ปัจจัยที่มีผลต่อประสิทธิภาพของการรถไฟแห่งประเทศไทย (รฟท.): การวิเคราะห์เชิงพหุและการสร้างรูปแบบของสมการ

Factors Affecting the Efficient Performance of State Railway Authority of Thailand (SRT): The Multivariate Analysis and the Model Building

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บทคัดย่อ

การรถไฟแห่งประเทศไทย (รฟท) เป็นรัฐวิสาหกิจหนึ่งในหลาย ๆ รัฐวิสาหกิจของประเทศไทย การเป็นรัฐวิสาหกิจทำให้การปฏิบัติการขององค์กรการรถไฟแห่งประเทศไทยต้องตกอยู่ในสภาพแวดล้อมที่ประกอบด้วยปัจจัยภายในตัวองค์กรเอง และปัจจัยภายนอกที่องค์กรไม่สามารถควบคุมได้

ด้วยความหลากหลายของปัจจัยที่อาจมีผลกระทบต่อการบริหารจัดการขององค์กรการรถไฟแห่งประเทศไทย จึงทำให้เป็นที่น่าศึกษาว่า ระหว่างปัจจัยทั้งภายในและภายนอกองค์กรนั้น ปัจจัยใดบ้างที่สร้างผลกระทบต่อประสิทธิภาพของการรถไฟแห่งประเทศไทยอย่างมาก และด้วยเหตุผลที่การรถไฟแห่งประเทศไทยได้ถูกจัดตั้งขึ้นมาเป็นระยะเวลานานจึงมีข้อมูลมากพอที่จะถูกเก็บรวบรวม เพื่อการวิเคราะห์ในเชิงอนุกรมเวลาได้นานถึง 25 ปี การวิเคราะห์ด้วยข้อมูลอนุกรมเวลาในงานวิจัยครั้งนี้ ได้ใช้เทคนิคการวิเคราะห์ที่หลากหลาย กล่าวคือ เทคนิคหลักเป็นเรื่องของลดจำนวนข้อมูลที่เป็นตัวแปรอิสระที่มีอยู่มากมายให้เหลือจำนวนที่น้อยลง เทคนิคนี้เรียกว่า เทคนิคการวิเคราะห์องค์ประกอบ จากนั้นจำนวนข้อมูลที่ได้จากการกลั่นกรองในขั้นต้น จะถูกนำไปวิเคราะห์หาค่าความสัมพันธ์กับตัวแปรตาม โดยวิธีการทางสถิติที่เรียกว่า การวิเคราะห์การถดถอยเชิงพหุ หรือพิจารณาว่า เมื่อทุกตัวแปรอิสระได้ถูกนำมาวิเคราะห์ในเวลาเดียวกัน จะแสดงค่าความสัมพันธ์กับตัวแปรตามมากน้อยแตกต่างกันเพียงใด

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การดำเนินการเช่นว่านี้ได้อาศัยตรรกะประกอบเทคนิคในการลดข้อมูลที่หลากหลาย จนในที่สุดก็พบว่า ปัจจัยที่มีผลกระทบต่อประสิทธิภาพของการรถไฟแห่งประเทศไทยนั้นไม่ใช่เป็นปัจจัยเดี่ยว แต่เป็นกลุ่มปัจจัย 3 กลุ่มหลัก ซึ่งได้ตั้งชื่อกลุ่มที่ 1 เรียกว่า กลุ่มแรงกดดันที่มีต่อองค์กร กลุ่มที่ 2 เรียกว่า กลุ่มความยุ่งยากทางสังคมและการเมือง และกลุ่มที่ 3 เรียกว่า กลุ่มการวิพากษ์วิจารณ์จากสาธารณะ โดยทั้ง 3 กลุ่ม มีอิทธิพลต่อประสิทธิภาพของการรถไฟแห่งประเทศไทยถึง 84%

Abstract

The State Railway Authority of Thailand (SRT) is a public enterprise in Thailand. As an organization, its performance is subject to various factors both internal and external environments of the enterprise.

The SRT was selected as a case study because of its advantages over other public enterprises in Thailand in terms of size of operation, length of service, and data availability. For the purpose of this project, data about its operation for 25 years were collected for multivariate analysis.

