the Board (CIVILBOD) 1951-1984
19. Ratio of Armed Forces Officers to Civil Servants (ARMCIVIL) 1951-1984
20. Number of Lawsuits Change in the RSR (LAWCHANG) 1952-1984
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22. Number of Objectives Stated in Qualitative Terms (QUALI) 1951-1984
23. Total Objectives (TOTOB) 1951-1984
24. Total Goals (TOTGOAL) 1951-1984
25. Ratio of Unverifiable Goals to Total Goals (RAUNVERG) 1951-1984
27. Ratio of Concurrent Positions of the Board Member (CONCUR) 1951-1984
28. Ratio of Steam Locomotives in Service and on Book (RASTEAM) 1951-1984
29. Ratio of Diesel Locomotives in Service and on Book (RADIESEL) 1951-1984
30. Ratio of Railcars in Service and on Book (RARAILCA) 1951-1984
31. Ratio of Passenger Cars in Service and on Book (RAPASS) 1951-1984
Appendix B. Data Treatment Using Time-Series Trend Estimation

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Note:
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SPECFUND = Special funds
SPASSCAR = Number of passenger cars in service
TELEGRAM = Telegrams
WELFARE = Number of welfare items provided for employees
DAVERAGE = Average age of diesel locomotives
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Note:
ACCRUDE = Accrued depreciation  
CONSOLID = Consolidated income or loss  
CURRASSET = Current assets of RSR  
DAYSTOP = Number of days of work stoppages  
DEBT = Total national external debt
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Note:
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DIESELS = Number of diesel locomotives in service
DOVER10 = Number of diesel locomotives age over 10 years
EDUCAT = Education expenditures
EQCOST = Equipment cost

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Note:
EXGOODS = Export of goods
GOVLA = Government-labor relations
INVODISP = Number of workers involved in dispute
RESERVE = Pension and welfare reserve
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Note:
FLIGHT = Number of domestic flights
FREIGHTA = Freight aviation in ton-kilometers
F21T30 = Number of freight cars age between 21 to 30 years
GROSSPAY = Amount of gross pay
HEALTH = Health expenditures
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Note:
LACOST = Labor costs
LAFORCES = Total national labor forces
LITERACY = Adult literacy rate
MAIL = Mail traffic
MONETARY = Assets in monetary system
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Note:
NATRES- = Total national resources
PASAVIA = Passenger aviation in kilometers
PUBSERVE = General public services expenditures
REALGDY = Real gross domestic income per capita
REPAY = Repayments of loans by RSR
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**Note:**

- **RSRWAGE** = Average minimum wage in RSR
- **SHIPRE** = Merchant ships registered
- **SOCIASEC** = Welfare and social security expenditures
- **STEAMS** = Number of steam locomotives in service
- **SUNDER20** = Number of steam locomotives age under 20
- **TRAINEMP** = Number of training employees
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Note:
UNEMPLOY = Total national unemployment
WAGE = Ratio of wage changes
D11TO20 = Number of diesel locomotives age between 11 to 20 years
SAVERAGE = Average age of steam locomotives
Appendix D. Data Treatment Using

Piecewise Interpolation

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Note:
SOVER20 = Number of steam locomotives age over 20 years
PUNDER10 = Number of passenger cars age under 10 years
F11TO20 = Number of passenger cars age between 11 to 20 years
F21TO30 = Number of passenger cars age between 21 to 30 years
F31TO40 = Number of passenger cars age between 31 to 40 years
FOVER40 = Number of passenger cars age over 40 years
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Note:
SFREIGHT = Number of freight cars in service
FUNDER10 = Number of freight cars age under 10 years
F11TO20 = Number of freight cars age between 11 to 20 years
F31TO40 = Number of freight cars age between 31 to 40 years
FOVER40 = Number of freight cars age over 40 years
PRINTVEST = Change of private investment
APPENDIX E
Appendix E. Principal Component Analysis for Sixteen Clusters

<table>
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<th>Variables</th>
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<td>Total objectives (TOTOB)</td>
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<td>Ratio of objectives stated in quantitative terms to all objectives (QUANTOB)</td>
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<td>Ratio of quantitative to qualitative objectives (QUANQUAL)</td>
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<td>Ratio of total objectives to total goals (OBGOAL)</td>
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<td>Number of diesel locomotives in service (DIESELS)</td>
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<td>Number of railcars in service (RAILCARS)</td>
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<td>Average age of steam locomotives (SAVERAGE)</td>
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<td>Average age of diesel locomotives (DAVERAGE)</td>
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<td>Average age of railcars (RAVERAGE)</td>
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<td>Ratio of railroad vehicles aged under 10 to 11-20 years (RA10TO20)</td>
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<td>Ratio of railroad vehicles aged under 10 to over 10 years (RA10TOOV)</td>
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<td>Ratio of railroad vehicles aged 11-20 to</td>
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</table>
### Control Activities Cluster

