

**SRI LANKAN
JOURNAL OF BUSINESS ECONOMICS
[SLJBE]**

VOLUME 03

ISSUE 01

DECEMBER 2012

ACHIEVEMENTS IN HUMAN CAPITAL FORMATION IN SRI LANKA
D. P. S. Chandrakumara

THE ANALYSIS OF DISPOSITION EFFECT AND PRICE REVERSAL
TAKING UNOBSERVABLE FACTORS INTO CONSIDERATION: WITH
SPECIAL REFERENCE TO THE SRI LANKAN STOCK MARKET
Y. M. H. P. Madduma Bandara

AN EMPIRICAL STUDY OF SOFTWARE DEVELOPMENT FAILURES IN
SRI LANKA
A. J. Perera and S. P. P. Amaratunge

CAUSALITY TESTING AND WAGNER’S LAW: THE CASE OF SRI LANKA
M. A. K. Sriyalatha

TRANSFORMATIONAL LEADERSHIP AND SUPPLY CHAIN
ORIENTATION: AN EMPIRICAL DESCRIPTIVE STUDY IN
MANUFACTURING RELATED BUSINESS SECTOR IN SRI LANKA
B. N. F. Warnakulasooriya



**DEPARTMENT OF BUSINESS ECONOMICS
UNIVERSITY OF SRI JAYEWARDENEPURA
SRI LANKA**

EDITORIAL BOARD

Prof. Danny Atapattu
Department of Economics,
University of Ruhuna, Sri Lanka

Prof. Sumanasiri Liyanage
Department of Economics and Statistics
University of Peradeniya, Sri Lanka

Prof. H. D. Karunaratne
Department of Business Economics
University of Colombo, Sri Lanka

Prof. J. W. Wickramasinghe
Former Professor in Economics
Department of Economics
University of Sri Jayewardenepura, Sri Lanka

Prof. H. M. T. N. R. Herath
Department of Economics
University of Sri Jayewardenepura, Sri Lanka

Prof. Y. K. Weerakoon Banda
Department of Finance
University of Sri Jayewardenepura, Sri Lanka

Dr. U. Anura Kumara
Head, Department of Business Economics
University of Sri Jayewardenepura, Sri Lanka

The SLJBE is a peer-reviewed journal published annually by the Department of Business Economics, University of Sri Jayewardenepura, Sri Lanka. The SLJBE serves as a forum for the dissemination of knowledge and understanding of business economics and related disciplines via high quality research, and is devoted to the study of economic issues and problems related to business enterprises employing both theoretical and empirical enquiry. The SLJBE promotes multi-disciplinary research and encourages international scientific cooperation and understanding among its main audiences, including educators, researchers, policy makers, practitioners, and graduate students.

EXECUTIVE EDITORS - SLJBE

EXECUTIVE EDITORS

Dr. (Mrs.) W. S. Handapangoda
Mrs. P. P. Lalani

© DEPARTMENT OF BUSINESS ECONOMICS

Faculty of Management Studies and Commerce

University of Sri Jayewardenepura

Nugegoda

SRI LANKA

Tele: +94 112802005

Email: bec@sjp.ac.lk

ISSN 1391-9601

All rights reserved.

2012

TABLE OF CONTENTS	PAGE NO.
ACHIEVEMENTS IN HUMAN CAPITAL FORMATION IN SRI LANKA <i>D. P. S. Chandrakumara</i>	1
THE ANALYSIS OF DISPOSITION EFFECT AND PRICE REVERSAL TAKING UNOBSERVABLE FACTORS INTO CONSIDERATION: WITH SPECIAL REFERENCE TO THE SRI LANKAN STOCK MARKET <i>Y. M. H. P. Madduma Bandara</i>	19
AN EMPIRICAL STUDY OF SOFTWARE DEVELOPMENT FAILURES IN SRI LANKA <i>A. J. Perera and S. P. P. Amaratunge</i>	32
CAUSALITY TESTING AND WAGNER'S LAW: THE CASE OF SRI LANKA <i>M. A. K. Sriyalatha</i>	47
TRANSFORMATIONAL LEADERSHIP AND SUPPLY CHAIN ORIENTATION: AN EMPIRICAL DESCRIPTIVE STUDY IN MANUFACTURING RELATED BUSINESS SECTOR IN SRI LANKA <i>B. N. F. Warnakulasooriya</i>	57

ACHIEVEMENTS IN HUMAN CAPITAL FORMATION IN SRI LANKA

D.P.S. Chandrakumara¹

ABSTRACT

Education, being one main way of human capital formation, plays a crucial role in socio-economic development. For a balanced regional development, similar to other resources, formation of human capital in all regions of a country is essential. The paper deals with how the human capital formation through formal education occurs at the regional level in Sri Lanka. The methodology, being quantitative, includes descriptive analysis and ranking of provinces through a composite index on human capital formation. The study completely depends on institutional and non-institutional secondary data sources. The results suggest that, among the provinces, the disparity in human capital formation through education is significant. The Western Province is ranked at the first place while the Eastern Province gets the last. North-Western Province and the Southern Province are also outstanding while the position of Uva and Central Provinces are not satisfactory. In addition, the study finds that there are gender-related disparities also in the formation of human capital at the regional level.

INTRODUCTION

Human capital² formation plays a crucial role in socio-economic development of a country (Psacharopoulos and Patrinos, 2002; Becker, 1964; Schultz, 1961). Education, being one of the principle ways of creating human capital, has been contributing a lot to the human capital formation. This is equally important when determining individual income, capacity to interact and communicate with others (World Bank, 2005). Thus, inequalities in people in the degree of human capital embedded in them due to education contribute to inequalities in the overall living standard among them. In Sri Lanka, literacy rate has reached a level as high as 92.5%, a rate which is comparable to developed nations (Central Bank of Sri Lanka (CBSL), 2005). When the degree of human capital formation is measured in terms of education attainment of the people, it is evident that the proportion of population who is educated up to secondary and post secondary levels has continuously improved and reached 41% and 21% respectively. In contrast, the percentage of population who never attended school has continuously declined. During the last 25 years, this percentage has declined from 11.8% in 1986/87 to 7.9% in 2003/04 (CBSL, 2005). The percentage of students who successfully complete G.C.E. O/L and A/L Examinations is respectively 37% and 56%

¹Senior Lecturer, Department of Economics, University of Sri Jayewardenepura, Sri Lanka.
E-mail: chandrakumara62@gmail.com

²The term human capital refers to the education and health levels of individuals or labor force created as a result of education, training and health service that make them more productive (Todaro, 2000; Schultz, 1961).

(WB, 2005). The computer literacy of those who attained G.C.E. (A/L) or above is 59.7% (Department of Census and Statistics, 2009). Thus, the overall situation of the country is such that human capital formation is satisfactorily high. However, it is important to know how the human capital is created at the regional level in the country and how comparably the people in different regions are being transformed into valuable human capital through education. This study focuses on this issue.

The paper unfolds in seven sections: introduction; aim and objectives of the study; research methodology; data sources of the study; the analysis of descriptive statistics on human capital formation through education; index for human capital formation; and conclusions.

AIM AND OBJECTIVES

The aim of the paper is to identify the situation of human capital formation through formal³ education at the regional level in Sri Lanka. In order to achieve this aim, the study is based on the following two specific objectives:

- i. To construct a composite index to measure the degree of human capital formation.
- ii. To identify the regional disparities in human capital formation.

Finally, the nine provinces of the country are ranked according to the degree of human capital formation so that one can identify weaker provinces.

METHODOLOGY

This paper uses the quantitative method of analysis for reaching the above aim and specific objectives. It consists of simple descriptive statistical methods such as percentage, tables, graphs and a composite index that measures the degree of human capital formation across the regions. Although a region can have different meanings, a region is meant to be a province in this study. Thus, the regional disparities in the Sri Lankan context are identified with regard to the nine provinces in Sri Lanka.

The nine provinces are ranked according to the degree of human capital formation based on a composite index constructed in the study. The construction of the index consists of five main steps. First, data on human capital which was created by education was gathered in relation to each province. Second, the main indicators of human capital formation which are common to all provinces were identified. Third, weights for each indicator of human capital formation were assigned with the help of “Principle Component Analysis⁴”. Finally, values of human capital formation indicators were multiplied by the respective weights so that a composite index for each province could be constructed by adding the values of each indicator for each province. The following is the equation for human capital formation index.

$$HCI_i = O_{i1}W_1 + O_{i2}W_2 + \dots + O_{ij}W_j + \dots + O_{in}W_n,$$

³Formal education includes structured learning formats, study for an educational qualification; organized institutions, methods or procedures etc while informal education is the knowledge obtained by association; asking questions from co-workers, and watching others etc (Roussel, 2000).

⁴Scores of the first principle component were taken as weights for different indicators of human capital formation so that there would not be any biasness in assigning the weights. This method of obtaining weights has also been used in measuring regional inequalities in education in Sri Lanka (Chandrakumara, 2010).

where, HCI_i is the human capital formation index of the i^{th} province. O_{ij} is the value for human capital formation of province i from the indicator j , and W_j is the weight derived from the Principle Component for dimension applied to indicator j , and so on. The Principle Component Analysis for deriving the weights was carried out with the statistical software MINITAB while the simple calculations, graphs, tables etc were performed in EXCEL.

DATA

The study depends on secondary data obtained from institutional and non-institutional sources. Sri Lankan institutions, particularly, Department of Census and Statistics (DCS), Central Bank of Sri Lanka (CBSL), Ministry of Education (ME), University Grants Commission (UGC) and international institutions, mainly, the World Bank (WB), United Nations Development Programme (UNDP) are the main sources of data. In addition, data available in the studies of individual level researchers were used for the study.

DESCRIPTIVE ANALYSIS

The position of human capital formation can be identified on the basis of the following indicators which represent the quantity and quality of the output produced by the education system in Sri Lanka. Analysis of provincial-wise data helps compare the degree of human capital formation among the provinces.

- i. Literacy Rate
- ii. Participation in formal education
- iii. Attainment of education
- iv. Passing rates at main examinations: G.C.E. (O/L) and G.C.E. (A/L)
- v. Percentage of students qualifying for university admission
- vi. Admission proportions by major stream of study

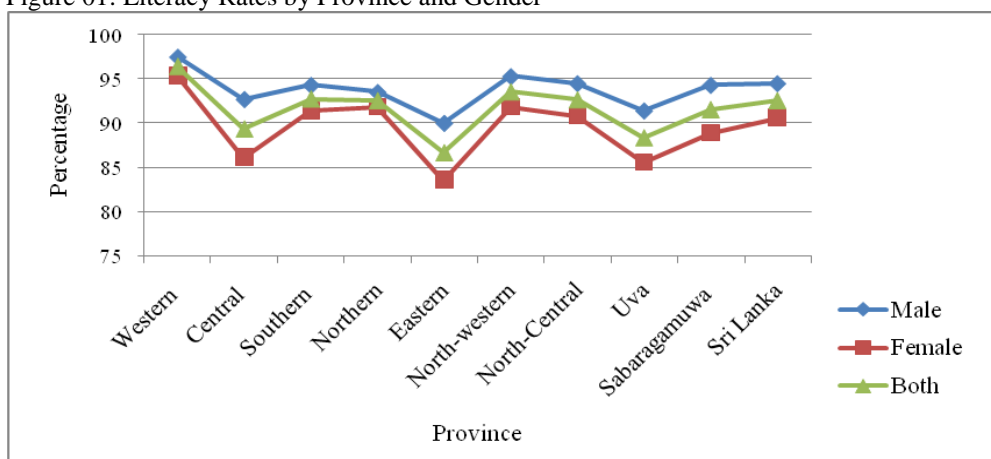
Literacy Rate⁵

The meaning of literacy is the ability of people to read and write in a language. Literacy rate is the number of literate persons as a percentage of population aged five years and above (CBSL, 1999). Even though this is not a sufficient indicator of human capital formation, it gives an approximate idea on the outcome of the education of a country. A higher literacy rate implies that people are trainable so as to build human capital in them. The literacy rate of Sri Lanka is substantially high that it exceeds 92 percent (CBSL, 2005). However, a comparison of literacy rates among the provinces shows that there is a substantial variation at the regional level. Figure 01 and Appendix 01 show three main features on the disparity in literacy rate.

First, it is evident that literacy rate is highest in the Western province and lowest in the Eastern province. The difference (96.4–86.6) between these two provinces is nearly 10 percentage points. Further, literacy rate in six provinces exceeds 90% while the other two, Central and Uva, are still below that level. Second, it shows that in all provinces, female literacy rate lies behind the male literacy rate. Finally, it seems that in provinces where the overall literacy rate is low, the gap between male and female is still higher (Figure 01). Thus, this situation in the pattern of literacy rates implies that there are regional disparities in the formation of human capital in interaction with other variables such as gender.

⁵ According to the CBSL (2005), literacy rate has been closely associated with the expansion of educational facilities in Sri Lanka. Thus, the literacy rate can be approximately considered as an outcome of the formal education.

Figure 01: Literacy Rates by Province and Gender



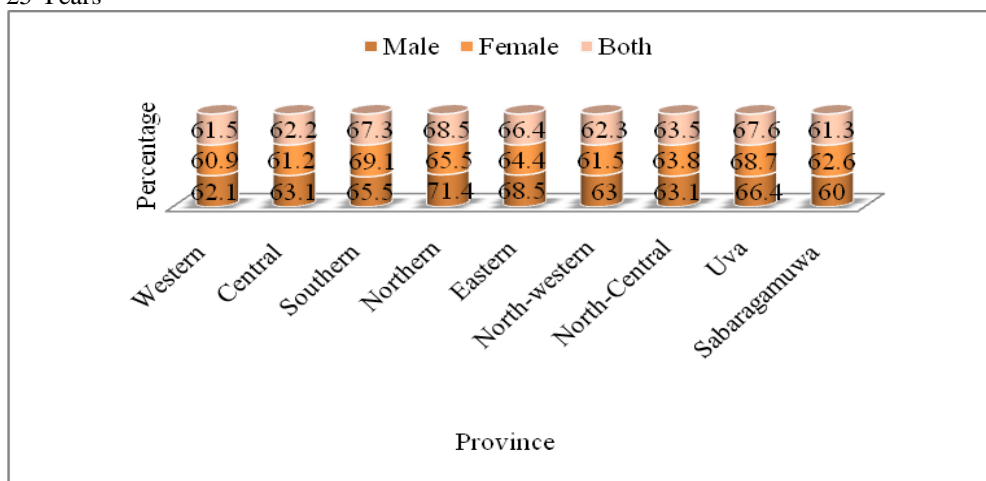
Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

Participation in Formal Education

Participation of children in formal education is very important for the formation of human capital. Completion of formal schooling is a prerequisite even for informal trainings. Thus, as a study which analyzes the human capital formation at regional level, it is important to examine how far children are participating in education. The population of the age group 5–25 years is considered as the base population of ‘potential students’ when participation rate in formal education is calculated (CBSL, 2005). According to this definition, participation rate in education in the island is nearly 64%. Figure 02 shows the participation rates related to age groups and the nine provinces of the country. The highest participation rate is shown in the Northern Province while the lowest rate is shown in Sabaragamuwa.

Figure 02: Children's Participation in Formal Education as a % of the Population Aged 5 - 25 Years

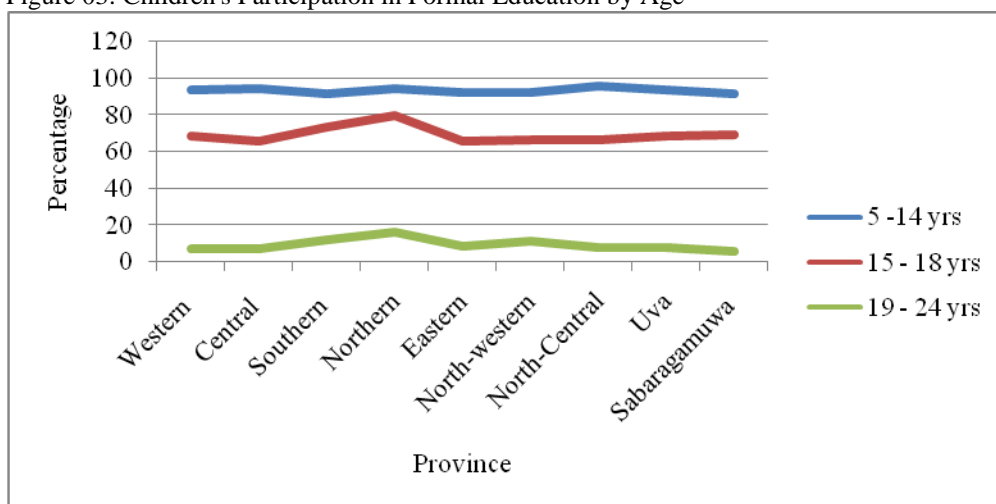


Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

Figure 03 clearly shows how the human capital formation through education narrows down with the age level of children. The participation in education is highest for the children aged 5 – 14 years. This must have been partly influenced by the compulsory education regulation of the government. However, the participation rate declines with the increase in age. The lowest participation rate is shown for the children of 19 – 24 years in age. This is, however, largely affected by the limited capacities of higher education institutes to absorb all those who qualify for higher education. In addition, a part of students drop out from education due to low results that disqualify them from stepping into higher level. The figure shows that Northern Province is outstanding in the educational participation at each level.

Figure 03: Children's Participation in Formal Education by Age

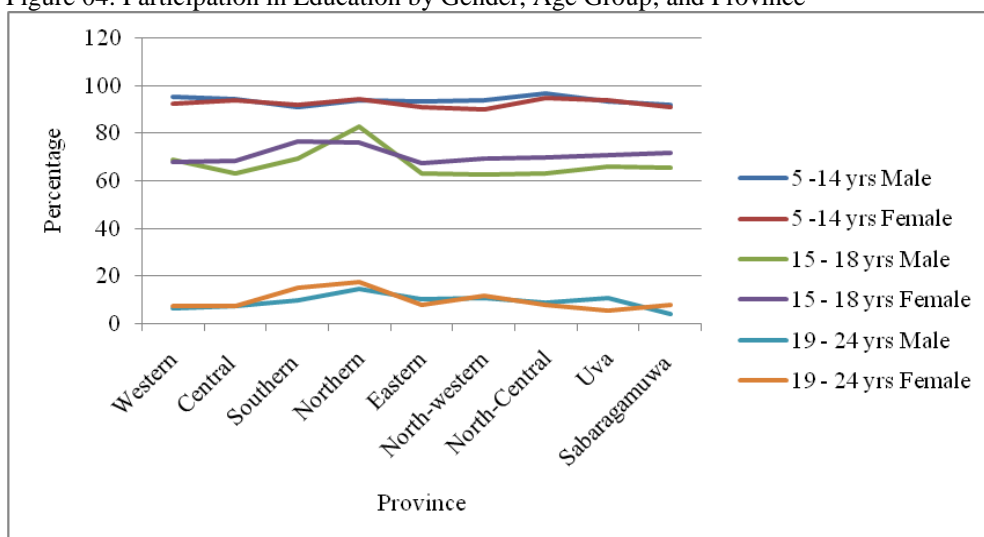


Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

In the age group of 5 – 14, there is no large gender difference among the provinces as per Figure 04. In the age group 15 – 18 years, male participation rate in the Northern Province is higher than that of females whereas in all other provinces it is lower than that of females. However, in the age group of 19 – 24, participation in the female education is higher in the Northern and also the Southern Provinces. By and large, it seems that even the minor variations between male and female participation across the provinces are seen in the age group of 15 – 18 years.