The major method of analysis was multiple regression testing. But, since there were a large number of variables, the principal component technique was used in the testing to reduce variables to a smaller number for further analysis. The multiple regression tests resulted in significant relationships.

As a result of the statistical operation, the three new factors derived from the factor analysis technique were labeled as "the organizational pressure," 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.

Introduction

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

Background of the Study

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

A multivariate approach used here is based on the conceptual framework of Van Meter and Van Horn who identified at least six factors that affect the policy implementation of the public agency: goals and/or objectives, resources, organization structure, political condition, economic

condition, and social condition (Van Meter and Van Horn, 1975, pp. 445 – 488). This research study followed Van Meter and Van Horn' s framework but modified 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.

Since it is believed that, in social science research, rarely does one independent variable fully explain the dependent variable; 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 regression technique is that independent variables will not be highly intercorrelated lest the explanatory power of only one variable be obscured by its intercorrelation with another.

Scope of the Study

As Tierney argued, 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 in Thailand are no exception. They 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 the 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 others, what might be called social aims.

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

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

(2) The operation of public enterprises are 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 mostly 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 and Independent Variables

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 influenced 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 groups 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 is a little different 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

(3) a conversion process, including the formal structures and procedures of government, that transforms (converts) demands and resources into public policies

(4) the policies that represent the formal goals, intentions, or statements of government officials

(5) the performance of the policy as it is actually delivered to clients

(6) the feedback of policies and performances to the environment, which is transmitted back to the conversion process as demands and resources at a later point in time (p. 446).

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 studied several disciplines, including sociology, public administration, social psychology, and political science, for their research. The theoretical framework they proposed has been 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 identifies six clusters of variables that more or less affect the delivery of public services. They argue 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.

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 enterprises.

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; Georgoulos and Tannabaum, 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 in terms of Thai baht as follows:

output = total revenue from freight and passenger service charges

input = 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 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. The 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, for this study, the variables that represented the independent variables 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 (Please see the Note of that follows Table 1: Cluster Representatives).

Table 1 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 the 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 1. Cluster Representatives

Type of Factors	Cluster Concepts	Representative	Factor Loadings
Internal	Goals and Objectives	OBGOAL	- (1)*
	Resources	SPASSCAR	.97697 (2)*
	Organization Structure	RULES	.98618 (3)*
External	Political Conditions	CONCUR	.87415 (4)*
	Economic Conditions	HIGHWAY	.99609 (5)*
	Social & Industrial Conditions	SECOND	.96598 (6)*

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 SRT), YEAR (Year identification), ASSET (Total assets of State Raiway), and OFALLLA (Ratio officers to all laborers)

(4) six variables : ARMEDBOD (Ratio of armed forces officers in the board), BOARD (Number of board members in SRT), CONCUR (Ratio of concurrent positions of the board members), TENURE (Average Tenure of 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 SRT), and NEGOTIAT (Number of labor negotiations in SRT).

The next procedure is to produce the appropriate multiple regression equation. The multiple regression model of the current study is as follows :

$$Y = a + b_1x_1 + e$$

or $$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + e$$

Where

Y = degree of efficient performance

b_i = slope or estimate of each x_i

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 :

$$Y = 1.0315 - 0.0063(OBGOAL) + 0.0003(SPASSCAR) - 0.0057(RULES) - 0.0634(CONCUR) + 0.00004(HIGHWAY) - 0.0000002(SECOND)$$

Table 2 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 2. Factors Affecting the Efficiency of SRT

Durbin – Watson d statistic	1.32
Multiple R	.91
R Square	.83
Adjusted R Square	.78
Standard Error	.06

Analysis of Variance	DF	Sum of Squares	Mean Square
Regression	6	0.37	0.06
Residual	18	0.07	0.004
F = 14.96			
Signif F = .0000			

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

Source : Computed by the author

Furthermore, Table 3 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 3. Correlation Matrix of Independent Variables

	OBGOAL	SPASSCAR	RULES	CONCUR	HIGHWAY	SECOND
OBGOAL	1.000	-.814	-.880	-.907	-.869	-.882
SPASSCAR	-.814	1.000	.953	.904	.930	.907
RULES	-.880	.953	1.000	.954	.988	.976
CONCUR	-.907	.904	.954	1.000	.925	.930
HIGHWAY	-.869	.930	.988	.925	1.000	.987
SECOND	-.882	.907	.976	.930	.987	1.000

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 goods 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 cause 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 (1983) 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". (p. 129)

For the purpose of model building, the representative variables from the sixteen cluster 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 4.