- Number of rules and regulations in RSR (RULES) \( 0.79724 \)
- Number of rule changes in RSR (RULECHAN) \( 0.65017 \)
- Decentralization change (DECENT) \( 0.59353 \)

### Organizational Size Cluster

<table>
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<td>Total assets of RSR (ASSETX)</td>
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<tr>
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<tr>
<td>Number of employees in RSR (TOTALEMP)</td>
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<tr>
<td>Total route in kilometers (TOTROUTE)</td>
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<tr>
<td>Freight traffic on railways (FREIGHT)</td>
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<td>Passenger traffic on railways (TOTALPAS)</td>
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<tr>
<td>Number of permanent laborers (PERMLA)</td>
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<td>Accrued depreciation (ACCRUDEX)</td>
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<td>Pension and welfare reserve (RESERVEX)</td>
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<tr>
<td>Amount of gross pay (GROSSPAX)</td>
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<td>Tonnage transported (TRANSOR)</td>
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<td>Repayment of loans by RSR (REPAYX)</td>
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<td>Number of freight cars on books (BFREIGHT)</td>
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<td>Total railroad vehicles on books (BRAIL)</td>
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### Political Involvement Cluster

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<td>Legislative oversight of public enterprises</td>
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<td>Government-labor relations</td>
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### Political Conditions Cluster

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<td>State coercive behavior</td>
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### Market Competition Cluster

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### Economic Conditions Cluster

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**Government Expenditures Cluster**

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**Educational Conditions Cluster**

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**Labor Movements Cluster**

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<td>Number of working days lost (DAYLOST)</td>
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<td>Number of days of work stoppages (DAYSTOP)</td>
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<td>Number of labor disputes (DISPUTES)</td>
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<td>Number of workers involved in disputes (INVODISP)</td>
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<tr>
<td>Number of labor unions (UNIONS)</td>
<td></td>
<td>0.14650</td>
</tr>
<tr>
<td>Number of labor union members (UMEMBER)</td>
<td></td>
<td>0.00352</td>
</tr>
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</table>

**Employee Conditions Cluster**

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of welfare items provided for employees (WELFARE)</td>
<td></td>
<td>0.89390</td>
</tr>
<tr>
<td>Ratio of wages changes from the previous year (WAGE)</td>
<td></td>
<td>0.86184</td>
</tr>
<tr>
<td>Fringe benefits (FRINGEX)</td>
<td></td>
<td>0.91952</td>
</tr>
<tr>
<td>Description</td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Personnel expenses in RSR (PERSONNX)</td>
<td>0.91349</td>
<td></td>
</tr>
<tr>
<td>Fringe benefits per permanent employees (BENEFITX)</td>
<td>0.93988</td>
<td></td>
</tr>
<tr>
<td>Salary and wages (SALARYX)</td>
<td>0.85680</td>
<td></td>
</tr>
<tr>
<td>Wage and salary per employee (AVERAGEX)</td>
<td>0.94764</td>
<td></td>
</tr>
<tr>
<td>Number of employees training in RSR institute (TRAINEMP)</td>
<td>0.77056</td>
<td></td>
</tr>
<tr>
<td>Domestic training programs employees attended (DOMESTIC)</td>
<td>0.92366</td>
<td></td>
</tr>
<tr>
<td>Employees trained in Thailand but outside RSR (INTHAI)</td>
<td>0.82260</td>
<td></td>
</tr>
<tr>
<td>Foreign training programs employees attended (FOREIGN)</td>
<td>0.74118</td>
<td></td>
</tr>
<tr>
<td>Employees trained outside Thailand (OUTTHAI)</td>
<td>0.62278</td>
<td></td>
</tr>
<tr>
<td>Average minimum wage in RSR (RSRWAGEX)</td>
<td>0.96280</td>
<td></td>
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</table>

**Labor Relations in Organization Cluster**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of labor negotiations in RSR (NEGOTIAT)</td>
<td>0.95955</td>
</tr>
<tr>
<td>Number of agreements over labor disputes in RSR (AGREEMEN)</td>
<td>0.56004</td>
</tr>
<tr>
<td>Number of disagreements over labor disputes in RSR (DISAGREE)</td>
<td>0.86559</td>
</tr>
<tr>
<td>Number of government involvements in labor dispute (GOVINVOL)</td>
<td>0.79274</td>
</tr>
<tr>
<td>Number of strikes and lockouts in RSR (RSRSTRIK)</td>
<td>0.84869</td>
</tr>
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</table>
APPENDIX F
Appendix F. Principal Component Analysis for Five Clusters