Figure 04: Participation in Education by Gender, Age Group, and Province



Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

Attainment of Education

Formal education which begins from the kindergarten passes different levels such as primary, secondary and tertiary levels. The number of years spent in formal schooling until end of the secondary education is 13 years. Those who sufficiently qualify and wish to continue formal education beyond higher secondary level, step into the tertiary level. For some people, education does not end even at their old age. However, after the secondary level, education is not necessary to be a continuous process. Education attainment implies the number of years or the level of education that the individuals or population of a country reached. This can be considered as a good indicator of human capital formation through education.

Appendix 03 displays the proportion of population who had formal education at different levels of education. According to the classification given in the table, higher levels of education indicate higher human capital levels. “Post-secondary” level represents the highest level of human capital while “no schooling” category represents the zero level of human capital created due to formal education. Appendix 03 reveals several features at regional level human capital formation. First, it shows that the Northern Province is the best in the creation of human capital resources with ‘post-secondary qualifications’ such as first degree and post-graduate degrees and trainings. Western Province is little behind the Northern even though the other provinces are far behind in the formation of post-secondary level qualification holders. Second, when the proportion of population with “secondary and above qualifications” is considered, it seems that the Western Province comes to the first place while all other provinces are far behind. Table 01 shows the order of the nine provinces when they are ranked based on this measure of human capital. Third, it seems that when the percentage of population belonging to “No schooling” category is considered, Western Province is the best while Eastern is the worst. Fourth, when the male-female difference in the attaining of post-secondary level education is taken into account, it seems that, as a whole, males are behind females. This women-favorable gap in the human capital formation is highest in the Northern Province. When the category of “No schooling” is taken

into account, Table 02 shows that majority under this category are males in all provinces. However, males under this category are exceptionally high in the Eastern Province. In Uva and Central Provinces also the percentage of male population under the “No schooling” category is high.

Table 01: Ranking of Provinces According to Attainment of Education

Province	% of Population Attained at Secondary Level and Above	Rank	Position of Human Capital Formation
Western	72.5	1	Best
Central	57.3	6	
Southern	60.7	4	
Northern	60.3	5	
Eastern	48.3	8	Worst
North-Western	63.0	2	Good
North-Central	61.7	3	
Uva	52.5	7	
Sabaragamuwa	60.3	5	
Sri Lanka	62.2		

Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

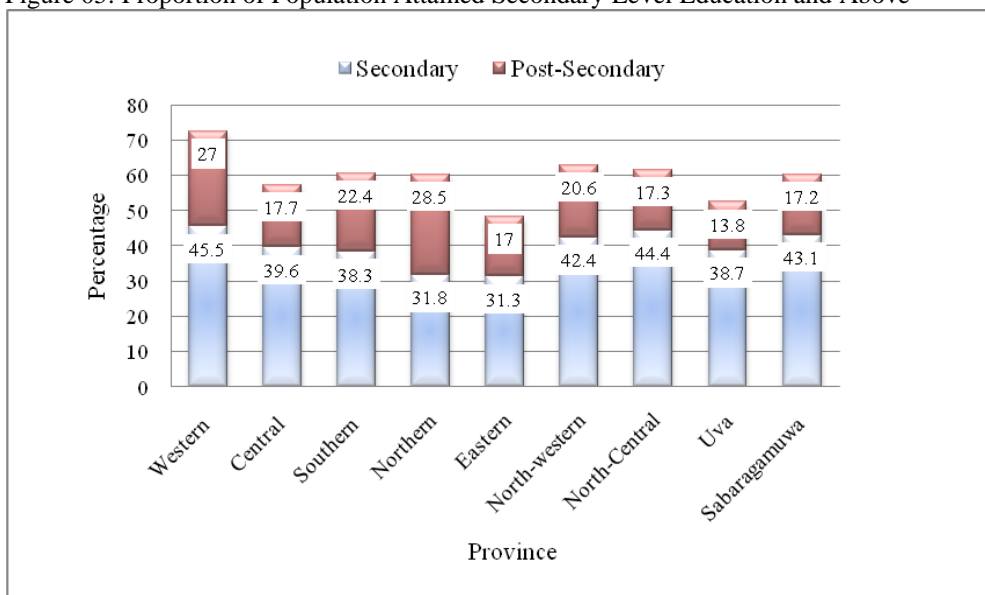
Table 02: Ranking of Provinces According to “No schooling”

Province	No Schooling	Rank	Position
Western	3.9	1	Best
Central	11.1	6	
Southern	7.7	4	
Northern	7.6	3	
Eastern	13.8	8	Worst
North-Western	6.7	2	Good
North-Central	7.6	3	
Uva	11.9	7	
Sabaragamuwa	9.0	5	
Sri Lanka	7.9	-	-

Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

Figure 05: Proportion of Population Attained Secondary Level Education and Above



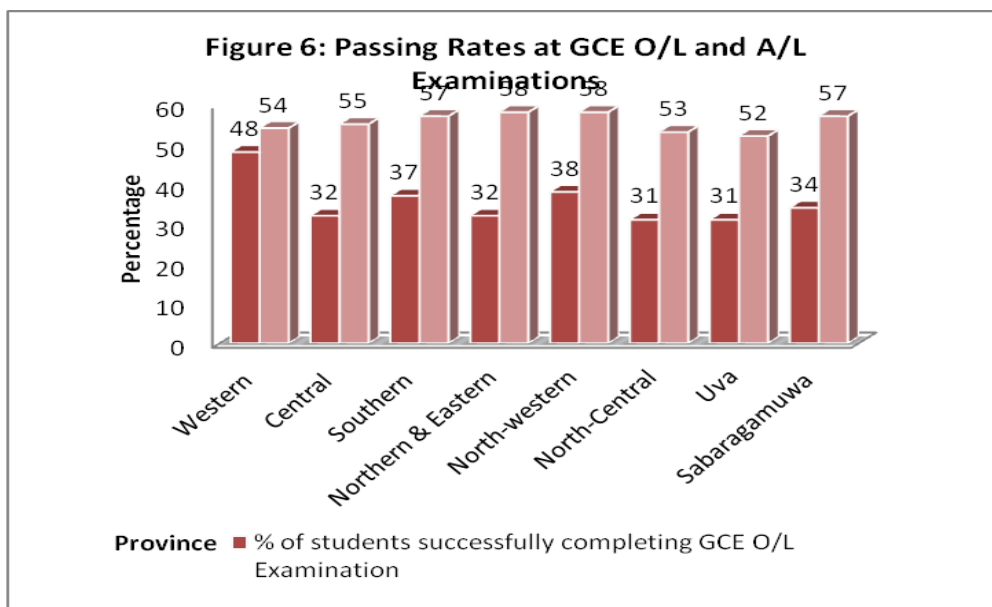
Source: Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

Passing Rates at National Level Examinations

As in other countries, there are two main nationally important examinations in the formal education in Sri Lanka. These two are namely General Certificate of Education (Ordinary Level) and General Certificate of Education (Advanced Level)⁶. Those who sufficiently pass G.C.E. O/L Examination can continue to G.C.E. A/L Examination. The students who pass the A/L Examination can enroll in tertiary education either in universities or other training institutions. At the same time, children have the opportunities to obtain trainings from technical and professional level institutions as well. However, when the figures on educational attainment of children at all levels are considered, it seems that human capital formation in Sri Lanka gets ahead via G.C.E. O/L and G.C.E. A/L Examinations (Appendix 02). Thus, the proportion of students who successfully pass these two examinations is a good indicator of human capital formation in Sri Lanka (Figure 06).

⁶G.C.E. (O/L) and G.C.E. (A/L).



Source: Treasures of the Education System in Sri Lanka, World Bank, 2007.

Figure 06 reveals several features in the passing rates of the two examinations. First, it shows that passing rate at the O/L examination is highest in the Western Province and all the remaining provinces are far behind that. The lowest passing rate is from the North-Central and Uva Provinces. Second, in contrast to the O/L passing rate, the highest passing rate at the A/L Examination is from the Northern and Eastern Provinces⁷ and the North-Central Province. This may cause to increase the proportion of students stepping into higher education from these provinces. Third, it seems that the proportion of students who successfully pass at the A/L is greater than that of O/L in all provinces. Finally, it seems that the rate of human capital formation significantly differs among the provinces in Sri Lanka.

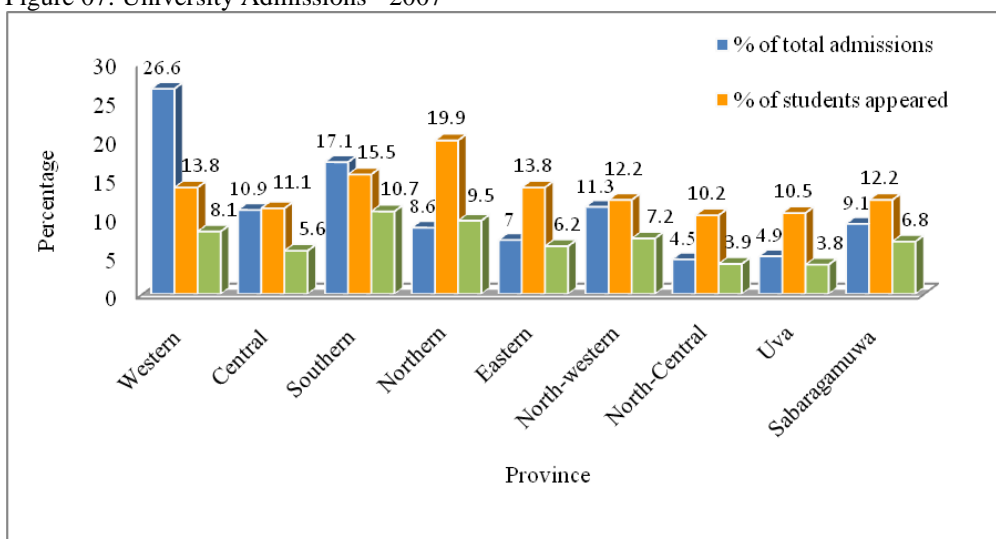
Admissions to University from the Nine Provinces

There is no doubt that the number of admissions to university per year from the nine provinces taken as a percentage of total admissions is a good indicator of human capital formation. Figure 08 shows that the Western Province is the highest when the university admissions, as a percentage of total admissions of the country, are taken into account. However, the Northern Province is the highest when the university admissions are taken as a percentage of total number of students appeared for the A/L examination. When the admissions are taken as a percentage of students appeared for the examination, Western Province comes to the third place which is behind even the Southern Province.

The merit admissions as a percentage of the total number of students appeared for the A/L examination per year can also be taken as an indicator of human capital formation. Figure 07 shows that according to this indicator, the Southern Province gets the first place while the Northern Province gets the second place.

⁷The position of the Eastern Province may have been overestimated as in this calculation the Northern and Eastern Provinces have been taken together.

Figure 07: University Admissions - 2007

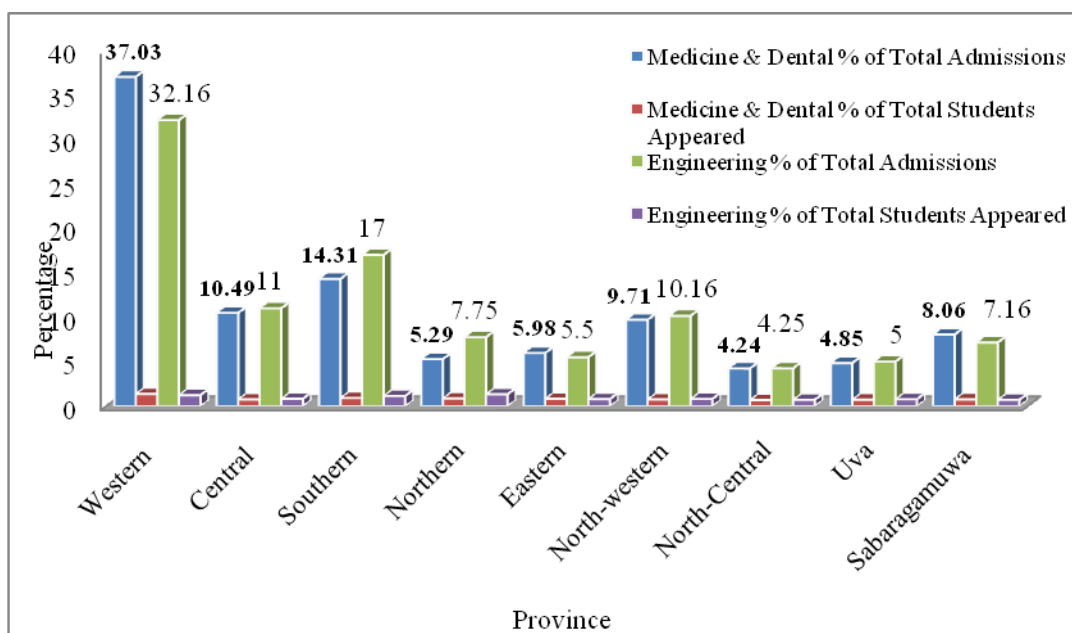


Source: Based on Sri Lanka University Statistics, University Grants Commission, 2008.

Admission Proportions by Major Stream of Study

Human capital formation begins to specialize in different areas of study after the junior secondary (GCE O/L) level. At the Advanced Level, students choose different streams due to various reasons and they mostly continue higher education related to the same stream. University admissions in different streams is a good indicator to show the extent of specialization in different forms of human capital. Students who pass A/L examination in Science must get highest marks (z-score) if they wish to enroll in Medicine and Engineering. Students with lower marks are given the chance to enroll in other streams such as Physical Science or Bio-Science, Veterinary Science and Agriculture. In the commerce stream also there are sub-divisions where students are selected based on choice and the marks (z-score) obtained. When the students are chosen according to this method, it is important to analyze how they are distributed among the nine provinces in the country.

Figure 08: University Admissions 2007 - Medicine and Engineering



Source: Sri Lanka University Statistics, University Grants Commission, 2008.

Table 03: University Admissions - 2007

Table 65: University Admissions - 2007																
	Arts	Commerce & Mgt.		Law	Medicine & Dental Science		Veterinary & Agricul.		Engineering		Indig. Medicine		Science & Other Related Disciplines			
Province	% of total admissions	% of total students appeared		% of total admissions	% of total students appeared		% of total admissions	% of total students appeared		% of total admissions	% of total students appeared		% of total admissions	% of total students appeared		
Western	14.0	2.1	31.9	3.2	25.1	0.2	37.0	1.4	24.7	0.7	32.2	1.2	28.6	0.3	31.7	4.8
Central	10.1	2.9	10.2	2.0	13.5	0.2	10.5	0.8	13.1	0.7	11.0	0.8	13.6	0.3	11.5	3.4
Southern	19.0	4.9	15.5	2.7	16.7	0.2	14.3	0.9	13.4	0.7	17.0	1.1	15.6	0.3	17.9	4.7
Northern	11.2	7.4	5.8	2.6	6.5	0.2	5.3	0.8	11.5	1.5	7.8	1.3	15.6	0.7	7.8	5.3
Eastern	10.1	5.7	6.0	2.6	7.4	0.2	5.9	0.8	7.0	0.8	5.5	0.8	3.1	0.1	5.6	3.2
North-	13.6	4.2	11.4	2.4	9.8	0.1	9.7	0.8	10.5	0.6	10.2	0.8	10.2	0.2	9.8	3.1

Western																	
North-Central	5.3	3.4	4.6	2.0	5.6	0.2	4.2	0.7	4.6	0.6	4.3	0.7	1.0	0.1	3.9	2.6	
Uva	4.9	3.0	5.3	2.1	6.0	0.2	4.8	0.7	5.5	0.6	5.0	0.8	2.7	0.1	4.6	2.8	
Sabaragamuwa	11.8	4.5	9.3	2.4	9.3	0.2	8.1	0.8	9.4	0.7	7.2	0.7	9.5	0.2	7.1	2.7	

Source: Sri Lanka University Statistics, University Grants Commission, 2008.

Figure 08 shows how the students' admissions for Medicine and Engineering are distributed by province. When the university admissions for medicine and Dental Science are taken as a percentage of total admissions from the same streams in the country, Western Province accounts for even more than 37%. However, when the number of admissions for Medicine and Dental Science is taken as a percentage of total number of students in the province, the significance of admissions is only 1.4% even though it is nearly double compared to other provinces. A similar situation can be observed in Engineering admissions also. For these streams, admissions from the North-Central, Uva, Northern and Eastern Provinces remain low. Figure 08 shows that the Western Province takes the first place in university admissions for the streams other than Arts while Uva and North-Central Provinces remain the lowest. Thus, the evidence is sufficient to show that there is an unambiguous disparity among the provinces in the formation of human capital in different areas of study.

INDEX FOR HUMAN CAPITAL FORMATION

Descriptive analysis revealed that there were disparities in the formation of human capital at the regional level. However, it is sometimes confusing when different indicators give different results for the same regions on the formation of human capital. For instance, when the human capital formation is measured in terms of the education attainment at secondary level and above, Northern Province is ranked at the fifth place. In contrast, when the passing rate at GCE A/L Examination is considered, the same province is ranked at the first place. Thus, a more appropriate measure of human capital formation is needed in understanding the disparities among the provinces. In order to fill this gap, a composite index was constructed incorporating five common indicators used in the descriptive part of analysis.

Table 04: Human Capital Indicators and Weights

Human Capital Indicator	Weight (Scores of the first principle component)
1. Literacy rate (LR)	0.584
2. Rate of attainment of education (RAE)	0.585
3. Passing rate at the GCE O/L Examination (PROE)	0.535
4. Passing rate at the GCE A/L Examination (PRAE)	0.019
5. Percentage of university admissions (% of total students appeared for the examination from the province) (UAMS)	0.173

The five indicators shown in Table 04 were used for the composite index. Weights for each indicator were obtained through the “Principle Component Analysis”. Scores of the first principle component were used as the weights for human capital formation indicators. Quantity or percentage value of each indicator was multiplied by the respective weights and determined the values related to each indicator. Finally, adding the values of all indicators together, the index values were obtained at the provincial basis (Table 05).