Table 4. Principal Components Factor Matrix

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

Source : Computed by the author

Note :

RULES = Number of rules and regulations in SRT

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 SRT 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 SRT

NEGOTIAT = Number of labor negotiations in SRT

POLITEST = Political protest

DAYSTOP = Number of working days stoppages

ARMEDBOD = Ratio of armed forces officer in the board

LEGISLAT = Number of legislative oversight

TENURE = Average tenure of board members

Table 5: Varimax Rotation for Twenty Variable Concepts 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.

Table 5. Varimax Rotation for Twenty Variable Concepts

Variable Concepts	Factor 1	Factor 2	Factor 3
RULES	.99118	.01958	.09293
NATRESX	.98972	-.00702	.08622
SECOND	.98534	-.06003	.00510
RAVERAGE	.98283	-.04504	-.01540
HIGHWAY	.98213	-.06724	.08981
YEAR	.97599	.06580	.16834
CONCUR	.96596	.05363	-.09244
MILITARX	.95313	-.12083	.13189
OFFALLLA	.93577	.06089	-.17913
SPASSCAR	.95521	-.03926	.24976
RSRWAGEX	.93189	.08857	.27225
RAILCARB	.91267	.16890	.18908
OBGOAL	-.90342	.05698	.16616
TENURE	-.67290	.08750	.61078
NEGOTIAT	.60389	.33641	-.19510
BOARD	.57764	-.14573	.44221
POLITEST	.01405	.83851	-.01270
DAYSTOP	.27618	.80992	-.08808
ARMEDBOD	.41786	-.65262	.01607
LEGISLAT	.15581	-.09059	.74085

Source : Computed by the author

Note : Abbreviations are the same as in Table 4.

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 an indirect effect on the dependent variable and the proximate variables are those that have a direct effect on the dependent variable. In other words, in the 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 spuriousness 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 6 gives the covariation of all twenty variable concepts.

Table 6. Correlation Matrix of Twenty Variable Concepts

OBGOAL	SPASSCAR	RAVERAGE	RULES	YEAR	
OBGOAL	1.000	-.814	-.886	-.879	-.851
SPASSCAR	-.814	1.000	.909	.953	.960
RAVERAGE	-.886	.909	1.000	.963	.940
RULES	-.879	.953	.963	1.000	.992
YEAR	-.851	.960	.940	.992	1.000
RAILCARB	-.762	.897	.883	.920	.946
OFFALLLA	-.816	.801	.918	.904	.876
BOARD	-.422	.604	.540	.618	.629
ARMEDBOD	-.414	.437	.427	.390	.378
TENURE	.712	-.471	-.717	-.596	-.521
CONCUR	-.906	.904	.945	.954	.932
LEGISLAT	-.065	.334	.217	.192	.225
POLITEST	-.022	.011	-.036	.036	.085
HIGHWAY	-.869	.929	.958	.987	.974
NATRESX	-.885	.959	.968	.995	.986
MILITARX	-.831	.914	.929	.958	.950
SECOND	-.881	.906	.975	.975	.952
DAYSTOP	-.197	.170	.237	.270	.296
RSRWAGEX	-.770	.932	.898	.956	.962
NEGOTIAT	-.513	.505	.607	.567	.558