<table>
<thead>
<tr>
<th>Variables</th>
<th>Loading on Factor One</th>
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<tbody>
<tr>
<td><strong>Resources Cluster</strong></td>
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</tr>
<tr>
<td>Number of passenger cars in services (SPASSCAR)</td>
<td>.97697</td>
</tr>
<tr>
<td>Average age of railcars (RAVERAGE)</td>
<td>.97697</td>
</tr>
<tr>
<td><strong>Organization Structure Cluster</strong></td>
<td></td>
</tr>
<tr>
<td>Number of rules and regulations in RSR (RULES)</td>
<td>.98618</td>
</tr>
<tr>
<td>Year identification (YEAR)</td>
<td>.98614</td>
</tr>
<tr>
<td>Number of railcars on book (RAILCARB)</td>
<td>.96187</td>
</tr>
<tr>
<td>Ratio of officers to all laborers (OFFALLLA)</td>
<td>.93845</td>
</tr>
<tr>
<td><strong>Political Conditions Cluster</strong></td>
<td></td>
</tr>
<tr>
<td>Number of board members in RSR (BOARD)</td>
<td>.64828</td>
</tr>
<tr>
<td>Ratio of armed forces officers in the board (ARMEDBOD)</td>
<td>.64742</td>
</tr>
<tr>
<td>Legislative oversights (LEGISLAT)</td>
<td>.13111</td>
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<tr>
<td>Political protest (POLITEST)</td>
<td>-.31659</td>
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<tr>
<td>Ratio of concurrent positions of the board members (CONCUR)</td>
<td>.87145</td>
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<tr>
<td>Average tenure of board members (TENURE)</td>
<td>-.71739</td>
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<tr>
<td><strong>Economic Conditions Cluster</strong></td>
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</tr>
<tr>
<td>Length of highway (HIGHWAY)</td>
<td>.99609</td>
</tr>
<tr>
<td>Total national resources in constant currency (NATRES)</td>
<td>.99609</td>
</tr>
<tr>
<td><strong>Social-Industrial Relation Conditions Cluster</strong></td>
<td></td>
</tr>
<tr>
<td>Military expenditure in constant currency (MILITARX)</td>
<td>.94046</td>
</tr>
<tr>
<td>Children in secondary school (SECOND)</td>
<td>.96598</td>
</tr>
<tr>
<td>Number of working days stoppages (DAYSTOP)</td>
<td>.33896</td>
</tr>
<tr>
<td>Description</td>
<td>Value</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Average minimum wage in RSR in constant currency (RSRWAGEX)</td>
<td>.95245</td>
</tr>
<tr>
<td>Number of labor negotiations in RSR (NEGOTIAT)</td>
<td>.73228</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY

Books


Blau, Peter M. 1956. Bureaucracy in Modern Society. New


Agency. London: Groom Helm, Ltd.

Jones, N. S. C. 1974. Politics, Public Enterprises and the
Industrial Development Agency: Industrialization,
Policies and Practices. New York: Holmes and Meier
Publishers Inc.

Katz, Daniel, and Robert L. Kahn. 1966. The Social
Psychology of Organizations. New York: John Wiley and
Sons.

Kaunda, K. D. 1968. Zambia's Economic Revolution. Lusaka,
Zambia.

Techno-Economic Environment on Firms' Organizations.
Report of Research Findings Presented to Participating
Corporations in a Studies of Organizational Structures.
Canada: McGill University.


Kim, Jae-On, and Charles W. Mueller. 1982. Introduction to
Factor Analysis: What It Is and How to Do It. Beverly
Hills, California: Sage Publications, Inc.

Kim, Jae-On, and Charles W. Mueller. 1982. Factor Analysis:
Statistical Methods and Practical Issues. Beverly Hills,
California: Sage Publications, Inc.

Kipnis, David. 1974. The Powerholder. In J. T. Redeschi,

Koontz, Harold , and Cyril O'Donnell. 1976. Management: A
Systems and Contingency Analysis of Managerial Functions.

Kuhn, Tillo E. 1962. Public Enterprise Economics and
Transport Problems. Berkeley and Los Angeles: University
of California Press.


Lawrence, P. R., and J. W. Lorsch. 1967. Organization and
Environment. Boston: Harvard Graduate School of Business
Administration.


Industries. London: George Allen and Unwin Ltd.


Pongpitsanupichit, Jirasak. 1985. Direct Foreign Investment and Thai Investment Promotion Policy. Bangkok, Thailand:
The Social Science Association Press.


Taylor, Charles Lewis and David A. Jodice. 1983. World


Walsh, Annmarie Hauck. 1978. The Public Business: The


Articles


Latham, Gary P., and Edwin A. Locke. 1979. Goal Setting -A
Motivational Technique That Works. Organizational Dynamics, 8: 68-80.


Reports


Office of the Prime Minister. 1968. Thailand Official Yearbook for 1968. Bangkok, Thailand. (Published in Thai)


Unpublished Materials


Angeles, California.