Table 05: Construction of Composite Index by Province

Sources: Calculations based on Consumer Finances and Socioeconomic Survey, CBSL,

Province	LR	Weight1	RAE	Weight2	PROE	Weight3	PRAE	Weight4	UAMS	Weight5	Index
Western	96.4	0.584	72.5	0.585	48	0.535	54	0.019	13.8	0.173	127.80
Central	89.3	0.584	57.3	0.585	32	0.535	55	0.019	11.1	0.173	105.76
Southern	92.7	0.584	60.7	0.585	37	0.535	57	0.019	15.5	0.173	113.21
Northern	92.5	0.584	60.3	0.585	32	0.535	58	0.019	19.9	0.173	110.96
Eastern	86.6	0.584	48.3	0.585	32	0.535	58	0.019	13.8	0.173	99.44
North-Western	93.5	0.584	63	0.585	38	0.535	58	0.019	12.2	0.173	115.00
North-Central	92.6	0.584	61.7	0.585	31	0.535	53	0.019	10.2	0.173	109.53
Uva	88.3	0.584	52.5	0.585	31	0.535	52	0.019	10.5	0.173	101.67
Sabara-gamuwa	91.5	0.584	60.3	0.585	34	0.535	57	0.019	12.2	0.173	110.09

2005; Treasures of the Education System in Sri Lanka, World Bank, 2007; University Statistics, University Grants Commission, 2006 and 2008.

Table 06: Index Value and Rank by Province

Province	Index	Variation from the Maximum	Rank
(1)	(2)	(3)	(4)
Western	127.80	0.00	1
Central	105.76	22.04	7
Southern	113.21	14.59	3
Northern	110.96	16.84	4
Eastern	99.44	28.36	9
North-Western	115.00	12.8	2
North-Central	109.53	18.3	6
Uva	101.67	26.13	8
Sabaragamuwa	110.09	17.71	5

Source: Own calculations

Table 07: Mean, SD, Minimum, Maximum and Range of the Index Values

Mean	SD	Minimum	Maximum	Range
110.38	8.30	99.44	127.80	28.36

Source: Own calculations

The index helps ordering and comparing of the provinces according to the degree of human capital formation in each province. The more is the value of the index, the higher is the human capital formation through education. The nine provinces of the country can be ranked according to the composite index. The Western Province is ranked at the first place in the formation of human capital while the North-Western and Southern Provinces respectively take the second and third ranks. Eastern Province is the worst in human capital formation according to the index. Uva Province also does not differ much from the position of the Eastern Province. The Column (3) in Table 06 shows how far the other provinces deviate from the Western Province according to the value of human capital formation index. Even the North-Western Province which is ranked at the second place in human capital formation shows a gap of nearly 13 percentage points compared to the Western Province. The range of the index value between the best and the worst regions, 28.36 percentage points, and the Standard Deviation of 8.30 also prove that the regional disparity in human capital formation through formal education is significantly high.

CONCLUSIONS

i. The study reaches the following conclusions on the regional level human capital formation in Sri Lanka:

ii. Almost all the indicators on human capital formation – literacy rate, education participation rate, attainment rate, passing rates at national level examinations, percentage of students who qualify for university admission – show that the regional disparity in the formation of human capital through formal education in Sri Lanka is significantly high.

iii. Although the literacy rate in all provinces is satisfactorily high, it varies in a 10 percentage point range across the provinces. The highest rate is from the Western Province while the lowest is from the Eastern Province.

iv. Literacy rate differs between male and female in such a way that female literacy rate lies behind the male literacy rate in all provinces. In provinces where the overall literacy rate is high, the gap between male and female is lower.

v. The rate of participation in education has a negative relationship with the age of children. This negative association seems stronger after completing the compulsory education by children. Rate of participation in education is highest for the children aged 5 – 14 years in all provinces. The participation rate is lowest for the children aged 19 – 24 years similarly in all provinces. Gender disparity in the participation rate is insignificant in all provinces.

vi. Northern Province is the best when the human capital formation is measured in terms of the proportion of population with post-secondary level qualifications. However, when it is measured in terms of the proportion of population with secondary and above qualifications, the Western Province is ranked at the first place.

vii. When the gender disparity in the attainment of post-secondary level qualifications is considered, it seems that females are forward than males in almost all provinces. This

women-favorable gap is highest in the Northern Province. When the gender disparity is measured in terms of the proportion of population who never attended school (No schooling category) the majority are males in all provinces. The percentage of male population under the “No schooling” category is exceptionally high in the Eastern Province and high in Uva and Central Provinces.

viii. When the human capital formation is measured based on the passing rates of children at national level examinations also, the regional disparity is significant. Successfully passing rate at the O/L examination is highest in the Western Province while all the remaining provinces are far behind. However, the highest passing rate at the A/L examination is found from the Northern, Eastern and North-Central Provinces.

ix. When the university admissions of children from the nine provinces are considered, it seems that there is a significant variation among the provinces. When the admissions are taken as a percentage of total admissions of the country, the Western Province is at the first rank. However, when the admissions are taken as a percentage of the total number of students appeared for the examination in each province, the Northern Province is the highest while the Western Province moves back to the third place even behind the Southern Province. When only the admissions on merit basis are taken into account as a percentage of students appeared, it seems that the Southern Province gets the first rank and the Northern Province gets the second rank.

x. Western Province is outstanding when the human capital formation in Medicine and Dental Science fields is taken into consideration while it is significantly lower in North-Central, Uva, Northern, and Eastern Provinces.

xi. Finally, when the provinces are ranked based on the composite index which includes five main indicators – literacy rate, rate of attainment of education, passing rate at the GCE O/L examination, passing rate at the GCE A/L examination and percentage of university admissions (% of total students appeared for the examination from the province) – the Western Province is ranked at the first place while even the position of the North-Western province, which is ranked at the second place, is significantly lower in the index value of human capital formation. Eastern Province is the worst in the formation of human capital while Uva is also not so different from the index value of the Eastern Province. The gap between the best and the worst provinces, 28.36 percentage points, proves that the disparity in the formation of human capital through formal education is significantly high.

REFERENCES

- Becker, G. S. (1964), *Human Capital: A Theoretical and Empirical Analysis*, Columbia University Press (for National Bureau of Economic Research), New York.
- Central Bank of Sri Lanka (2005), *The Consumer Finances and Socio-Economic Survey Report 2003/04 Part 1*, Colombo.
- Central Bank of Sri Lanka (1999). *The Consumer Finances and Socio-Economic Survey Report 1996/97 Part 1*, Colombo.
- Chandrakumara, D.P.S. (2010). Construction of an Asset Index for Measuring Relative Welfare Level of Families. Problems and Prospects of Economic Development in the 21st Century: A Festschrift in Honour of Professor Dayananda Somasundara. In: M. Sunil Shantha, H.M. Bandara and H.M.S. Priyanath (eds). Godage International Publishers (Pvt) Ltd., Colombo.
- Department of Census and Statistics. (2009). *Computer Literacy Survey-2009*. Colombo.
- Psacharopoulos, G. and Patrinos, H.A. (2002), *Returns to Investments in Education: A Further Update*, Policy Research Working Paper 2881, The World Bank, Washington.

- Roussel, S. (2000), Factors Influencing Participation in Post-secondary Education and Training in Australia: 1989 to 1997, REB Report 7/2000, Research and Evaluation Branch, Department of Education, Training and Youth Affairs, Australia.
- Schultz, T. W. (1961), Investment in Human Capital, *American Economic Review*, 51(1): 1-17.
- Todaro, M.P. (2000), *Economic Development*, Addison-Wesley Ltd., Delhi.
- UNDP (2007), *Human Development Report 2007/2008*, New York.
- University Grants Commission. (2008), *Sri Lanka University Statistics – 2007*. Colombo.
- University Grants Commission. (2006). *Sri Lanka University Statistics – 2006*, Colombo.
- World Bank. (2007). *Treasures of the Education System in Sri Lanka: restoring, performance, expanding opportunities and enhancing prospects*. The World Human Resource Development Unit, Colombo.
- World Bank. (2005). *World Development Report: Equity and Development*. A co-publication of The World Bank and Oxford University Press, Washington.

Appendix 01: Literacy Rates at Provincial Level

Province	Male	Female	Both
Western	97.5	95.4	96.4
Central	92.7	86.1	89.3
Southern	94.3	91.4	92.7
Northern	93.5	91.8	92.5
Eastern	90.0	83.5	86.6
North-Western	95.3	91.8	93.5
North-Central	94.5	90.8	92.6
Uva	91.4	85.5	88.3
Sabaragamuwa	94.3	88.9	91.5
Sri Lanka	94.5	90.6	92.5

Source: Based on Consumer Finances and Socio-Economic Survey, CBSL, 2005.

Note: Excluding Killinochchi, Mannar and Mullaitivu Districts.

Appendix 02: Children's Participation in Formal Education as a Percentage of Population Aged 5 – 25 Years

Province	5 – 14			15 – 18			19 – 24			All Groups		
	M	F	Both	M	F	Both	M	F	Both	M	F	Both
Western	95.2	92.6	93.9	69.1	68.0	68.5	6.5	7.6	7.1	62.1	60.9	61.5
Central	94.4	93.9	94.1	63.4	68.5	65.8	7.4	7.3	7.3	63.1	61.2	62.2
Southern	91.3	91.9	91.6	69.4	76.5	73.2	10.0	15.1	12.5	65.5	69.1	67.3
Northern	94.1	94.3	94.2	82.7	75.8	79.6	14.6	17.6	16.3	71.4	65.5	68.5
Eastern	93.4	91.2	92.3	63.5	67.6	65.5	10.1	7.8	8.8	68.5	64.4	66.4
North-Western	94.2	90.2	92.3	62.9	69.4	66.3	10.9	11.8	11.4	63.0	61.5	62.3
North-Central	96.7	94.9	95.7	63.5	70.0	66.5	8.9	7.9	8.4	63.1	63.8	63.5
Uva	93.5	94.0	93.8	66.3	70.7	68.5	10.9	5.6	8.3	66.4	68.7	67.6
Sabaraga -muwa	92.3	91.2	91.8	65.7	71.9	68.8	4.1	7.9	6.0	60.0	62.6	61.3
Sri Lanka	93.9	92.5	93.2	66.6	70.5	68.6	8.4	9.4	8.9	63.9	63.6	63.8

Source: CBSL, 2005.

Note: Excluding Killinochchi, Mannar and Mullaitivu Districts.

Appendix 03: Education Attainment Rates by Province

Province	No Schooling			Primary			Secondary			Post-Secondary		
	M	F	Both	M	F	Both	M	F	Both	M	F	Both
Western	2.7	4.9	3.9	23.5	23.8	23.6	47.2	44.0	45.5	26.5	27.4	27.0
Central	7.7	14.3	11.1	34.3	29.0	31.6	41.9	37.4	39.6	16.0	19.3	17.7
Southern	6.2	9.0	7.7	34.2	29.3	31.6	40.7	36.1	38.3	18.9	25.6	22.4
Northern	6.8	8.3	7.6	34.5	30.1	32.1	33.0	30.8	31.8	25.6	30.9	28.5
Eastern	10.3	16.9	13.8	40.2	35.9	37.9	32.3	30.5	31.3	17.3	16.7	17.0
North-Western	4.8	8.4	6.7	32.6	28.4	30.4	44.0	40.9	42.4	18.6	22.4	20.6
North-Central	5.7	9.4	7.6	31.4	30.1	30.7	45.4	43.3	44.4	17.5	17.1	17.3
Uva	8.9	14.7	11.9	38.0	33.4	35.6	40.0	37.5	38.7	13.1	14.5	13.8
Sabaragamuwa	6.1	11.7	9.0	33.3	28.1	30.6	45.6	40.9	43.1	15.0	19.3	17.2
Sri Lanka	5.8	9.7	7.9	31.6	28.3	29.9	42.9	39.4	41.0	19.7	22.5	21.2

Source: CBSL, 2005.

Note: Excluding Killinochchi, Mannar, and Mullaitivu Districts.

THE ANALYSIS OF DISPOSITION EFFECT AND PRICE REVERSAL TAKING UNOBSERVABLE FACTORS INTO CONSIDERATION: WITH SPECIAL REFERENCE TO THE SRI LANKAN STOCK MARKET

Y. M. H. P. Madduma Bandara¹

ABSTRACT

Disposition Effect, which has been popularized and well documented as one of the various explanations for the persistence of momentum in the returns of the stocks over various time horizons was first documented by Shefrin and Statman (1985). Accordingly, the disposition effect refers to the tendency of investors to realize their profits too early and reluctance to realize their losses that arise out of changes in stock prices. The downward pressure on the prices of winner stocks due to higher growth in trading volume could lead to a price reversal, which ultimately results in losers outperforming winners for a specific time. This price reversal tendency could be influenced by many factors of which some are observable and, some, unobservable. Consideration of observable factors while disregarding those unobservable variables may result in producing biased and counterintuitive estimates by cross sectional and time series analyses. Based on the studies by Cressy and Farag (2009, 2010) this study examines by using Fixed Effects Model which takes unobservable factors into consideration, whether past losers outperform past winners. Using daily data from the Sri Lankan stock market, a sample of 20 stocks that faced a drastic 1 day price change was taken to examine price reversals. Even though cross section and pooled regression results yield insignificant results, fixed effects model strongly supports price reversals of the winning and losing stocks. These results suggest that the unobservable time specific together with firm specific factors play a major role in explaining price reversals in the Sri Lankan stock market.

INTRODUCTION

Behaviour of stock returns has been an active area of research for the past several years. The theories, such as Capital Asset Pricing model (CAPM), Arbitrage Pricing Model (APT), and Intertemporal Capital Asset Pricing Model (ICAPM) have emerged to explain the way stock prices are determined. These theories basically show the role of risk in determining the expected returns of a stock. Nevertheless, many studies have yielded contradicted predictions to these theories. For instance Basu (1977), using a sample from April 1957 to March 1971, showed that stocks with high earnings/price ratios (or low P/E ratios) earned significantly higher returns than stocks with low earnings/price ratios. In addition, Banz (1981), in his study showed that the stocks of firms with low market capitalizations have higher average returns than firms with large capitalization. His findings

¹ Lecturer, Department of Business Economics, University of Sri Jayewardenepura, Sri Lanka. E-mail: hmadduma@gmail.com

indicated that differences in beta do not capture return differences which arise out of these market capitalization disparities.

Among these, momentum is one of the strongest price anomalies. Momentum refers to the profits that could be obtained by the investment strategy of buying past winners and selling past losers. According to Debondt and Thaler (1985), "Losers" are the stocks that have had poor returns over the past three to five years, and, "Winners" are those stocks that had high returns over a similar period. Momentum could not persist if there is at least weak form efficiency in the market and if stock prices follow a random walk. Jagadeesh and Titman in 1993 documented this inconsistency. In the study of Jagadeesh and Titman, they show that past winners continue to outperform past losers over 3 – 12 months horizon in the US market. They also found that risk adjustments to the returns heighten momentum instead of explaining it. Haugen and Baker (1996), Rouwenhorst (1998) proves that this momentum holds in international markets too.

Many explanations have been attributed to the reasoning of this tendency in the stock markets. Although some have argued that the results provide strong evidence of "market inefficiency," others have argued that the returns from these strategies are either compensation for risk, or alternatively, the product of data mining (Jagadeesh and Titman, 2001). Conrad and Kaul (1998) argue that profitability in momentum strategy could be due to cross sectional variations in the expected returns of individual securities. These cross sectional dispersions are not related to time series patterns of the returns on which the strategies were formed. Barberis et al (1998), Daniel et al (1998) and Harrison and Stein (1999) present behavioural models to explain the profitability of momentum strategy. Kothari, Shanken, and Sloan (1995) and Brown, Goetzmann, and Ross (1995) cite survival bias as a problem that can exaggerate predictive power. Rouwenhorst (1998) taking twelve international equity markets shows that momentum persists even after the returns are corrected for risks.

Disposition Effect, which has been popularized and well documented as one of the various explanations for the persistence of momentum in the returns of the stocks over various time horizons was first documented by Shefrin and Statman (1985). Accordingly, the disposition effect refers to the tendency of investors to realize their profits too early and reluctance to realize their losses. Consequently, investors would hang on to the losing stocks and sell the winning stocks. Many empirical studies have been carried out to explore the existence of this behavioural heuristic in different markets since the work of Shefrin and Statman.

The rational decision making theory states that an investor who is compliant with the rational behaviour axioms would make decisions based on the tradeoff between the risks and returns (Chui, 2001). Such an investor would make his choices so as to get the maximum expected return for the risk level he is ready to assume. But this theory does not accommodate the possible effects of disposition effect. A number of theories have been emerged to explain the disposition effect among investors. Some of them are, prospect theory, mental accounting, mean reversion and seeking pride (avoiding regrets).

Most studies have been conducted to test the existence of disposition effect and its role in explaining the profitability of the momentum strategy. But apart from a few limited natural experiments, nobody has yet instituted an empirical relationship between irrationality of investor behaviour and changes in asset prices (Goetzman, Massa 2003). Moreover, the simultaneous analysis of the investment behaviour of all the investment categories has been limited to a few studies like Grinblatt and Keloharju (2000, 2001), Shumway et al (2006), mainly due to limitation of data. The existing studies that analyse different investor categories utilize different research methods, different data in terms of frequency and time

horizon and different institutional arrangements making it difficult to identify and compare general behaviour and performance patterns of separated investor categories (Grinblatt and Keloharju, 2000).

There are many studies that have been conducted to examine how the existence of disposition effect could be used to explain the patterns of cross sectional expected returns over different horizons. For example, Grinblatt and Han (2002) analyses how aggregate demand and equilibrium price progress over time in the presence of fixed proportion of disposition prone investors and it is shown that the disposition effect can explain the profitability of momentum strategy between three months and one year. In addition, Frazzini (2006), Barberis and Huang (2001) and Hur et al (2010) have found that prospect theory and mental accounting framework play a significant role in explaining the cross section of stock returns. However, a proper analysis of the price behaviour should be accompanied by a time dimension to the data and measures of the unobservables affecting share prices (Cressy and Farag, 2010). Despite the fact that some of these factors are unobservable, ignorance could lead to heterogeneity biases in the estimates. They have incorporated these aspects in their study in 2010 and have adopted panel data methods to investigate cross sectional and time series effects within the post event period for winners and losers.

This study applies the methodology by Cressy and Farag (2010) to study the price reversal of winning and losing stocks in the Sri Lankan stock market. Twenty stocks that experienced a one day dramatic price change during 2006-2010 have been taken as the sample in consideration. A dramatic change refers to a rise or fall of prices more than 10% on a particular day. Even though Cross Sectional and pooled OLS methods fail to provide evidence of price reversals, application of fixed effect model discloses strong price reversal of past winners and past losers emphasizing the importance of unobservable time and firm specific factors. Further, Fixed Effect model explores a negative relationship between firm size and the post event abnormal returns which is expected according to the small firm effects.

LITERATURE REVIEW

The momentum in the stock returns was first examined and discovered by Jagadeesh and Titman in 1993. They revealed that a strategy of buying stocks with high returns over the horizons of three to twelve months and selling stocks with low returns for the same time horizon would dominate buy and hold strategy. Momentum refers to the tendency of past winners continuing to outperform past losers. Many studies have provided evidence that past stock returns are related to cross sectional stock returns over short (one week to one month), intermediate (over three to 12 months) and long (three to five years) time horizons. Rouwenhorst (1998) tests for momentum in international equity markets taking a sample of 12 European countries and he finds that past winners outperform past losers by about 1 percent per month in the medium terms (for up to one year). He also finds that this price continuation is stronger for small firms. Haugen and Baker (1996) discovered that profitable momentum strategies persist in the US, Germany, France, the UK and Japan.