	BOARD	ARMEDBOD	TENURE	CONCUR	LEGISLAT
OBGOAL	-.422	-.414	.712	-.906	-.065
SPASSCAR	.604	.437	-.471	.904	.334
RAVERAGE	.540	.427	-.717	.945	.217
RULES	.618	.390	-.596	.954	.192
YEAR	.692	.378	-.521	.932	.225
RAILCARB	.543	.326	-.484	.861	.260
OFFALLLA	.429	.350	-.775	.921	.062
BOARD	1.000	.308	-.098	.500	.139
ARMEDBOD	.308	1.000	-.240	.347	.086
TENURE	-.098	-.240	1.000	-.738	.152
CONCUR	.500	.347	-.738	1.000	.103
LEGISLAT	.139	.086	.152	.103	1.000
POLITEST	-.221	-.339	.100	.069	-.104
HIGHWAY	.614	.432	-.584	.925	.191
NATRESX	.598	.407	-.599	.952	.205
MILITARX	.578	.429	-.533	.876	.236
SECOND	.572	.434	-.661	.930	.173
DAYSTOP	.135	-.331	-.209	.330	-.104
RSRWAGEX	.702	.307	-.420	.873	.261
NEGOTIAT	.163	.003	-.401	.531	-.045

	MATRESX	MILITARX	SECOND	DAYSTOPRS	RWAGEX
OBGOAL	-.885	-.831	-.881	-.197	-.770
SPASSCAR	.960	.915	.907	.171	.932
RAVERAGE	.968	.929	.975	.238	.898
RULES	.995	.958	.976	.270	.957
YEAR	.986	.951	.952	.296	.963
RAILCARB	.910	.885	.871	.395	.885
OFFALLLA	.891	.867	.921	.382	.820
BOARD	.598	.579	.572	.135	.702
ARMEDBOD	.407	.429	.434	-.331	.308
TENURE	-.600	-.534	-.662	-.209	-.421
CONCUR	.952	.876	.930	.331	.874
LEGISLAT	.205	.236	.174	-.104	.262
POLITEST	.023	-.091	-.045	.551	.066
HIGHWAY	.984	.982	.987	.182	.984
NATRESX	1.000	.961	.974	.227	.945
MILITARX	.961	1.000	.963	.078	.921
SECOND	.974	.963	1.000	.216	.920
DAYSTOP	.227	.078	.216	1.000	.294
RSRWAGEX	.945	.921	.920	.294	1.000
NEGOTIAT	.593	.547	.601	.332	.558

	RAILCARB	OFFALLLA	POLITEST	HIGHWAY	NEGOTIAT
OBGOAL	-.762	-.816	-.022	-.869	-.513
SPASSCAR	.897	.801	.011	.929	.505
RAVERAGE	.883	.918	-.036	.958	.608

RULES	.920	.904	.036	.987	.567
YEAR	.946	.876	.085	.974	.559
RAILCARB	1.000	.857	.167	.889	.504
OFFALLLA	.857	1.000	.043	.899	.560
BOARD	.543	.429	-.221	.614	.163
ARMEDBOD	.326	.350	-.339	.432	.004
TENURE	-.484	-.775	.100	-.584	-.402
CONCUR	.861	.921	.069	.925	.532
LEGISLAT	.206	.062	-.104	.191	.045
POLITEST	.167	.043	1.000	-.035	.215
HIGHWAY	.889	.899	-.035	1.000	.552
NATRESX	.909	.890	.022	.984	.593
MILITARX	.885	.886	-.091	.982	.547
SECOND	.870	.921	-.045	.987	.601
DAYSTOP	.395	.381	.550	.182	.322
RSRWAGEX	.885	.819	.066	.948	.558
NEGOTIAT	.504	.560	.215	.552	1.000

Source : Computed by the author

Note : Abbreviations are the same as in Table 4.

Five variable concepts can be specified as distant variables (YEAR, HIGHWAY, NATRESX, MILITARX and SECOND) because of their timeorder 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 covariation 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 NEGOTIAT, do not show both time order and covariation with any other variable. They are considered the proximate or (direct) variables as well.

The five distant variables can be excluded from the analysis because their influence does 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 7 and Table 8.