By contrast, Debondt and Thaler (1985, 1987) observe return reversals over long horizons. According to their studies, portfolios with loser stocks will outperform the portfolios with winning stocks about five years later (Long run). Similarly Schiereck et al (1999), using data of German stock market finds that momentum strategy is profitable in the intermediate terms where as contrarian strategy becomes profitable in the short run and in the long run. Kang et al. (2002) using data on A shares in Chinese market find the presence of abnormal profits for short term contrarian and intermediate momentum strategies. Phua et al (2010) provide evidence for the existence of momentum effect in Australian market.

Contrary to the findings of Rouwenhorst (1998), they show that profitability is higher for larger firms listed on Australian Stock Exchange.

Many explanations have been attributed to the reasoning of this tendency in the stock markets. Although some have argued that the results provide strong evidence of "market inefficiency," others have argued that the returns from these strategies are either compensation for risk, or alternatively, the product of data mining (Jagadeesh and Titman, 2001). Yet, the reasons for this are widely debated. Conrad and Kaul (1998) argue that profitability in momentum strategy could be due to cross sectional variations in the expected returns of individual securities which play a vital role in determining the profitability of either momentum or contrarian strategies. These cross sectional dispersions are not related to time series patterns of the returns on which the strategies were formed. Barberis et al (1998), Daniel et al (1998) and Harrison and Stein (1999) present behavioural models to explain the profitability of momentum strategy. Kothari, Shanken, and Sloan (1995) and Brown, Goetzmann, and Ross (1995) cite survival bias as a problem that can exaggerate predictive power. Rouwenhorst (1998) taking twelve international equity markets shows that momentum persists even after the returns are corrected for risks.

Jagadeesh and Titman (2001) shows that even though other anomalies such as small firm effects documented by Banz (1981) (which claims the superior performance of value stocks relative to growth stocks) are not observed after the time period considered in original studies, the momentum strategy remains to be profitable when they extended the test for the period of 1990-1998, which is different from the period they considered in their original study in 1993. Hence they conclude that momentum profits are not entirely due to data snooping biases. Contradictory to the hypothesis of Conrad and Kaul (1998), Grundy and Martin (2001) find that risk adjusted profitability of a total return momentum strategy is more than 1.3% per month and remarkably large and stable across sub periods, even after subtracting each stock's mean return from its return during the period. Moskowitz and Grinblatt (1999) find that industry effects on momentum could be non trivial. But again, Moskowitz and Grinblatt (1999), Grundy and Martin (2001), and Chordia and Shivakumar (2002) also show that momentum due to individual stock effect is distinct from that of industry effects (Grinblatt and Han, 2002).

Recently, researchers came up with another behavioural explanation for the momentum in stock returns, and, Shefrin and Statman (1985) defined this as the disposition effect. Mental Accounting (Thaler, 1980) and Prospect Theory (Kahneman and Tversky, 1979) have become two main motives for the investors to demonstrate such disposition oriented behaviour. Over the last few decades, many studies have been conducted to test the existence and potential influence of the disposition effect not only in capital markets but also in real estate markets. Disposition effect being one of the well documented behavioural biases that lead to momentum in stock returns, leads investors to behave contrary to the rational investment theory and they would sell their winning stocks too early and keeping their losing stocks in the hesitation to realize the losses. Consequently this will have an impact on stock prices by causing excess demand pressure on losing stocks and excess selling pressure on winning stocks which ultimately leads to stock prices being under react to information about the companies. But once this irrational behaviour is realized and possible impact is corrected, the stock prices are adjusted accordingly and this is one of the reasons why a momentum strategy could remain profitable in a financial market. The supporting empirical evidences for this notion are the studies by Grinblatt and Han (2002, 2005) and Frazzini (2006).

The degree to which different categories of investors are subject to this behavioural bias has also been investigated by several studies. Hur et al. (2005), study the role of

individual investors in disposition effect induced momentum by using US stock market data for the period of 1984 – 2005. They find that higher the presence of individual investors in a stock, more the ability of disposition effect to explain momentum. They also find that disposition effect of individual investors is more towards hard-to-value stocks complying with Kumar (2009). In addition, Odean (1998), Barber and Odean (2000, 2001, and 2002) and Brown et al. (2006) provide evidence that individual investors are more tend to be influenced by disposition effect. Choe and Eom (2009) find the existence of disposition effect in Korean stock index futures market. Moreover they find that sophistication and trading experience tend to reduce the disposition induced behaviour of investors, hence individual investors are more susceptible to disposition effect compared to foreign and institutional investors. These findings comply with the findings by Grinblatt and Keloharju (2000). Their study which relies on data from Finland suggests that the increase in sophistication level will cause investors to pursue momentum strategies. As such, the most sophisticated investors in the Finnish financial markets, the foreign investors follow a momentum strategy whereas domestic investors, households in particular, pursue a contrarian strategy displaying disposition effect.

Goetzmann and Massa (2003), based on the study by Grinblatt and Han (2002), derive several implications for volume, volatility and returns in the presence of disposition effect. They construct direct restrictions on how the returns, volatility, and volume change as the proportion of disposition investors in the market changes which is denoted by μ . Accordingly, three market variables should have a negative relationship with the proportion of disposition investors when the prices of the stocks are above the reference price. This is because when a stock is performing well, an increase in the proportion of disposition investors will cause to reduce the net demand for that stock. This in turn will reduce prices (P_{t+1}), returns, trading volume and volatility. The advantage of using this direct method is that μ is independent of the true economic value of the asset (Goetzmann and Massa, 2003). These restrictions are then empirically tested using data on individual investors obtained from a brokerage house in US. This study limits only to the individual investor category and to a sample of around 78,000 households. Hence it is examined how the market is impacted as the proportion of individual investors who are subject to the behavioural bias changes.

DATA

The dataset consists of information about top 20 stocks traded in the Colombo Stock Exchange (CSE) in Sri Lanka. The data of daily stock returns, market capitalization and trading volume were collected for the period 2006-2010. These stocks have experienced one day dramatic change in prices over this period. To estimate CAPM parameters, period of (-105, -6) was taken while the test period is (+1,+120) days. The β s estimated in CAPM are used to measure abnormal returns (AR) and cumulative abnormal returns (CAR) in the post event period. To overcome the problem of severe autocorrelation, 10 day returns have been calculated according to Cressy and Farag (2010). Accordingly the dataset consists of 10 pre-event and 12 post-event observations. The event is the situation where a stock experiences a one day dramatic price change. Winners are the stocks that experienced a price hike of more than 10% and losers are the stocks that had a price fall for more than 10% on one day.

METHODOLOGY

The study uses the methodology by Cressy and Farag (2010) which is based on their study in 2009. By using FE model, the behaviour of the Cumulative Average Abnormal Returns for winners is studied. There could be many observable as well as unobservable factors that could lead to post-event behaviour of stock prices and returns. Inclusion of observable variables while ignoring the unobservable factors could result in heterogeneity biases making OLS estimates biased. An unobservable variable could be time-specific, which varies only across time. In addition, these could be firm-specific which implies the variation across the entities concerned.

Before proceeding to the details of regression analyses, details and calculation of basic variables are explained below.

Daily Returns: Daily returns are calculated as, $r_{it} = \ln \left(\frac{P_t}{P_{t-1}} \right)$ where P is the closing price of a stock.

Abnormal Returns (AR): Abnormal returns are calculated using the equation, $AR_{it} = R_{it} - (\alpha_i + \beta_i R_{mt})$. α and β estimates are obtained using the pre-event data.

Cumulative Abnormal Returns (CAR) and Cumulative Average Abnormal Returns (CAAR): These are calculated using following equations.

$$CAR_{it} = \sum_{\tau=1}^t AR_{i\tau}$$

$$CAAR_t = \sum_{i=1}^I CAR_{it} / I$$

where, I is equal to number of stocks and it is 20 in this case.

First, Cross – Section Time Series approach has been used to explain price reversal. As per, Cressy and Farag (2009), Cox and Peterson (1994) the relevant equation is,

$$CAR_i = \mu + \beta_1 AR_{i0} + \beta_2 \ln mcap_i + \beta_3 \ln trvol_{it} + \varepsilon_i$$

$$i = 1, 2 \dots \dots 20 \quad (1)$$

where,

$$CAR_i = \sum_{t=1}^{12} CAR_{it} / 12$$

In this equation AR_{i0} is the Abnormal Return (AR) for stock i on the event day. $\ln mcap_i$ is the natural log of market capitalization of the stock (i) one period before the event and $\ln trvol_{it}$ is the percentage change in turnover ratio (TR_t/TR_{t-1}) one period before the event. This variable is taken as a proxy to capture the change in trading activities of the stock. Secondly, Pooled OLS regression will be estimated and the relevant equation is,

$$AR_{it} = \mu + \beta_1 AR_{i0} + \beta_2 \ln mcap_{it} + \beta_3 \ln trvol_{it} + \varepsilon_{it}$$

In this regression AR_{it} is used instead of CAR_{it} in order to avoid problems of severe autocorrelation problems (Cressy Farag, 2010).

Then a poolability test should be conducted in order to conclude the suitability of panel data regressions for the dataset. This involves testing the null hypothesis of poolability of panel data with respect to stocks and time.

Once the poolability is verified, there are basically two panel data analyses that can be conducted on the dataset. They are Fixed Effect (FE) and Random Effect (RE) models. The decision of whether to use FE or RE depends on a few factors. RE treats unobservable effects to be random while FE assumes them to be fixed in nature. The RE estimator requires that the individual effects must be uncorrelated with the regressors for it to be consistent. If this assumption is not tenable, the FE estimator should be used. Estimation of Hausman specification test (Hausman, 1978), permits to test the null hypothesis that the RE estimator is consistent. The rejection of null hypothesis implies the adoption of FE model in capturing time specific and firm specific effects that are unobservable in the model.

EMPIRICAL RESULTS

Table 01: Descriptive Statistics for Winners and Losers

Variable	Winners				Losers			
	Mean	Std.dev	Min	Max	Mean	Std.dev	Min	Max
CAR_{it}	-0.0600	0.1372	-0.3425	0.2549	0.0468	0.2110	-0.6564	0.3368
AR_{it}	-0.0015	0.0561	-0.2025	0.3345	0.0085	0.0648	-0.1570	0.3613
AR_{i0}	0.1027	0.0896	-0.0482	0.3108	-0.6695	0.9291	-2.8445	-0.0427
$lnmcap_{it}$	23.4474	0.7609	22.5873	25.2004	23.7751	0.7098	22.7382	25.3221
$lntrrol_{it}$	12.6292	47.580	0.0013	372	6.9104	33.5119	0.0022	299.788

Source: Author constructed

The sample company period is 260, which has been constructed by of 13 post-event periods per company and 20 companies. The initial price rise for the winners is 10.27%, and, for the losers, it is -66.95%. This high value for losers is because of the drastic price change of two companies in the sample that recorded a price drop of 93% and 53% respectively. However, average cumulative abnormal returns records values of -6% and 4.68% respectively suggesting a price reversal over the period.

Table 02 reports the results of the cross sectional analysis. The model does not show any significance in terms of the regressors. The model in general is insignificant which is denoted by the p – value.

Table 02: Cross Sectional Regressions

	Winners	Losers
Constant	0.6362 (1.1182)	0.8041 (2.65)
$lnmcap$	-0.0292 (0.0484)	-0.0335 (0.1115)
Ar_{i0}	-0.1134 (0.4054)	0.0484 (0.1484)

$Introl_i$	-0.0105 (0.0152)	0.0018 (0.0419)
R^2	0.1737	0.2328
Adjusted R^2	-0.01017	-0.5343
F-test	0.63	0.3
(p-value)	0.6133	0.8232

Source: Author constructed

Note: Standard errors are in parentheses.

Even if the results are insignificant, the signs of the covariates are consistent with the ones obtained by Cressy and Farag (2010). According to a-priori expectations, small firm effects suggest a negative relationship between $lnmcap$ and CAR_i . The negative coefficient for AR_{i0} suggests that the larger the initial price change, the smaller the subsequent CAR though AR remains possible and the opposite is true for the losers (Cressy and Farag, 2010). $Introl$ is negative for winners and positive for losers which shows the fact that the downward pressure on price for winners by increasing the sales volume may reduce the CAR and vice versa.

Table 03 reports the results of the pooled OLS regression. Here AR_{it} has been regressed instead of CAR in order to avoid severe autocorrelation (Farag, Cressy, 2010).

Table 03: Pooled OLS Regression

	Winners	Losers
Constant	0.0718 (0.1573)	0.0128 (0.2423)
$lnmcap$	-0.0028 (0.0068)	-0.0006 (0.0102)
Ar_{i0}	-0.0572 (0.058)	0.0144 (0.0077)
$Introl$	8.96E-07 (1.37E-06)	5.35E-07 (1.17e-06)
R^2	0.0175	0.0438
Adjusted R^2	-0.0019	0.0079
F-test	0.9	1.22
(p-value)	0.4412	0.3077

Source: Author constructed

Note: Standard errors are in parentheses.

Again, as cross sectional regression, the model does not show any significance in terms of the regressors. Overall, the model is not significant either for winners or losers depicted by the F-statistics.

Despite the insignificance, the signs of the regressors in pooled regression analyses are consistent with the ones that have been obtained by Cressy and Farag (2010) and also the estimates obtained using cross section regression. However, sign for *Intrvol* has been changed as in the results obtained by Cressy and Farag (2010). This can be a sign of heterogeneity bias that has been occurred after including time dimensions to the model.

Table 04 shows the results of the poolability test. First the pooled regression is estimated for winners and losers by including only the variables that change over time and across stocks. Those two variables are *lnmcap* and *Intrvol*. AR is regressed over those two variables. Then poolability test has been carried out by calculating the residuals in the restricted model and the unrestricted model.

Table 04: Poolability Test

	Winners	Losers
pooled sse	0.4599	0.349
Σ sse (by stock)	0.3424	0.15277
F	1.115289	1.13
P	0.325	0.3465
Σ sse (by date)	0.39261	0.255559
F	0.623242	0.531831
P	0.9413	0.9713

Source: Author constructed

With the p-values of 0.325 and 0.3465 for winners and losers respectively, we do not reject the null hypothesis of poolability by stocks. In the same manner, considering the p-values of 0.9413 and 0.9713, the null hypothesis by time is not rejected. This enables us to proceed with the panel data analysis.

In order to test for the choice between fixed effects and random effects models, Hausman statistics was considered and the results are as follows for winners and losers.

Table 05: Hausman Test Statistics

	Winners	Losers
Chi-square	62.1	10.86
(p)	0.0000	0.0044

Source: Author constructed

In both cases, the null hypothesis that the RE is consistent is soundly rejected by the data. Therefore FE model can be considered as the suitable method in analysing panel data.

When the FE model is utilized, all the time invariant and firm invariant variables should be omitted from the model. Hence, of the total variables used so far, *lnmcap* and *Intrvol* will be included while omitting AR_{it} from the model. Accordingly, Table 06 details the results of the FE regression.

Table 06: FE Estimation of AR_{it}

	Winners	Losers
Constant	-2.8596 (0.8542)	-3.4309 (0.9726)
lnmcap	-0.1219 (0.0364)	-0.1438 (0.0409)
Introl _i	1.32E-06 (1.35E-06)	1.05E-06 (1.06E-06)
R ²	0.0794	0.1514
F-test	6.08	6.69
(p-value)	0.0029	0.0021

Source: Author constructed

Note: Standard errors are in parentheses

By utilizing FE model, a dramatic improvement has occurred in both models of winners and losers. The R² are 7.94% and 15.14% for winners and losers respectively. F-tests suggest that overall, the models are significant at 95% confidence level. This suggests that the unobservable time-specific and firm-specific effects play a crucial role in the behaviour of post AR_i s.

SUMMARY AND CONCLUSION

The existence of disposition effect in a market may have different implications over the performance of that market. One of the main implications is the price reversal of loser and winning stocks due to the buying and selling pressures caused on those two stocks respectively. Many factors could affect the post event behaviour of ARs. Among them, there could be some time specific and firm specific factors that are not observable. Cross Section or Time Series regression analyses may reasonably explain this behaviour by taking observable factors into consideration. But ignorance of the unobservable factors could lead those models to produce biased estimators which can reduce the validity of the model while producing counter intuitive results. This study analyses the behaviour of post event ARs of 20 stocks in the Sri Lankan Stock Exchange over the period 2006-2010. The Cross section and Pooled OLS methods that ignore the unobservable effects fail to provide significant results. But once the time and firm specific effects are accounted for by utilizing FE method, the model shows a significant improvement. This suggests that the unobservable effects play a major role towards the price reversal patterns in the Sri Lankan stock market.

REFERENCES

- Alizadeh, Sassan, Michael W. Brandt, and Francis X. Diebold, 2002, Range-based estimation of stochastic volatility models, *The Journal of Finance* 57, 1047-1091.
- Banz, Rolf W., 1981, The relationship between return and market value of common stocks, *Journal of Financial Economics* 9, 3-18.
- Barber, Brad M., and Terrance Odean, 2000, Trading is hazardous to your wealth: The common stock investment performance of individual investors, *The Journal of Finance* 55, 773-806.
- Barber, Brad M., and Terrance Odean, 2001, Boys will be boys: Gender, overconfidence, and common stock investment, *The Quarterly Journal of Economics* 116, 261-292.
- Barber, Brad M., and Terrance Odean, 2002, Online investors: Do the slow die first?, *The Review of Financial Studies* 15, 455-487.
- Barberis, Nicholas, and Ming Huang, 2001, Mental accounting, loss aversion, and individual stock returns, *Journal of Finance* 56, 1247-1292.
- Barberis, Nicholas, Ming Huang, and Tano Santos, 2001, Prospect theory and asset prices, *The Quarterly Journal of Economics* 116, 1-53.
- Barberis, Nicholas, Andrei Shleifer, and Robert Vishny, 1998, A model of investor sentiment, *Journal of Financial Economics* 49, 307-343.
- Barberis, Nicholas, and W. E. I. Xiong, 2009, What drives the disposition effect? An analysis of a long-standing preference-based explanation, *The Journal of Finance* 64, 751-784.
- Barberis N. , Xiong W., 2008, Realization utility, *NBER Working Paper No. W14440*, <http://ssrn.com/abstract=1289674>.
- Brown, Philip, Nick Chappel, Ray Da Silva Rosa, and Terry Walter, 2006, The reach of the disposition effect: Large sample evidence across investor classes, *International Review of Finance* 6, 43-78.
- Brown, Stephen J., William N. Goetzmann, and Stephen A. Ross, 1995, Survival, *The Journal of Finance* 50, 853-873.
- Campbell, John Y., 2000, Asset pricing at the millennium, *The Journal of Finance* 55, 1515-1567.
- Choe, Hyuk, and Yunsung Eom, 2009, The disposition effect and investment performance in the futures market, *Journal of Futures Markets* 29, 496-522.
- Choe H., Eom Y., 2007, The aggregate price impact of the disposition effect, *Seoul National University*.
- Chordia, Tarun, and Lakshmanan Shivakumar, 2002, Momentum, business cycle, and time-varying expected returns, *Journal of Finance* 57, 985-1019.
- Chui, Peter M. W., 2001, An experimental study of the disposition effect: Evidence from macau, *Journal of Psychology & Financial Markets* 2, 216-222.
- Conrad, Jennifer, and Gautam Kaul, 1998, An anatomy of trading strategies, *The Review of Financial Studies* 11, 489-519.
- Cox D., Peterson D.R., 1994, Stock returns following large one-day declines:Evidence on short-term reversals and longer-term performance, *Journal of Finance* 49, 255-67.
- Cressy R., Farag H., 2009, Do size and unobservable company factors explain stock price reversals? , *Journal of economics and Finance* forthcoming, DOI 10. 1007/s12197-009-9076-4
- Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998, Investor psychology and security market under- and overreactions, *The Journal of Finance* 53, 1839-1885.

- De Bondt, Werner F. M., and Richard Thaler, 1985, Does the stock market overreact?, *Journal of Finance* 40, 793-805.
- De Bondt, Werner F. M., and Richard H. Thaler, 1987, Further evidence on investor overreaction and stock market seasonality, *Journal of Finance* 42, 557-581.
- Efthymiou, Vassilis A., and George N. Leledakis, 2011, The price impact of the disposition effect on the ex-dividend day of nyse and amex common stocks, *SSRN eLibrary*.
- Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3-56.
- Farag H., Cressy R., 2010, Do unobservable factors explain the disposition effect in emerging stock markets?, *Applied Financial Economics* 20, 1173-1183.
- Frazzini, Andrea, 2006, The disposition effect and underreaction to news, *Journal of Finance* 61, 2017-2046.
- Goetzman, William N., and Massimo Massa, 2008, Disposition matters: Volume, volatility, and price impact of a behavioral bias, *Journal of Portfolio Management* 34, 103-125.
- Grinblatt, M., Han, B., 2002, The disposition effect and momentum, *NBER Working Paper* 8734.
- Grinblatt, Mark, and Bing Han, 2005, Prospect theory, mental accounting, and momentum, *Journal of Financial Economics* 78, 311-339.
- Grinblatt, Mark, and Matti Keloharju, 2000, The investment behavior and performance of various investor types: A study of finland's unique data set, *Journal of Financial Economics* 55, 43-67.
- Grinblatt, Mark, and Matti Keloharju, 2001, What makes investors trade?, *The Journal of Finance* 56, 589-616.
- Grundy, Bruce D., and J. Spencer Martin, 2001, Understanding the nature of the risks and the source of the rewards to momentum investing, *The Review of Financial Studies* 14, 29-78.
- Harrison, Hong, and Jeremy C. Stein, 1999, A unified theory of underreaction, momentum trading, and overreaction in asset markets, *The Journal of Finance* 54, 2143-2184.
- Haugen, Robert A., and Nardin L. Baker, 1996, Commonality in the determinants of expected stock returns, *Journal of Financial Economics* 41, 401-439.
- Hausman, J.A., 1978, Specification tests in econometrics, *Econometrica* 46, 1251-371.
- Hellwig, Martin F., 1980, On the aggregation of information in competitive markets, *Journal of Economic Theory* 22, 477-498.
- Hur, Jungshik, Mahesh Pritamani, and Vivek Sharma, 2010, Momentum and the disposition effect: The role of individual investors, *Financial Management (Blackwell Publishing Limited)* 39, 1155-1176.
- Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65-91.
- Jegadeesh, Narasimhan, and Sheridan Titman, 2001, Profitability of momentum strategies: An evaluation of alternative explanations, *Journal of Finance* 56, 699-720.
- Kahneman, Daniel, and Amos Tversky, 1979, Prospect theory: An analysis of decision under risk, *Econometrica* 47, 263-291.
- Kahneman, Daniel, and Amos Tversky, 1979, Prospect theory: An analysis of decision under risk, *Econometrica* 47, 263-291.
- Kang, Joseph, Ming-Hua Liu, and Sophie Xiaoyan Ni, 2002, Contrarian and momentum strategies in the china stock market: 1993-2000, *Pacific-Basin Finance Journal* 10, 243-265.

- Kaustia, Markku, 2004, Market-wide impact of the disposition effect: Evidence from ipo trading volume, *Journal of Financial Markets* 7, 207-235.
- Kaustia, Markku, 2004, Market-wide impact of the disposition effect: Evidence from ipo trading volume, *Journal of Financial Markets* 7, 207-235.
- Kothari, S. P., Jay Shanken, and Richard G. Sloan, 1995, Another look at the cross-section of expected stock returns, *The Journal of Finance* 50, 185-224.
- Moskowitz, Tobias J., and Mark Grinblatt, 1999, Do industries explain momentum?, *Journal of Finance* 54, 1249-1290.
- Odean, Terrance, 1998, Volume, volatility, price, and profit when all traders are above average, *The Journal of Finance* 53, 1887-1934.
- Phua, Victor, Howard Chan, Robert Faff, and Robert Hudson, 2010, The influence of time, seasonality and market state on momentum: Insights from the Australian stock market, *Applied Financial Economics* 20, 1547-1563.
- Rouwenhorst, K. Geert, 1998, International momentum strategies, *Journal of Finance* 53, 267-284.
- Schierbeck, Dirk, Werner de Bondt, and Martin Weber, 1999, Contrarian and momentum strategies in Germany, *Financial Analysts Journal* 55, 104.
- Seru, Amit, Tyler Shumway, and Noah Stoffman, 2010, Learning by trading, *Review of Financial Studies* 23, 705-739.
- Shefrin, Hersh, and Meir Statman, 1985, The disposition to sell winners too early and ride losers too long: Theory and evidence, *Journal of Finance* 40, 777-790.
- Talpsepp, Tönn, 2009, Reverse disposition effect of foreign investors, *SSRN eLibrary*.
- Thaler, Richard, 1980, Toward a positive theory of consumer choice, *Journal of Economic Behavior & Organization* 1, 39-60.
- Thaler, Richard H., 1999, Mental accounting matters, *Journal of Behavioral Decision Making* 12, 183-206.
- Thaler, Richard H., 2008, Mental accounting and consumer choice, *MARKETING SCIENCE* 27, 15-25.
- Wang, Jiang, 1993, A model of intertemporal asset prices under asymmetric information, *The Review of Economic Studies* 60, 249-282.
- Wang, Jiang, 1994, A model of competitive stock trading volume, *Journal of Political Economy* 102, 127-168.
- Weber, Martin, and Colin F. Camerer, 1998, The disposition effect in securities trading: An experimental analysis, *Journal of Economic Behavior & Organization* 33, 167.
- Zuchel, H., 2001, What drives the disposition effect?, *Mannheim University Working Paper No. 01-39*.

AN EMPIRICAL STUDY OF SOFTWARE DEVELOPMENT FAILURES IN SRI LANKA

A. J. Perera¹ and S. P. P. Amaratunge²

ABSTRACT

Software development projects are considered as a unique entity in terms of project management due to the inherent attributes they encapsulate, thus making them distinct and susceptible to failure. Therefore, the importance of software project risk management is emphasized where the identification of the factors which affect software development projects to fail being the main component. This survey-based study focuses on identifying the factors that affect software development failures and the causes of these factors in Sri Lankan software development companies. Twenty-seven factors affecting software development failures were identified using a stringent scientific methodology and were tested to ascertain their validity, importance and the causes in terms of the Sri Lankan context using an interview based questionnaire. Twenty-five software development companies which belong to the software exporters' association were selected for data collection, and the gathered data were analyzed to ascertain the significance to the defined objectives using statistical tools. Misunderstanding of user requirements, poor project management skills of managers, and the lack of communication between the members of the software development team were identified as the top three factors affecting software development failures in Sri Lanka, while the lack of proper communication between the development team and the customer, poor project management knowledge of managers, and lack of proper planning were identified as the main phenomena which cause these factors to originate in software development projects in Sri Lanka.

INTRODUCTION

Information technology (IT) is one of the fastest growing industries in developed countries (Hartmanand and Ashrafi, 2002). IT projects can implement a rapidly expanding range of equipment, applications, services, and basic technologies that provide information to support the operation, management, analysis and decision-making functions within an organisation (Bacarini et al, 2004). In 1995, the spending of the United States (US) on software development projects reached \$250 billion with 175,000 recorded software development projects. In that year, the US companies have paid an estimated \$59 billion on

¹Senior Team Leader, Cambio Software Engineering Pte. Ltd., Sri Lanka. Email: apjanaka@yahoo.com

²Professor, Department of Business Economics, University of Sri Jayewardenepura, Sri Lanka. Email: sppamaratunge@yahoo.com

cost overruns and another \$81 billion on cancelled projects (Wallace and Keil, 2004). As implied by the statistics, software development project failures are a major issue and many studies can be found in literature which has attempted to reduce the number of project failures in the software development industry. Standish group report of 2004 specified that over 70% of the software development projects in the US were failures. Therefore, software development failures are important to be identified and mitigated in software development projects (Wallace and Keil, 2004).

Software development is becoming one of the most important industries in Sri Lanka and many foreign organizations outsource software development projects to Sri Lankan software development companies. Some of the major players in the software field, like Microsoft³ and RedHat⁴ have country offices in the island. Furthermore, there are many large software firms in the country and some multinational software companies⁵ have opened development centres in Sri Lanka. Sri Lankan software development companies also face the issue of software development failures. Although reliable information on the costs associated with the total software development failures in Sri Lanka could not be found due to the non-availability of statistics, it is clear that Sri Lankan software companies also face the problem of failure in software development projects even though the extent of the implications is not known.

Software has four unique inherent attributes: complexity, conformity, changeability and reliability, which make software development a very difficult and complex task (Brooks, 1987). These attributes make software unique and impossible to mitigate against all risks. Therefore, there is no set method which can be followed in reducing software development failures. The best way is to mitigate risk so that the project will have a greater probability of success. Software development project managers have to identify the factors which might affect the failures of software development project and then try to reduce these factors in the software development process.

There are two types of investigations into factors of software development failures; some studies define individual factors while some amalgamate factors into defined groups by formulating frameworks which facilitate in the identification of the factors which cause software development failures. One of the main frameworks defined for identifying software development failures was compiled by Keil et al (1998) in their paper "A Framework for identifying software project risks". Keil et al defined four quadrants of type of factors which relate to software development failures. Customer mandate, scope and requirements, execution and environment were defined as the four quadrants. The validity of this study was emphasized by Wallace and Keil (2004) where they proved the validity of the framework defined by Keil et al (1998) by interviewing over five hundred software development project managers in the US. This study has used the above said two researches and has tried to attain two objectives; Ascertain the major factors⁶ which effect software development project failures in Sri Lanka software development companies and to rank them according to the significance of the factor to software development project failures and

³Microsoft is a software development, which has developed the Windows Operating System.

⁴RedHat is another software company, which is the creator of ReHat Linux Operating System.

⁵IFS and Cambio are two examples of major software players in the world having development centres in Sri Lanka.

⁶Phenomena, which lead to software development projects to fail.

to ascertain the causes⁷ of the factors of software development failures in Sri Lankan software development companies.

METHODOLOGY

A stringent and comprehensive methodology was followed when compiling this study to attain maximum validity and reliability. Initially, existing literature was collected and analyzed to comprehend the context of the problem faced. Literature was collected from various sources with scientific journals being the preferred sources. The found literature was individually analyzed and important factors⁸ were identified and this resulted in the compilation of concepts related to software development failures. This process was undertaken in a methodical and scientific manner focusing on gaining maximum validity and reliability to the concepts which were identified. Two methods were used in concept identification: concepts were identified using the literature survey and concepts were identified via data gathering from industry professionals⁹. Data gathering through experts was essential in terms of the validity of the concepts since there were no previous studies done to find the factors which contribute to software development failures in Sri Lankan software companies.

List of twenty seven concepts were identified to be studied for the relationship they have in terms of software development project failures in Sri Lankan software development companies. This concept identification process was of four fold, integrating both data collection from industry professionals and getting input from existing literature. Initially, concepts were identified getting feedback from industry professionals, which resulted in the compilation of twenty four concepts. These twenty four concepts were then modified by three software project managers reducing the list to twenty one. This list of twenty one concepts was compared against two studies found in literature: risk categorization framework, a framework developed by Keil et al in their research paper published in Communication of ACM¹⁰ 1998, and software project risks and their effect on outcomes by Wallace and Keil published in Communication of ACM in 2004, which were used to further modify the list of twenty one factors, based on which a list of twenty six concepts was identified. Finally, the pilot survey resulted in the addition of one more concept and a final list of twenty seven concepts was identified. Table 01 describes the filtering of concepts in the four stages to formulate the list of twenty seven concepts.

Concept identification leads to the operationalization of these concepts in to variables. The identified concepts were analyzed and converted into variables. There were two main kinds of variables identified; independent variables and dependent variables. Dependent variable of the study was identified as “Software development failures”. Four main independent variables were identified; customer mandate, scope and requirements, execution, and environment. The twenty seven concepts identified were divided among these four quadrants and used to explain the four variables. Customer mandate consists of four factors; communication between the development team and users, change management

⁷Phenomena, which directly cause the factors to occur.

⁸Factors which affect software development projects to fail.

⁹Industry professionals are conceptualized as people working in software development industry with five years of working experience and have worked in more than two software development companies conducting software development related work.

¹⁰Communication of ACM is the monthly journal of association for computer machinery. This was launched in 1957 and is considered one of the main computer related journals in the world.

(customer side), lack of top management commitment (customer side) and lack of user participation, while scope and requirements consists of five factors; misunderstanding user requirements, changing user requirements, poorly defined project scopes, incorrect or conflicting user requirements, and undefined project success criteria. Execution consists of fifteen factors; lack of skilled staff, poor management skills, use of incorrect modelling techniques, insufficient budgets, bypassing lifecycle stages when running short of time or when considered not that important, lack of commitment of team members, inadequate testing, high employee turnover, lack of training of staff, lack of proper quality standards, lack of skilled staff, insufficient research, lack of proper documentation, lack of industry/domain knowledge and communication between members of the development team with environment quadrant containing three factors; unstable organizational environment, corporate politics with negative effect on project and resources shifted from the project due to changes in organizational priorities.

Variables identified in the operationalization phase were used to develop a questionnaire for data collection. Conformity of the questionnaire to the objectives was of paramount importance and the entire design process was guided by the two objectives to gain high validity and reliability to the questionnaire. When designing the questionnaire, care was taken so that every question led to measure a certain variable or to get data relating to a variable. Furthermore, all questions were developed to be single directional¹¹ in order to enable smooth analysis of the collected data. Questionnaire designed focused on making the questions as simple as possible and to explain the needed information clearly to the respondent. Although the clarity of the questions is not emphasized due to the method of data collection being an interview based questionnaire, the clarity and the descriptiveness of the questions were maintained.

Operationalization divided the twenty seven concepts identified into four main concepts; customer mandate, scope and requirements, execution, and environment. The questionnaire was also designed in terms of this segmentation with the inclusion of four main sections to represent the four quadrants; customer mandate, scope and requirements, execution and environment. These sections included questions for each of the factors identified and included inside each of the sections. A single factor was represented by two questions in the questionnaire. First question was used to ascertain if the respondent agreed that the particular factor was a cause in software development failures in the respondent's organization. Five factor Likert scale, a famous attitudinal scale, was used to measure the responses of the first question with five options being given to the respondent; strongly agree, agree, neutral, disagree, and strongly disagree. The second question was designed to get the feedback of respondents who selected either strongly agree or agree in the first question. Second question asks the respondent to list down the causes for the particular factor to occur in organizations. Four options are given as selections, and a fifth option is given for respondents who think that the reason is not included in the questionnaire to describe their perceived reasons. The questionnaire had fifty four questions with each of the twenty seven factors having two questions each.

¹¹Negative questions were not used.

Table 01: Four Step Concept Identification Process

Step 1 - (24 factors identified)	Step 2 - (21 factors identified)	Step 3 - (26 factors identified)	Step 4 - (27 factors identified)
Lack of proper Communication between stakeholders	Communication between development team and users	Communication between development team and users	Communication between development team and users
Lack of proper documentation	Communication between the team	Communication between the team	Communication between the team
Use of wrong technologies	Lack of proper documentation	Lack of proper documentation	Lack of proper documentation
Lack of skilled staff	Use of wrong technologies	Use of wrong technologies	Use of wrong technologies
Misunderstanding user requirements	Lack of skilled staff	Lack of skilled staff	Lack of skilled staff
Lack of teamwork	Misunderstanding user requirements	Misunderstanding user requirements	Misunderstanding user requirements
Changing User requirements	Changing User requirements	Changing User requirements	Changing User requirements
Poor Management skills	Poor Management skills	Poor Management skills	Poor Management skills
Change management (customer side)	Change management (customer side)	Change management (customer side)	Change management (customer side)
Coordination between stakeholders	Use of incorrect modeling techniques	Use of incorrect modeling techniques	Use of incorrect modeling techniques
Use of incorrect modeling techniques	Lack of top management commitment (customer side)	Lack of top management commitment (customer side)	Lack of top management commitment (customer side)
Lack of top management commitment (customer side)	Insufficient budgets	Insufficient budgets	Insufficient budgets
Insufficient budgets	Lack of industry knowledge	Lack of industry knowledge	Lack of industry knowledge
Lack of industry knowledge	Bypassing lifecycle stages	Bypassing lifecycle stages	Bypassing lifecycle stages
Poor prioritization of tasks	Commitment of team members	Commitment of team members	Commitment of team members
Bypassing lifecycle stages	Poorly defined project scopes	Poorly defined project scopes	Poorly defined project scopes
Lack of commitment of team members	Insufficient research	Insufficient research	Insufficient research
Poor monitoring and control of (upper) management on the status progress of the project	Inadequate testing	Inadequate testing	Inadequate testing
Poorly defined project scopes	High employee turnover	High employee turnover	High employee turnover
Insufficient research	Lack of training of staff	Lack of training of staff	Lack of training of staff
Inadequate testing	Lack of proper quality standards	Lack of proper quality standards	Lack of proper quality standards
High employee turnover		Lack of user participation	Lack of user participation
Lack of training of staff		Incorrect/conflicting requirements	Incorrect/conflicting requirements
Lack of proper quality standards		Undefined project success criteria	Undefined project success criteria
		Unstable organizational environment	Unstable organizational environment
		Internal corporate politics	Internal corporate politics
		Resource allocation	

Source: Author constructed

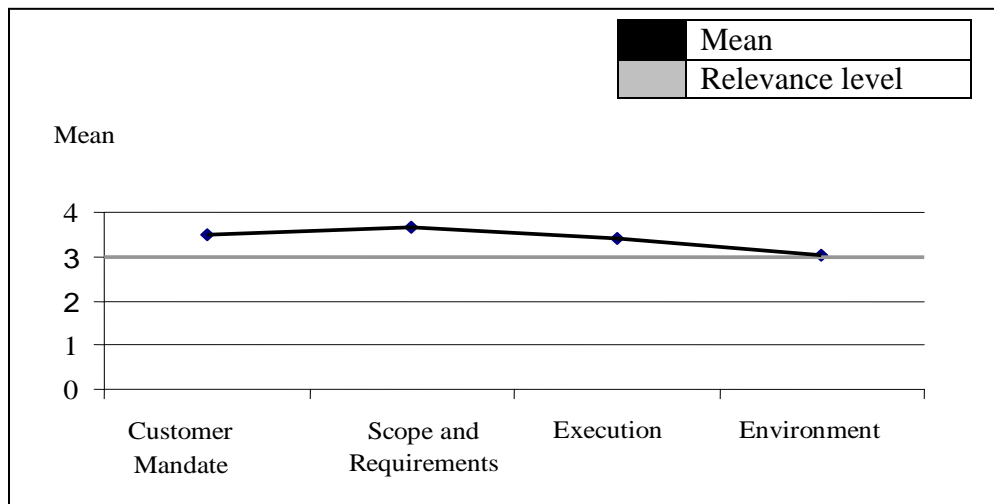
Unit of analysis was taken as organizations, aligning with the objective of finding the factors which affect software development failures in Sri Lankan software companies. Target population was identified as the set of software development companies in Sri Lanka. Only primary data were used, where data was collected in the field using an interview based questionnaire in a non-contrived environment. Data were gathered from twenty five software development companies in Sri Lanka who are members of the software exporters' association.