Table 7. Factor Structure Matrix of Fifteen Proximate Variables:

Principal Components Extraction Results

Variable Concepts	Factor 1	Factor 2	Factor 3
RULES	.98808	-.03416	.06038
RAVERAGE	.98177	-.06520	-.05646
CONCUR	.96893	.04987	-.10188
SPASSCAR	.93918	-.13969	.19400
RSRWAGEX	.93471	-.02031	.25423
OFFALLLA	.93396	.09333	-.17718
RAILCARB	.92215	.07825	.19975
OBGOAL	.89832	.02941	.20458
TENURE	-.66812	-.07777	.62011
NEGOTIAT	.60252	.37229	-.10279
BOARD	.58806	-.29454	.35834
POLITEST	.04052	.80244	.23602
DAYSTOP	.32065	.77799	.16165
ARMEDBOD	.40438	-.64568	-.19653
LEGISLAT	.17971	-.31986	.68609

Source : Computed by the author

Note : Abbreviations are the same as in Table 4.

Table 8. Factor Structure Matrix of Fifteen Proximate Variables :
Varimax Rotation Results

Variable Concepts	Factor 1 Organizational Pressures	Factor 2 Socio-Political Downturn	Factor 3 public Criticisms
RAVERAGE	.97407	.-.06139	.13684
CONCUR	.97340	.03287	.05569
RULES	.96173	.00548	.23700
OFFALLLA	.95330	.04931	-.03435
OBGOAL	-.91823	.07640	.02699
SPASSCAR	.88706	-.05270	.38673
RAILCARB	.87749	.15554	.31977
RSRWAGEX	.87696	.07956	.40416
TENURE	-.76565	.11200	.48807
NEGOTIAT	.62473	.33114	-.11066
POLITEST	.03012	.83640	-.02815
DAYSTOP	.31766	.79472	-.04157
ARMEDBOD	.40729	-.66691	.09159
LEGISLAT	.04912	-.08034	.77229
BOARD	.50768	-.15346	.52885

Source : Computed by the author

Note : Abbreviations are the same as in Table 4.

The result of the principal components extraction creates three initial factor structures. As illustrated in Table 7., 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 rotation, as illustrated in Table 8, 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 a 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 SRT, 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 9 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 Downtum" 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 in Table 9.

Table 9. Factor Affecting Efficient Performance

Durbin - Watson d Statistic	1.42
Multiple R	.92
R Square	.84
Adjusted R Square	.82
Standard Error	0.06

Analysis of Variance	DF	Sum of Squares	Mean Square
Regression	3	0.37	0.12
Residual	21	0.07	0.003
F = 37.15			
Signif F = .0000			

Variables	B	Standard Error B	BETA	T	Sig T
Organizational Pressures	-0.12	0.01	-0.86	-9.89	.0000
Socio – Political Downturn	-0.03	0.01	-0.24	-2.77	.0114
Public Criticisms	-0.03	0.01	-0.21	-2.45	.0232
Constant (a)	1.07	0.01		92.90	.0000

Source : Computed by the author

Table 9. 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 SRT. 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 .0114 level.

Finally, Public Criticisms has a B Value of -0.03, and a T score of -2.45, significant beyond the .05 level (0.0232). 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 (PRESSURES) - 0.03 (DOWNTURN) - 0.03 (CRITICISMS)

or

EFFICIEN = 1.07 - 0.12 (PRESSURES) - 0.03 (DOWNTURN) - 0.03 (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 SRT. The changes in those three factors have a negative impact, and the effects of these three 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 turnover rate 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 criticisms of the enterprise's operations can discourage management and hinder efficient performance as well. Essentially, all three factors substantially influence the operating efficiency of the SRT.

Summary

This research project has applied various statistical techniques to reduce the large number of variables to be small enough to do the multiple regression equation. These techniques are normally practicable since, in reality, the factors that affect the efficiency of one public

enterprise are a large number of, rather than a very few, factors as we usually hypothesize.

As a result, the analysis of this study 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, but the second equation, as a result the data reduction technique, has only three independent variables. The first equation shows an unsatisfied model because of the lack of significance when each independent variable is computed, while the second equation, that applies the factor analysis techniques to find out the new structures of independent variables, is more satisfying since the three new factors are significantly related to the degree of operating efficiency.

REFERENCES

Aharani, Yair. 1981. Performance Evaluation of State-Owned Enterprises: A Process Perspectives. ***Management Science***, 27: 1340-1347.

Bardach, Eugene. 1977. ***The Implementation Game: What Happen After a Bill Becomes a law***. Cambridge, Mussachusetts: The M.I.T. Press.

Becker, Selwyn W. and Duncan Newhouser. 1975. ***The Efficient Organization***. New York: Elsevier Scientific Publishing Company, Inc.

Blau, Peter M., Wolf V. Heyderbrand and Robert E. Stauffer. 1966. The Structure of Small Burcaucracies. ***American Sociological Review***, 31: 179-191.

Bohrnstedt, George W. and David Knoke. 1982. ***Statistics for Social Data Analysis***. Itasca, Illinois: F.E. Peacock Publishers, Inc.

Carlisle, Howard M. 1982. ***Management: Concepts, Methods, and Applications***. Chicago: Science Research Associates, Inc.

Downs, George W. and Patrick D. Larkey. 1986. ***The Search for Government Efficiency: From Theories to Helplessness***. New York: Random House.

Easton, D. 1965. ***A Framework for Critical Analysis***. Englewood Cliffs, New Jersey: Prentice Hall.

Farmer, Richard N. and B.M. Richman. 1965. ***Comparative Management and Economic Progress***. Homewood, Illinois: Richard D. Irwin, Inc.

Fosler, R. Scott. 1978. State and Local Government Productivity and the Private Sector. ***Public Administration Review***, 1: 22-27.

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

Georgoulas, Basil S. and Arnold S., Tannabaum. 1969. A Study of Organizational Effectiveness. In Amitai Etzioni, ed., ***Readings on Modern Organization***. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Hage, Jerald. 1965. An Axiomatic Theory of Organization. ***Administrative Science Quarterly***. 10: 289-320.

Hefty, Thomas R. 1969. Return to Scale in Hospitals: A Critical Review of Recent Research. ***Health Services Research***, 4: 267-280.

Ingbar, Mary Lee and Lester D. Taylor. 1968. ***Hospital Costs in Massachusetts***. Cambridge, Massachusetts: Harvard University Press.

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

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.

McLaughlin, Milbrey. 1976. Implementation as Mutual Adaptation. In Walter Williams and Richard Elmore, eds., ***Soial Program Implementation***. New York, Academic Press.

Nachmias, David, and Chava Nachmias. 1981. ***Ressearch Methods in the Social Sciences***. New York: Martin's Press.

Nakamura, Robert T. and Frank Smallwood. 1980. ***The Politics of Policy Implementation***. New York: St. Martin's Press.

Overall, John E., and C. James Klett. 1983. ***Applied Multivariate Analysis***. Florida: Robert E. Krieger Publishing Company.

Pennings, Johannes M. and Paul S. Goodman. 1981. Toward a Workable Framework. In Paul S. Goodman, Johannes M. Pennings and Associates, eds., ***New Perspectives on Organizational Effectiveness***. San Francisco: Josey Bass Publishers.

Prassuman, Jeffrey L. and Aaron B. Wildavasky. 1973. ***Implementation***. Berkeley: University of California Press.

Price, James L. 1968. ***Organizational Effectiveness: An Inventory of Propositions***. Homewood, Illinois: Richard D. Irwin, Inc.

Rein, Martin and Francine F. Rabinovitz. 1978. Implementation: A Theoretical Perspective. In Walter D. Burnham and Martha W. Weignberg, eds., ***American Politic and Public Policy***. Cambridge, Massachusetts: The M.I.T. Press.

Shand, D.A. and J.R. Buttersby. 1975. Role and Concepts of Profit in the Public Sector. ***New Zealand Journal of Public Administration***, 38: 1975, 25-38.

Thurstone, L. L. 1947. ***Multiple Factor Analysis***. Chicago: University of Chicago Press.

Tierney, John T. 1984. Government Corporations and Managing the Public's Business. ***Political Science Quarterly***, 99: 73-92.

Van Meter, Donald S. and Carl E. Van Horn. 1975. The Policy Implementation Process: A Conceptual Framework. ***Administration and Society***, 6: 455–488.

Waitayangkoon, Chalermpol. 1988. Factors Affecting Efficient Performance of Royal State Railways of Thailand. A time-Series Data Analysis. Dissertation, Department of Political Science, University of North Texas.

Wu, Chi-Yuen. 1967. Public Enterprises as an Instrument of Development. ***Journal of Administration Overseas***, 6: 149-158.