Data analysis was done after all data were collected and entered in to SPSS (version 13.0). Information was represented in SPSS in a meaningful and correct format to facilitate smooth analysis of the data. All data collected using the questionnaires were of the type Ordinal, and, representation of these data in SPSS was done, so that a factor will be represented by a single variable in SPSS. The questions used to query the relevance of the factor used the five point Likert scale and the scale values were represented as Strongly Agree – 5, Agree - 4, Neutral – 3, Disagree – 2, and Strongly Disagree – 1. The questions ascertaining the causes of the factors were represented by five variables per factor in SPSS. Each option in the questions was represented by a variable in SPSS and each of this contained a Boolean value (1,0); if the respondent selected a particular option as being a cause for a certain factor, it was represented by as one (1) in SPSS, and if the respondent did not select an option, it was represented by a zero (0).

ANALYSIS

The four quadrants, customer mandate, scope and requirements, execution and environment were all considered important in software development failures in Sri Lankan software companies. When analysing the mean values¹² of the relevant quadrants, it is clear that all four quadrants were important in terms of software development project failures (Figure 01). The environmental quadrant is the least important with a mean value of 3.04, while the scope and requirements quadrant had the highest mean value of 3.66. Even though scope and requirement quadrant was considered as the most important with a mean value of 3.66, the mean table alone did not show us the exact picture of the result since execution quadrant had fifteen factors and there were a few factors like lack of a sufficient budget which got a very low approval rating (2.76 mean value for factor) as a factor in software development failures, while factors such as the lack of project management skills of project managers got very high ratings (3.92 mean value for factor).

Figure 01: Summary of the Four Quadrants



Source: Author constructed

¹²Mean values of over three were considered as the factor being important in terms of software development failures.

When analysing the importance of factors for software development failures, it is clear that misunderstanding of user requirements is seen as the most important factor in software development failures (factor mean value of 4.0). Eighty-eight per cent of the respondents either agreed or strongly agreed that this was a factor in software development failures, while only 8% thought otherwise. Lack of proper communication between team members and Incorrect and conflicting user requirements, and Lack of domain knowledge of the team members were seen as the main causes for misunderstanding user requirements. Another important factor was Poor project management skills of project managers. This had factor mean value of 3.94 and 80% of the respondents thought that this was a factor in software development project failures in Sri Lanka. Lack of planning and poor project management knowledge of managers was seen as the main causes of this factor. Lack of communication between team members and poorly defined project scopes were also seen as important factors with high mean values, while factors, such as Internal corporate politics and high employee turnover were regarded less important relatively. There were two factors which had mean values less than 3.00: Lack of a sufficient budget and Lack of a stable environment in the company were given mean values 2.76 and 2.72. This is an important conclusion, especially when we consider the economic situation¹³ of the country. It is clear that monetary problems or the stability of the companies do not figure as being important in factors of software development failures in Sri Lanka. Table 02 defines the list of factors and causes of these factors listed according to importance measured by its mean.

Table 02: Factor and Cause Summary of the Twenty Seven Factors

Factor	Mean	Main Cause
Misunderstanding of user requirements	4.00	Lack of proper communication between team members and customer
Poor project management skills of project managers	3.92	Poor project management knowledge of managers
Lack of communication between team members	3.88	Deficiencies in the communication mechanism in the company
Poorly defined project scopes	3.84	Lack of proper planning
Lack of documentation	3.64	Low priority given to documentation and documentation ignored when tight deadlines
Incorrect or conflicting user requirements	3.64	Customer not comprehending his/her requirements properly
Lack of change management in user side	3.60	Lack of knowledge in change management
Insufficient software testing	3.60	Lack of time for testing
Lack of management commitment from customer side	3.56	Not understanding the extent of the implications of the system
Use of wrong technologies	3.52	No technical feasibility study done

¹³Economic indicators like inflation rate and exchange rate fluctuations suggest that the economy is in a recession. Furthermore, the security situation in the country also paints a bleak picture of the economy and its stability.

Skill level of staff members	3.52	No trained staff for the required technologies
Dynamic user requirements	3.52	Customer not certain of the requirements
Lack of user participation	3.44	Problems in the customer organization and User involvement not integrated to the project plan
Lack of training for staff	3.40	Lack of emphasis shown on training
Lack of industry knowledge	3.40	Domain new to the team
Incorrect modeling techniques	3.36	Formal modeling techniques not used by the company
Communication between the development team and users	3.36	Deficiencies in the communication mechanism between users and the development team
Undefined success criteria	3.32	Poor project management
Lack of proper quality standards	3.32	Time constraints
High employee turnover	3.32	Lack of a good culture in the company
Internal corporate politics	3.24	Poor management skills of managers
Insufficient research done on technologies	3.24	No dedicated resources for R&D
Resources being shifted from the project	3.12	Lack of resources in other projects
By-passing development life cycle stages	3.12	Time constraints
Lack of commitment of the development team	3.04	Salary deficiencies and overworked employees
Lack of a sufficient budget	2.76	Allocating less money than actually needed
Lack of a stable environment in the company	2.72	Uncertainty about the future survival of the company

Source: Author constructed

Poor management practices, time constraints, the inability to comprehend the exact requirements of the software to be developed, and the lack of communication were seen as the main causes of twenty seven factors of software development failures.

Customer mandate quadrant found the lack of change management practices in the customer organization and communication gap between the development team and users as being the main causes, while the Scope and requirement quadrant emphasized that the inability to comprehend the exact requirements of the software to be developed as being the main cause. Identifying and comprehending the requirements properly was considered as an essential element in terms of software development failures and misunderstanding of requirements was also ranked the number one factor of software development failures. This implies that misunderstanding of user requirements is not only a major factor but also a cause for many other factors. In the execution quadrant, time constraints were seen as the main cause for the risk factors. It was found that when under tight time constraints, the

managers tend to avoid some important stages in the life cycle stages¹⁴ and these cause software development project failures. Environment quadrant found that internal corporate politics and shifting of resources was the main cause for software development failures and these factors also indirectly lead to poor management practices as being the cause. Table 3 explains the factor and cause summary of each of the four quadrants according to the importance of the factors for software development project failures in Sri Lankan software development companies.

Table 03: Quadrant-wise Factor and Causes Summary

Quadrant / Factor	Main Cause/s	Mean	<= Neutral	> Neutral
<i>Customer Mandate</i>				
Lack of change management in user side	Lack of knowledge in change management	3.60	10	15
Lack of management commitment from customer side	Not understanding the extent of the implications of the system	3.56	10	15
Lack of user participation	Problems in the customer organization and User involvement not integrated to the project plan	3.44	11	14
Communication between the development team and users	Deficiencies in the communication mechanism between users and the development team	3.36	13	12
Quadrant mean		3.49		
<i>Scope and Requirements</i>				
Misunderstanding of user requirements	Lack of proper communication between team members and customer	4.00	3	22
Poorly defined project scopes	Lack of proper planning	3.84	6	19
Incorrect or conflicting user requirements	Customer not comprehending his/her requirements properly	3.64	10	15
Dynamic user requirements	Customer not certain of the requirements	3.52	11	14
Undefined success criteria	Poor project management	3.32	13	12
Quadrant mean		3.66		

¹⁴Software development life cycle stages.

<i>Execution</i>				
Poor project management skills of project managers	Poor project management knowledge of managers	3.92	4	21
Lack of communication between team members	Deficiencies in the communication mechanism in the company	3.88	5	20
Lack of documentation	Low priority given to documentation and Documentation ignored when tight deadlines	3.64	7	18
Insufficient software testing	Lack of time for testing	3.60	7	18
Use of wrong technologies	No technical feasibility study done	3.52	9	16
Skill level of staff members	No trained staff for the required technologies	3.52	9	16
Lack of industry knowledge	Domain new to the team	3.40	10	15
Lack of training for staff	Lack of emphasis shown on training	3.40	11	14
Incorrect modeling techniques	Formal modeling techniques not used by the company	3.36	12	13
High employee turnover	Lack of a good culture in the company	3.32	12	13
Lack of proper quality standards	Time constraints	3.32	12	13
Insufficient research done on technologies	No dedicated resources for R&D	3.24	12	13
By-passing development life cycle stages	Time constraints	3.12	13	12
Lack of commitment of the development team	Salary deficiencies and overworked employees	3.04	15	10
Lack of a sufficient budget	Allocating less money than actually needed	2.76	17	8
Quadrant mean		3.40		
<i>Environment</i>				
Lack of a stable environment in the company	Uncertainty about the future survival of the company	2.72	20	5
Internal corporate politics	Poor management skills of managers	3.24	13	12
Resources being shifted from the project	Lack of resources in other projects	3.12	14	11
Quadrant Mean		3.04		
Lack of a stable environment in the company	Uncertainty about the future survival of the company	2.72	20	5

Internal corporate politics	Poor management skills of managers	3.24	13	12
Resources being shifted from the project	Lack of resources in other projects	3.12	14	11
Quadrant mean		3.04		

Source: Author constructed

According to Table 03, all four factors in the customer mandate quadrant, lack of change management in user side, lack of management commitment from customer side, lack of user participation and Communication between the development team and users were all treated as being of important by the respondents in terms of factors affecting software development failures in Sri Lanka. Mean values are more than three for all factors, implying that they are considered by respondents as being important factors in software development project failures in Sri Lankan software development companies. Further analysis based on the total number of responses given for as agreed and strongly agreed against the number of responses given for neutral, disagreed and strongly disagreed defines that the Lack of change management in user side, Lack of management commitment from customer side, and Lack of user participation are considered by more than 50% of the respondents as either agreed or strongly agreed in terms of importance in software development failures, while Communication between the development team and users is considered by more than 50% of the respondents as either neutral, disagree or strongly disagree in terms of importance for software development failures.

When analysing the mean values of the responses for the five factors in the scope and requirements quadrant, we can see a minimum mean value of 3.32 for undefined success criteria and a maximum mean value of 4.00 for misunderstanding user requirements. Since all five factors are over the mean value of three, we can conclude that all factors are considered as important when considering software development failures. We can analyse the importance of these factors furthermore if we analyse this result based on the total number of responses given for as agreed and strongly agreed with the number of responses given for neutral, disagreed and strongly disagreed. If the user selects either agreed or strongly agreed, the respondent can be treated as agreeing that the relevant factor affects the software development project failures in Sri Lanka. It can be seen that misunderstanding user requirements had most responses above neutral, while undefined success criteria had the least responses. In fact the order of the factors when sorted according to the number of responses above neutral is same as in the mean value. But the important factor here is that undefined success criteria were considered important by less than 50% of the respondents. Therefore, the importance of undefined success criteria can be questioned although the mean value of the factor is above three. Therefore, we can conclude that in the scope and requirements quadrant, while all five factors are important for software development failure, misunderstanding user requirements is the main factor which affects the software projects failures, while undefined success criteria are the least important factor. Furthermore, undefined success criteria are believed by less than 50% as being important for software development failures.

Time constraints are seen as the main reason for the causes of the factors in the execution quadrant. Most software projects are under tight time constraints and when the time constraints are exceeded, the project managers, while trying to deliver the product quickly to the customer, make many mistakes. When the mean values of factors in quadrant three are analysed, it is observed that it varies between 3.92, poor project management skills

and 2.76, lack of a sufficient budget. This gives a fairly diverse list of factors varying according to importance. According to the mean values, the most important factor is the lack of project management skills of project managers, and the least important is the budgetary limitations. Lack of a sufficient budget is the only factor with less than three mean values. If these factors were analysed based on the total number of responses given for as agreed and strongly agreed with the number of responses given for neutral, disagreed and strongly disagreed, the most important factor becomes the lack of communication between team members while the least important factor remains the lack of a sufficient budget. The interesting factor we can see from this is, three factors by-passing life cycle stages; lack of commitment of the development team and the lack of a sufficient budget have less than 50% believing that they are important factors in software development failures in Sri Lankan software companies.

Environment quadrant has the least mean value out of the four quadrants. The fact that the mean value is 3.04 implies that although it is the lowest among the four quadrants, it is still important in terms of software development failures. Poor management skills and practices are seen as the major cause which affects the environmental factors in a software project. Internal corporate politics and resources shifting from projects are considered as important by respondents; surprisingly a lack of stable environment in the company is seen as not important relatively, which implies that people don't compromise their work even if the stability of their jobs are at risk. Only 20% said that the lack of a stable environment in the company had an effect on software development failures (strongly agree or agree). This might be attributed to the fact that people work harder when there is a risk to the company in order to save the company and their jobs. Nearly half the people think that internal corporate politics are a major factor in software development failures, while only 28% disagrees. Most people attribute this to poor management skills of the managers or the lack of motivation among team members which might also be a product of the poor management skills of the managers. Poor management skills among managers in the software field might be directly attributed to the fact that most of the teams, if not all, are led by technical people with little or no management experience. Shifting of resources is considered by nearly half the respondents as being an important issue while only 32% believe this is not an issue. Many believe resources are shifted because of lack of resources while poor management skills of managers are also attributed for this issue. The important thing here is only two respondents believed that lack of funds were to blame for this. This implies that lack of resources is not directly tied with budgets which again direct us to bad employee management policy which in turn directs us to poor management.

SUMMARY AND CONCLUSIONS

This study focused on ascertaining the factors which affect software development project failures in Sri Lankan software development companies and to figure out the causes of these factors, in line with the two objectives defined. Overall view of the identified factors affecting software development project failures in Sri Lankan software development companies implies that poor management practices and the lack of comprehension of requirements¹⁵ are the two main factors which cause software development projects to fail. The knowledge of the software development project managers in terms of project management practices is seen as an essential component of success while the ability of the software development team to comprehend the customer requirements also features as an integral part of a successful software development project.

¹⁵ The functionality that the software product should conform to.

With respect to the first objective; misunderstanding of user requirements, poor project management skills of project managers, lack of communication between team members and, poorly defined project scopes were identified as the top four factors which affect software development failures, while lack of a stable environment in the company and lack of a sufficient budget were seen as the two least important factors.

In accordance with the second objective; lack of proper communication between team members and customer, poor project management knowledge of managers, and the lack of proper planning were seen as the main causes of these factors of software development failures. The important observation here is that some factors, such as misunderstanding user requirements were identified as causes for the origination of other factors emphasizing the importance of these factors to the software development process. It can be implied that the software development companies should focus on improving project management practices, the timely delivery of software giving efficient time estimates, improve requirement gathering process and improve the communication mechanisms both internally and externally to reduce the occurrence of the factors which contribute to software development project failures.

When analysing the findings using the risk categorization framework, it can be concluded that factors in customer mandate, scope and requirements, execution of the development process and the environment were all considered as important in terms of factors which affect software development project failures in Sri Lankan software development companies.

Factors relating to scope and requirements quadrant were seen by respondents as the most important in terms of software development project failures in Sri Lankan software development companies. Misunderstanding of user requirements was considered the highest ranked factor which affects software development project failures. It was emphasized that software development companies should focus on fully comprehending the requirements of the customer and developing the software accordingly. Three causes, lack of proper communication between team members and customer, incorrect and conflicting user requirements, and lack of domain knowledge of the team members were identified by respondents as the three main causes that lead to misunderstanding of user requirements. These three causes identified were also identified as factors of software development failures. Incorrect and conflicting user requirements was ranked as the 6th most important factor, Lack of domain knowledge of the team members ranked 15th and lack of proper communication between team members and customer ranked 17th. Therefore, it is clear that the project managers have to focus on improving communication between the customer and the development team and eradicate incorrect user requirements from being communicated to the development team. Also, it is clear that the project managers should formulate strategies to improve the domain knowledge of the development team. Further, three factors; poorly defined project scopes, dynamic user requirements and undefined success criteria were also considered important in terms of software development failures in the scope and requirements quadrant.

Lack of change management in the customer organization was seen as the most important factor in the customer mandate quadrant. Deficiencies in change management practices are seen as the main factor from the customer organization which will affect software development project failures. This finding illustrates that the change management techniques are extremely important when installing new software in a company since most software packages will change the work-flow of the company and the employees have to change their working methods in order to get the expected results from the software. Lack of knowledge in change management and the lack of emphasis or importance given to change

management were perceived as being the two main causes of not having proper change management strategies in the customer organization. Lack of management commitment from customer side, lack of user participation and communication between the development team and users were also considered as important factors which affect software development failures.

Poor project management skills were seen as the most important factor affecting software development failures in the execution quadrant. It is implied that the main factor affecting software development failures in the development process (execution) is the poor project management skills of project managers. Lack of planning, and poor project management knowledge of managers were seen as the main two causes of poor project management skills. Lack of communication between team members was also seen as one of the important factors in software development failures. The respondents saw deficiencies in the communication mechanism in the company as the main cause for the problems in communication. Further to these two factors; lack of software documentation, software testing and the knowledge and skill level of staff were also seen as major factors affecting software development failures.

Environmental factors were treated as the least important in terms of factors that affect software project failures with lack of a stable environment in the company ranking as the lowest among the selected factors. The highest ranked factor in the environment quadrant was the internal corporate politics, which implies that internal corporate politics is the most important factor outside the software development project¹⁶ that will affect software development project failures. Poor project management skills and the uncertainty surrounding the future existence of the company were seen as the main causes of the factors in the environmental quadrant.

REFERENCES

- Addison, Vallabh, T., Seema (2002). Controlling Software Project Risks, An Empirical Study of Methods Used By Experienced Project Managers. Proceedings of SAICSIT.
- Amaratunge, S., (2007) Subject Manual of Research Methods.
- Anthony, P., D'Costa. (2002). Software Outsourcing and Development Policy Implications: An Indian Perspective. International Journal of Technology Management, vol., 24, Numbers 7-8 /, 705 – 723.
- Bacarini, Salm, G., Love, P. (2004). Management of Risks in IT Projects. Industrial Management and Data Systems, vol., 104, number 4.
- Board of Investment of Sri Lanka (BOI). Web site www.boi.lk.
- Boehm, B.W. (1991). Software Risk Management: Principles and Practices. Institute of Electrical and Electronics Engineers (IEEE).
- Boehm, B.W. (May 1991). Spiral Model of Software Development and Enhancement. Institute of Electrical and Electronics Engineers (IEEE).
- Brooks, F.P.Jr., (April/1987). No Silver Bullet: Essence and Accidents of Software Engineering. IEEE Computer; 20, 4, 10-19.
- Carr, Marvin, J., Suresh, L., Konda, Monarch, I., Ulrich, C., Walker, C.F. (June 1993). Taxonomy Based Risk Identification. CMU/SEI-93-TR-6, Software Engineering Institute, Carnegie Mellon University.
- CHAOS. The Standish Group Report of 1995.

¹⁶Factors external to software development projects, such as the economic condition of the country or the financial situation of the software development company.

- Clemons, E.K. (January 1991). Investments in Information Technology. Communication of ACM vol., 34, no. 1.
- Hartman, F., Ashrafi, R.A. (2002). Project Management in the Information Systems and Information Technologies Industries. Project Management Journal, Vol. 33 No. 3, pp. 4-14.
- Johne, R., Lyytinen, K., (February 2000). Components Of Software Development Risk: How To Address Them ? A Project Manager Survey. IEEE, Transactions on Software Engineering, 26 (2).
- Keil, M., Cule, P., Lyytinen, K., Schmidt, R. (Nov.1998). A Framework for Identifying Software Project Risks. Communication of ACM 41, 11, 76–83.
- Kontio, J. (2002). Risk Management: What went wrong and what is the new agenda. 7th European Conference on Software Quality, Helsinki, Finland.
- Lacity, C., Willcocks, L., Feeny, D.F., (1996). The Value Of Selective IT Sourcing. Sloan Management Review.
- Laudon, K.C., Laudon, J.P. (2004). Management Information Systems : Managing the Digital Firm (Eighth Edition). India: Pearson Education (Singapore) Pvt. Ltd.
- Lyytinen, K., Mathiassen, L., Ropponen, J. (1996). A Framework For Software Risk Management. Scandinavian Journal of Information Systems, 8(1):53–68.
- May, L.J. (July 1998). Major Causes Of Software Development Project Failures. Cross Talk, the Journal of Defence Software Engineering.
- Murthi, S. (September/October 2002). Preventive Risk Management for Software Projects. IT Professional, vol., 04, number 5.
- Opatha, H.H.D.N.P., (2006) Subject Manual of Research Methods.
- Sherer, A., Susan. (1995). The Three Dimensions of Software Risk. Proceedings of the 28th Annual Hawaii International Conference on System Sciences.
- Wallace, L., Keil, M. (April 2004). Software Project Risks and Their Effect on Outcomes. Communication of ACM vol., 47, number 4.

CAUSALITY TESTING AND WAGNER'S LAW: THE CASE OF SRI LANKA

M. A. K. Sriyalatha¹

ABSTRACT

This paper presents an empirical investigation into the validity of Wagner's Law for Sri Lanka over the period 1959-2010. The research methodology employed includes testing for unit root, with the Augmented Dickey-Fuller (ADF) test, the use of a Vector Autoregression (VAR) model for the implementation of the Granger causality test, and cointegration tests according to Johansen-Juselious. The cointegration tests indicate that there is a long run relationship between public expenditure (TE) and Gross Domestic Product (GDP), and the ratio of total government (public) expenditure to gross domestic product (TE/GDP) and GDP (First and Six version of Wagner's Law). Both eigenvalue and trace tests indicate that there is one cointegrating vector. Although the results reported herein do not reveal uniformity among the six versions of Wagner's Law, the results show an apparent prevalence of the direction of causality from growth of GDP to public expenditure. For the first three versions of Wagner's Law and the fifth version appear that Granger- causality runs one-way from GDP to TE, GDP to Total Consumption Expenditure (TCE), per capita gross domestic product (GDP/POP) to TE, and (GDP/POP) to per capita government expenditure (TE/POP), respectively. According to empirical findings of this study, it is possible to say that the growth of public expenditure in Sri Lanka is depended on and determined by economic growth as Wagner's Law.

INTRODUCTION

The relationship between public expenditure (government expenditure) and economic growth has attracted considerable interest among economists and policy makers since recently. Public expenditure is a key instrument of state intervention to achieve several policy goals. But there is a debate about whether the government should intervene in the market in order to correct the activities done by market forces. The classical economists disagree with the government intervention and believe that market forces swiftly bring the economy to long-run equilibrium through adjustment in the labor market. Keynesian economists identified the use of fiscal policies to boost economic activity in the time period of recessions. They prescribe expansionary fiscal policies to avoid long recessions. They identified the government expenditure as an exogenous policy instrument.

Classical and Neoclassical judgments of fiscal policies are ineffective on the basis of crowding-out phenomenon. This concept explains that when public expenditure rises,

¹ Senior Lecturer, Department of Business Economics, University of Sri Jayewardenepura, Sri Lanka. Email: kumudunis1@gmail.com

public goods are substitute for private goods. Then, it leads to lower the private expenditure on education, health, transportation, and other goods and services. Whenever, the government borrows heavily for spending, it makes pressures on the credit market, and, as a result, interest rate goes up. Increased interest rate reduces the private investment. However the government intervention in the economy is beneficial because it leads to correction of the resource allocations. Sometimes, it may delay or slow down the growth of economic activities. For example, competition between the less efficient public sector and the private sector in the credit market often leads to an increase in interest rate. As a result of this situation, investment as well as economic growth goes down. At the same time tax imposed by the government can affect the market prices and resource allocation process. Although government actions may also slow down the economic activities, there are arguments for the importance of government intervention in the market to correct the activities done by market forces.

Thus, the growth of public expenditure as a proportion of Gross National Product (GNP) or Gross Domestic Product (GDP) has claimed considerable attention from economists, who have mainly focused their attention on the analysis of the reasons for the growth of public expenditure. Therefore, the specific objective of this research is to see if there is a causal relationship between government expenditure and economic growth.

Due to different definitional problems, limitations, etc. the study was limited to data from the period between 1959 and 2010. The data are also examined in per capita terms and some data used in the analysis are in the form of ratios. The data are taken from the World Development Indicators (WDI) 2010 CD-ROM and Central Bank Annual reports in Sri Lanka. In the study, all variables are in natural logarithms of the variables and thus, first difference of the variable gives the growth rate. Using the econometric methodology, it is expected to study the Granger causality and long-run relationships of the variables.

THEORETICAL BACKGROUND

For a long time, there has been no general theory of determination of public expenditure. However, over one hundred years ago, a simple model of determination of public expenditure was developed by Adolph Wagner. This model can be identified as the oldest and the most cited model that explains public expenditure growth. After the publication of Wagner's works in 1958, Wagner's Law has become very popular in academic circles. And it has been tested by many researchers. For example, on the basis of his findings, Bird (1971) formulated a law of expanding state expenditure; it highlighted the importance of growing government activity and expenditure as a main feature of progressive states. Wagner's Law basically examines the long-run trends in public expenditure and economic growth, where economic growth leads to greater public sector expansion. According to Wagner (1883), when the economic activity grows, there is a tendency for the government activities to increase in the long-run. The model explains that in the process of economic development, public expenditure tends to increase at a faster rate than that of national output. Three reasons are given to justify this hypothesis as follows:

- i. Social activities of the state

Wagner assumed that private sector monopolies would not pay attention to the social needs of society as a whole and therefore, those needs should be fulfilled by the public corporations.

- ii. Administrative and protective actions

Further he explained that if private sector companies became larger and larger, the economy would become unstable. The individual companies create some problems and those would adversely affect the society as a whole.

iii. Welfare functions

Finally, government would need to expand the provision of some economic and social welfare activities to the society as a whole.

There are at least six broad versions of Wagner's Law, which define the relationship between economic growth and public expenditure. There is no formal rule to decide which one is the best and the easiest to use in testing the model. Therefore, any researcher should consider six versions of the law to postulate the causality direction. The six versions of the Wagner's Law are summarized in logarithm form in Table 01.

Table 01: Six Versions of Wagner's Law

Functional Form	Version
$LTE = a + bLGD$	Peacock-Wiseman (1968)
$LTCE = a + bLGD$	Pryor (1969)
$LTE = a + bLGD/POP$	Goffman (1968)
$L(TE/GDP) = a + bLGD/POP$	Musgrave (1969)
$L(TE/POP) = a + bLGD/POP$	Gupta (1967)
$L(TE/GDP) = a + bLGD$	Mann (1980)

Source: Based on the Wagner's Law

Where TE is the total government expenditure, GDP is the gross domestic product, TCE is the total government consumption expenditure, POP is the population of the country, GDP/POP is the per capita gross domestic product, TE/GDP is the ratio of total government expenditure to gross domestic product, TE/POP is the per capita government expenditure. In the above table, the first version of the Wagner's Law explains that the total public expenditure is a function of GDP. The second version indicates that the total consumption expenditure is a function of GDP of the country. Next explains that the change in total public expenditure is a result of the change in per capita GDP. The forth version of Wagner's Law describes the change in per capita income leads to change in the ratio of public expenditure to national income. The fifth model explains the relationship between per capita GDP and per capita total expenditure. The last point explains that the ratio of total public expenditure to GDP is a function of national income.

LITERATURE SURVEY

This section briefly reviews some selected papers that have studied the impact of government expenditure on economic growth and relationship between government expenditure and economic growth. There have been quite a number of empirical studies analyzing the effect of public expenditure on economic growth so far. However, the results are different from one to another based on the adopted techniques and data. In most of the studies, the effect of public expenditure on economic growth rate is also inconclusive. As mentioned above, public finance studies have hypothesized the growth in public expenditure as a result of growth in national income. Macroeconomic view revealed the other way that has treated the public expenditure as an exogenous variable. In a recent study by Agell et al (1997), it is revealed that there is no relationship between the rate of economic growth and size of the public sector in terms of public expenditure. Most of the empirical studies have analyzed the effect of public expenditure on economic growth by using cross-section or panel data. Ram (1986) revealed that the government expenditure promoted economic growth.

Aschauer (1989), Barro (1991), and Easterly and Rebelo (1993) found that the government expenditures on “core infrastructure”, such as streets, highways, airports, and other public capital expenditures have the most explanatory power for private sector productivity. Devarajan et al (1993) have observed that the level of current expenditure has a significant positive effect on economic growth and the level of capital expenditure does not have any significant effect on the economic growth and it is negative. The evidence on the effect of sectoral composition of expenditure also is inconclusive. Barro (1990) indicates that growth effects of education and defense expenditure are higher. Diamond (1989) shows that there is a relationship between social sector expenditure and economic growth. Further, it is revealed that there is no evidence to conclude that the infrastructure expenditure is a significant factor in growth process.

Landau (1986) studied the impact of government expenditure on economic growth. In this study, government expenditure has been divided in to five sections: consumption, education, defense, transfers, and capital expenditure. The Study was conducted based on cross-section data for less developed 96 countries from 1960 to 1980. The results revealed that the above five sections have reported either significant negative, or insignificant positive effect on economic growth. Grier and Tullock (1989) examined the correlation between the growth of government expenditure in GDP and economic growth for 24 OCED countries and 89 other countries for the period of 1951-1980 and 1961-1980 respectively. They found that the growth of government expenditure in GDP and economic growth has a positive effect in Asian countries, but a negative one in OECD, African, and American countries. Chen et al. (2003) analyzed the proportion of public sector expenditure to GDP and economic growth rate for 09 countries from 1972 to 1992. They found that the economic growth rate decreased with increased proportion of the public expenditure to GDP. Demirbas (1999) investigated the existence of a long-run relationship between public expenditure and GNP for the period of 1950 to 1990 using the data for Turkey. He used time series aggregate data and the study revealed that there was no evidence to support the long-run relationship between public expenditure and economic growth. Krzyzaniak (1974) conducted a study for Turkey for the period of 1950 to 1969. He used regression analysis to identify the significance of public expenditure on GNP and found a statistically significant relationship between the income elasticity of public expenditure and GNP which supports Wagner’s Law.

Ziramba (2008) examined the validity of Wagner’s Law by using the causal relationship between real government expenditure and real income for South Africa for the period 1960-2006. This study revealed a long-run relationship between real government expenditure and real income. Results of the causality test showed that there was bidirectional causality. On the basis of the results, the researcher concluded that Wagner’s Law does not support in South Africa.

Although a large numbers of studies are available in public finance literature, only a few have applied modern econometric techniques. Thus, the contribution of this study to the literature on the growth of public expenditure in terms of Wagner’s Law will be in terms of a new approach. It applies recent econometrics techniques that investigate time series properties of the variables, and examine the causal relationship between economic growth and public expenditure.

METHODOLOGY AND RESULTS

The data employed for the study consist of GDP, total public expenditure, total public consumption expenditure, all in real terms from 1959 to 2010. The data are also examined in per capita terms and some data used in the analysis are in the form of ratios. In

the study, TE/GDP is the ratio of total government expenditure to GDP, as required by the various formulations of Wagner's Law. This paper studied pair wise Granger causality tests, and used the bi-variate Granger causality test. The bi-variate regression equations are given as follows:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_j y_{t-j} + \beta_1 x_{t-1} + \dots + \beta_j x_{t-j} + \varepsilon_t \quad (1)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_j x_{t-j} + \beta_1 y_{t-1} + \dots + \beta_j y_{t-j} + \mu_t \quad (2)$$

The bi-variate regression equations (1) and (2) test causality by implementing the propositions that,

- i. the future cannot cause the present or the past;
- ii. an event x can only cause y if it occurs before y ; and
- iii. the prediction of y can be made more accurate given the occurrence of x .

The Granger (1969) approach to the question of whether χ causes y is to see how much of the current γ can be explained by its past value. Further adding lagged values of χ can improve the explanation of γ . γ is said to be Granger-caused by χ if χ helps in the prediction of γ . The two-way causation is frequently the case; χ Granger cause γ and γ Granger cause χ . F-statistic is used to test the joint significance of each of the other lagged endogenous variables in the equations. The null hypothesis for the F-statistics is given as follows.

$$\beta_1 = \beta_2 = \dots = \beta_j = 0 \quad (3)$$

Cointegration and causality tests will be performed in order to recognize whether there are long run relationships among time series. In these tests, the pattern of effect of one variable on another will be tested. Before starting the cointegration and causality tests, it is essential to investigate stationarity (or non-stationary) of each time series. If a time series is non-stationary, the regression analysis done in a conventional way will produce spurious results. In this context, the first step is to examine the time series properties of the variables.

A number of alternative tests are available for testing the stationarity of time series data. The Augmented Dickey-Fuller (ADF) test has been used to test stationarity of these variables. These tests are carried out at both levels and first difference of each time series. First, the unit root test results are reported in Table 02 for the levels and their first differences.

Table 02: Results of the Unit Root Test in Level and First Difference

Variable	Level			First Difference		
	Constant	Constant, Linear Trend	Conclusion	Constant	Constant, Linear Trend	Conclusion
LGDP	2.475923	-3.446796	U. R	-	-	Not U.R.
LTCE	2.447143	-1.764483	U. R	4.069197**	4.293645**	Not U.R.
LTE	0.703712	-2.382686	U. R	6.066178**	6.814512**	Not U.R.
L(GDP/POP)	2.562523	-4.083560**	U. R in Constant	8.200747**	8.238046**	Not U.R.
				4.634343**	5.025295**	

L(TE/POP)	0.942063	-2.662244	U. R	-	-	Not U.R.
				8.210976**	8.346791**	
L(TE/GDP)	-1.472335	-1.851297	U. R	-	-	Not U.R.
				11.51026**	11.53359**	

Source: Author constructed

Notes: Augmented Dickey-Fuller (ADF) Test examines the null hypothesis of a unit root against stationary.

All critical values are at 5% significant level (MacKinnon (1996) one-sided p-values).

Significant at the 5 % confidence level is represented by **.

The results show that the ADF test statistics for the per capita gross domestic product (GDP/POP) variable exceed the critical value in absolute term in the level and all other variables are non-stationary in their levels. However, when the first differences of each variable were taken, the ADF statistics are greater than the respective critical values in absolute terms, indicating that the level variables are I (1) and all other variables are stationary.

The paper found that while GDP/POP variable is integrated of order zero I (0), the other variables are integrated of order one I (1). Next, the study conducted generalized Johansen cointegration tests to see whether the TE, GDP, TCE, and the TE/GDP have a long run relationship. The tests indicate that there is a long run relationship between TE and GDP, and TE/GDP and GDP (First and Six versions of Wagner's Law). Both eigenvalue and trace tests indicate that there is one cointegrating vector.

Table 03: Results of the Johansen Co-integration Test between GDP and TE

The null hypothesis for both the tests is $r = 0$			
Trace tests		Maximum Eigenvalue tests	
Test statistics	Critical values	Test statistics	Critical value
26.74400**	25.87211	22.45853**	19.38704
The null hypothesis for both the tests is $r \leq 1$			
Trace tests		Maximum Eigenvalue tests	
Test statistics	Critical values	Test statistics	Critical value
4.285475	12.51798	4.285475	12.51798

Source: Author constructed

Note: Critical values are at the 5% significance level. MacKinnon-Haug-Michelis (1999) p-values.

**

Significant at the 5% level.

Table 04: Results of the Johansen Co-integration Test between GDP and TCE

The null hypothesis for both the tests is $r = 0$			
Trace tests		Maximum Eigenvalue tests	
Test statistics	Critical values	Test statistics	Critical value
21.30994	25.87211	16.77117	19.38704
The null hypothesis for both the tests is $r \leq 1$			
Trace tests		Maximum Eigenvalue tests	
Test statistics	Critical values	Test statistics	Critical value
4.538769	12.51798	4.538769	12.51798

Source: Author constructed

Note: Critical values are at the 5% significance level. MacKinnon-Haug-Michelis (1999) p-values.

**

Significant at the 5% level.

Table 05: Results of the Johansen Co-integration Test between (TE/GDP) and GDP

The null hypothesis for both the tests is $r = 0$			
Trace tests		Maximum Eigenvalue tests	
Test statistics	Critical values	Test statistics	Critical value
26.74400**	25.87211	22.45853**	19.38704
The null hypothesis for both the tests is $r \leq 1$			
Trace tests		Maximum Eigenvalue tests	
Test statistics	Critical values	Test statistics	Critical value
4.285475	12.51798	4.285475	12.51798

Source: Author constructed

Note: Critical values are at the 5% significance level. MacKinnon-Haug-Michelis (1999) p-values.

**

Significant at the 5% level.

The existence of a long-run relationship between the Government Expenditure and GDP advocates that there must be Granger causality in at least one direction. In order to examine whether one variable is causally related to another, Granger (1969) introduced a concept of causality which is commonly known as, "Granger causality". This concept is based on the idea that the future cannot affect the present or the past. In a bivariate concept, if current and lagged values of 'X' improve the prediction of the future value of 'Y', then it is said that X Granger causes Y. In the present research, the causality test is carried out for the six versions of Wagner's Law. The standard F-test is used in order to determine the causal relationship between the variables. Interchanging the causal and the dependent variables in the regression equation allows a test for bi-directional causality. In the tests, causality is hypothesized to run from GDP or GDP/POP to the dependent variables, which are taking four different forms, TE, TCE, TE/GDP and TE/POP. In other words, the hypothesis that GDP causes public expenditure, requires that public expenditure does not cause GDP. The number of lags was selected using the Akaike Information Criterion (AIC). The null hypothesis is tested by using F- statistics. The results are presented in Table 6 in bivariate system of causality.

Table 06: Results of the Granger Causality Tests on the Six Versions of Wagner's Law

Null Hypothesis	F-Statistic
	Lag 1
DLOG(GDP) does not Granger Cause DLOG(TE)	15.5767*
DLOG(TE) does not Granger Cause DLOG(GDP)	2.81892
DLOG(GDP) does not Granger Cause DLOG(TCE)	4.36892**
DLOG(TCE) does not Granger Cause DLOG(GDP)	0.40412
DLOG(GDP_POP) does not Granger Cause DLOG(TE)	10.7951*
DLOG(TE) does not Granger Cause DLOG(GDP_POP)	3.22284
DLOG(GDP_POP) does not Granger Cause DLOG(TE_GDP)	0.04233
DLOG(TE_GDP) does not Granger Cause DLOG(GDP_POP)	1.78848
DLOG(GDP_POP) does not Granger Cause DLOG(TE_POP)	11.3715*
DLOG(TE_POP) does not Granger Cause DLOG(GDP_POP)	1.78848
DLOG(GDP) does not Granger Cause DLOG(TE_GDP)	0.00699
DLOG(TE_GDP) does not Granger Cause DLOG(GDP)	2.81892

Source: Author constructed

(*) (**) Rejection of the null hypothesis at 1%, and 5%, respectively and therefore, there is Granger causality.

The results in Table 06 show that there is evidence to support unidirectional causality from income to expenditure. In the short-run, the study found that the GDP/POP (per capita income) Granger causes government spending (TE) and the per capita government expenditure (TE/POP). The Gross Domestic Product (GDP) Granger causes government spending (TE) and the total government consumption expenditure (TCE). Hence, these results are consistent with Wagner's Law. According to empirical findings of this study, it is possible to say that the growth of public expenditure in Sri Lanka is depended on and determined by economic growth as Wagner's Law.

CONCLUSIONS

In this research, Wagner's Law was tested using the aggregate data for Sri Lanka for the period of 1959 to 2010. First this paper looked at the time series properties of the data, i.e. conducted the unit root test. The test indicated that both the public expenditure and GDP variables are non-stationary in levels except (GDP/POP), but stationary in first differences. Though the variables are in the different order of integration, this study does not use the per capita gross domestic product (GDP/POP) for testing cointegration relationships. The study found that while the GDP/POP variable is integrated of order zero $I(0)$, the other variables are integrated of order one $I(1)$. The study conducted generalized Johansen cointegration tests to see whether the total government expenditure (TGE), the gross domestic product (GDP), the total government consumption expenditure (TCE), and the ratio of total government expenditure to gross domestic product (TE/GDP) have a long run relationship. Both eigenvalue and trace tests indicate that there is one cointegrating vector. Next this paper carried out Granger causality test for the short-run relationship between the

variables. Granger causality test found that the growth of GDP contributed to the growth of public expenditure.

Although the results reported herein do not reveal uniformity among the six versions of Wagner's Law, the results show an apparent prevalence of the direction of causality from growth of GDP to public expenditure. For the first three versions of Wagner's Law and the fifth version appear that the Granger- causality runs one-way from DLGDP to DLTE, DLGDP to DLTCE, DL(GDP/POP) to DLTE, and DL(GDP/POP) to DL(TE/POP), respectively. Thus, results show that the growth of GDP contributes to the growth of public expenditure in Sri Lanka. The policy implications are simple. Policies that encourage gross domestic product are likely to contribute to public expenditure. Thus, if the past behavior is any guide, further increases in the economic growth are likely to be translated into higher public expenditure in Sri Lanka.

REFERENCES

- Agell, J., Lindh, T., and Ohlsson, H. (1997) "Growth and the Public Sector: a Reply", *European Journal of Political Economy*, 15 (2), 359-66.
- Aschauer, D.A. (1989) Is Public Expenditure Productive?, *Journal of Monetary Economics*, 23, 177-200.
- Barro, R. J. (1990) Government Spending in a Simple Model of Endogenous Growth, *Journal of Political Economy* 98 (5), 103-05.
- Barro, R. J. (1991) Economic Growth in a Cross-section of Countries, *Quarterly Journal of Economics* 106, 407-43.
- Bird, R. M. (1971) "Wagner's Law of Expanding State Activity", *Public Finance*, 26, 1-26.
- Chen, D. Y., Tseng, T. Wu, T., and Chang, W. (2003) "The Relationship between Public Expenditure and Economic Growth – An International Comparative study", National Chiao Tung University, Taiwan.
- Demirbas, S. (1999) "Co integration Analysis- Causality Testing and Wagner's Law: The case of Turkey, 1950-1990" Presented at the annual meeting of the European Public Choice Society in Lisbon.
- Devarajan, Shantayanan, Vinaya Swaroop, and Hengfu Z., (1993) *What do Governments buy? The Composition of Public Expenditure and Economic Performance*. The World Bank Working Paper 1082, Washington, DC.
- Diamond, J. (1989) *Government Expenditure and Economic Growth: An empirical investigation*. IMF Working Paper 89/45, Washington DC.
- Easterly, W. and Rebelo, S. (1993) Fiscal Policy and Economic Growth, *European Economic Review*, 48, 285-306.
- Goffman, I.J. (1968) "On the Empirical Testing of Wagner's Law: A Technical note", *Public Finance*, 23, 359-64.
- Grier, K. and Tullock, G. (1989) An Empirical analysis of Cross-national Economic Growth 1951-1980, *Journal of Monetary Economics*, 24, 259-76.
- Gupta, S. (1967) "Public Expenditure and Economic Growth: A Time Series Analysis", *Public Finance*, 22, 423-61.
- Granger, C.W.J. (1969) "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods, *Econometrica* 37(3), 424-38.
- Krzyzaniak, M. (1974) "The Case of Turkey: Government Expenditures, the Revenue Constraint, and Wagner's Law", *Growth and Change*, 5, 13-19.

- Landau, D. (1986) Government and Economic Growth in the Less Developed Countries: An Empirical Study for 1960-1980, *Economic Development and Cultural Change*, 35(1), 35-75.
- Mann, A.J. (1980) "Wagner's Law: An Econometric Test for Mexico 1925-1976", *National Tax Journal* 33, 189-201.
- Musgrave, R. A. (1969) *Fiscal Systems*. New Haven and London: Yale University Press.
- Peacock, A.T. and Wiseman, J. (1979) "Approaches to the Analysis of Government Expenditure Growth", *Public Finance Quarterly*, 7, 3-23.
- Pryor, F.L. (1969) *Public Expenditures in Communist and Capitalist Nations*. London: George Allen and Unwin Ltd.
- Ram, R. (1986) Government Size and Economic Growth: A new Framework and Some Evidence from Cross-section and Time Series Data. *The American Economic Review* 76(1), 191-203.
- Wagner, A. (1983) " Three Extracts on Public Finance", in R. A. Musgrave and A.T. Peacock (eds) (1958), *Classics in the Theory of Public Finance*. London: Macmillan.
- Ziramba, E. (2008) Wagner's Law: An Econometric Test for South Africa. *South African Journal of Economics*, 76 (4), 596-606.

TRANSFORMATIONAL LEADERSHIP AND SUPPLY CHAIN ORIENTATION: AN EMPIRICAL DESCRIPTIVE STUDY IN MANUFACTURING RELATED BUSINESS SECTOR IN SRI LANKA

B.N.F. Warnakulasooriya¹

ABSTRACT

The challenge of cultivating or developing supply chain oriented culture is often primarily an organizational one and depends on top management leadership. Strategic leader's vision plays a critical role in shaping an organization's direction, values and orientation. He/she must first realize the significance of strategic, operational and market impact of applying supply chain oriented culture to his/her firm. Literature suggests that transformational leaders help to realign the values and norms of their organization, to accommodate and promote both internal and external change when necessary, and to influence major changes in organization members and build commitment for the organization's objectives. Despite the theoretical and managerial importance ascribed to the transformational leadership (TL), less emphasis has been devoted to empirically test whether or not it has direct influence over the development of supply chain oriented culture. Thus, this study attempts to address the question whether the TL style would foster a supply chain orientation (SCO) inside the firms directly involved in the supply chain. The major objective of this study is to examine the association between TL style and the degree of SCO. The study examined a descriptive hypothesis where an association between TL and SCO was inferred only. It does not examine the causal hypothesis, where the determination of degree of SCO by TL was inferred. The single cross sectional design was employed to collect data through a self administered questionnaire. Unit of analysis was the manufacturing related firms. A sample of 45 firms was randomly selected from the registry of the Colombo Stock Exchange-2007. Results indicate an association between TL and SCO in manufacturing related organizations though the contribution of each dimension of the TL varies.

INTRODUCTION

A prerequisite for implementation of supply chain management (SCM) is the fostering of a supply chain orientation (SCO) inside the firms directly involved in the supply chain since strategic orientation guides an organization's alignment with its environment by shaping its strategic attributes and competencies (Hambrick 1983; Manu and Sriyam 1996;

¹ Professor, Department of Marketing, Faculty of Management Studies and Commerce, University of Sri Jayewardenepura, Sri Lanka. Email: neville@sjp.ac.lk

Gatignon and Xuereb (1997). SCO guides decision making and problem solving both inside the firm and within the boundaries of supply chain prior to successfully implementing supply chain management (SCM) (Mellow and Stank 2005). While numerous factors influence the development of supply chain oriented culture, the style of leadership may have the greatest influence over it. Leadership, which embodies a process of moving groups of individuals in a desired direction through largely non coercive means (Kotter 1988), plays a vital role in organizations by providing direction and facilitating the processes that enable organizations to achieve their goals and objectives (Zaccaro and Klimoski 2001). Specially, literature suggests that transformational leaders help to realign the values and norms of their organization, and when necessary, to accommodate and promote both internal and external change (e.g. Burns 1978; Avolio, Waldman, and Yammarino 1991; Hartog et al., 1997). And, Yukl (1994) describes transformational leadership (TL) as influencing major changes in organization members and building commitment for the organization's objectives. According to Bass and Avolio (1993), transformational leaders foster a culture of creative change and growth rather than one which maintains status quo. Grojean et al (2004) argue that the transformational leadership approaches will help to increase the acceptance of the organization values leading to greater congruence of values between the followers and the organization. Despite the theoretical and managerial importance ascribed to the TL, less emphasis has been devoted to empirically test whether or not it has a direct influence over the development of supply chain oriented culture. Thus, the major purpose of this study is to address the question "whether or not the TL style facilitates fostering a supply chain oriented culture inside the firms directly involved in the supply chain?" The major objective of this study is to examine the association between TL style and the degree of SCO.

The first section of this study gives the conceptual account, the second section elaborates on the methodology, and the third section presents discussion followed by recommendations and then, the conclusion.

CONCEPTUAL BACKGROUND

Transformational Leadership (TL)

Yukl (1989) defines TL as "the process of influencing major changes in the attitudes and assumptions of organization members and building commitment for the organization's mission or objectives" (p. 204). Burns (1978) characterized transformational leaders as those who motivate followers by appealing to higher ideals and moral values. Transformational leaders attempt to use intrinsic motivation to inspire others to go beyond personal interest and work toward a higher collective purpose, arouse heightened awareness and interests in the group or organizations, increase confidence, and move followers gradually from concern for existence to concern for achievement and growth (Grojean et al 2004; Yammarino and Dubinsky 1994). TL goes beyond the attempts of leaders who seek to satisfy the current needs of followers through transactions or exchange via contingent reward behavior (Bass 1985). The dynamics of TL involve strong personal identification with the leader, joining in a shared vision of the future, or going beyond the self interest exchange of rewards for compliance (Harter and Bass 1988).

Bass and Avolio (1994) proposed that TL is composed of four dimensions, described as the "Four Is" and measured by the Multifactor Leadership Questionnaire (MLQ). The first is idealized influence (charisma), which is based on a follower's respect and admiration for the leader. Next is individualized consideration (IC), the extent to which the leader cares about the individual followers' concerns and developmental needs. Third is intellectual stimulation (IS), the degree to which the leader provides followers with interesting and challenging tasks and encourages them to solve problems in their own way.

Finally, inspirational motivation (IM) is based on communication of expectations and followers' confidence in the leader's vision and values.

Supply Chain Orientation

Mentzer et al (2001, p.4) define supply chain as “a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of product, services, finances, and /or information from a source to a customer.” Mentzer et al (2001, p.11) define SCO as the “recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain.” SCO adopts a systems approach to viewing the supply chain as a whole and to managing the total flow of goods inventory from the supplier to the ultimate customer. It also predicated a perspective that favours cooperative efforts to synchronize and congregate intra-firm and inter-firm operational and strategic capabilities into unified whole (Mentzer et al 2001). The actual implementation of SCO, across various companies in the supply chain is called SCM (Min and Mentzer 2004). The studies done by Mentzer et al (2001) and Min and Mentzer (2004) considered supply chain orientation as a multi –dimensional construct which includes such dimensions as trust (credibility and benevolence), commitment, organizational compatibility, cooperative norms and top management support. Trust includes credibility and benevolence. Credibility is a firm's belief that its partner stands by its words, fulfills promised role obligation, and, be sincere. Benevolence refers to a firm's belief that its partner is interested in the firm's welfare, is willing to accept short term dislocations, and will not take unexpected actions that would have a negative impact on the firm. Trust, overall, determines cooperation and relationship commitment. Commitment refers to an implicit or explicit pledge of relational continuity between exchange partners. Cooperative norms are the perception of the joint efforts of both the supplier and distributor to achieve mutual and individual goals successfully while refraining from opportunistic action. Organizational compatibility means the similarity in goals, objectives, operating philosophies and corporate culture. Top management support includes leadership and commitment to change and it plays a critical role in defining a firm's direction.

Transformational Leadership and Supply Chain Orientation

A firm must establish a cultural orientation to guide decision making and problem solving both inside the firm and within the boundaries of supply chain prior to successfully implementing supply chain management (SCM) (Mellow and Stank 2005). Creating an organizational climate and culture that guide decision making and problem solving both inside the firm and within the boundaries of supply chain prior to successfully implementing supply chain is a crucial role of top-level leadership. (Mellow and Stank 2005). The challenge of cultivating or developing supply chain oriented culture is often primarily an organizational one and depends on top management leadership. Strategic leader's vision plays a critical role in shaping an organization's direction, values and orientation (Kotter, 1990; Hambrick and Mason 1984).

The TL may impact supply chain oriented culture in different ways. For example, transformational leaders change their culture by first understanding it and then realigning the organization's culture with a new vision and a revision of its shared assumptions, values, and norms (Bass 1985). Transformational leaders help to realign the values and norms of their organization, and when necessary, to accommodate and promote both internal and external change (Avolio, Waldman, and Yammarino 1991). How leaders react to problems, resolve crises, reward and punish followers is all relevant to an organization's culture as well as how the leader is viewed both internally by followers and externally by clients/

customers (Bass & Avolio 1993). According to Bass and Avolio (1993), transformational leaders who build on assumptions such as people are trustworthy and purposeful; everyone has a unique contribution to make, and complex problems are handled at the lowest level possible and articulate them to followers, foster a culture of creative change and growth rather than one which maintain status quo.

TL approaches will help to increase the acceptance of the organization values leading to greater congruence of values between the followers and the organization (Grojean et al 2004). The dimensions of TL may impact the climate of an organization in different ways. For example, intellectual stimulation which encourages followers to question their own, as well as the leader's and organization's values, beliefs and goals, prevent employees from keeping blind faith in leader. Blind faith in leaders locks the organization into a cycle of self-affirming processes that maintain a self-identity out of tune with reality (Rowse and Berry 1993). These traps are called psychic prisons. The cultural prison is reinforced by members who endow leaders with magical qualities which raise the leaders' self-esteem and establish narcissistic tendencies which result in obsessive needs for self-preservation (Rowse and Berry 1993). Dimensions of idealized influence and inspirational motivation of TL inspire followers to accept the leader's vision and collective values of the group. House and Shamir (1993) suggest that charismatic aspect of transformation leadership influences the hierarchy of values and identities within a person's self-concept. As a result, followers' identification with the collective values is a more salient aspect of the self-concept; followers internalize the values and goals of the leaders; followers become personally committed to these values and goals; and followers become willing to subordinate their own interest to work toward the collective good. The group or collective level self-concept then becomes the most salient of self-concepts and individuals are motivated to act consistently with this self-concept to enhance their self-esteem (Grojean et al 2004). Bass and Avolio (1993, p.113) assert "there is a constant interplay between culture and leadership. Leaders create mechanisms for cultural development and the reinforcement of norms and behaviours expressed within the boundaries of the culture. Cultural norms arise and change because of what leaders focus their attention on, how they react to crises, the behavior they role model, and whom they attract to their organizations. The characteristics and qualities of an organization's culture are taught by its leadership and eventually adopted by its followers." Thus, this study hypothesizes that, in Sri Lankan context, there is a strong positive association between the TL and the degree of supply chain orientation in the manufacturing related business firms.

METHODOLOGY

The study is descriptive in nature, and attempts to examine the descriptive hypotheses if a relationship does exist between the TL and the degree of supply chain orientation in the manufacturing related business firms in Sri Lanka. The study does not attempt to control any variable and to establish a cause and effect relationship. A single cross sectional design was employed to collect data through a self administered questionnaire. The questionnaire collected information about TL and the degree of supply chain orientation. Unit of analysis was the manufacturing firm. A sample of 45 firms was randomly selected from the registry of the Colombo Stock Exchange-2007. Proxies were the marketing or marketing related managers of the services firms.

Operationalization

Supply chain orientation

The SCO construct was operationalized based on the study done by Min and Mentzer (2004). Dimensionality of the construct arrives at a priori. Min and Mentzer (2004) consider SCO as a second order factor, which is higher in abstraction, consisting of six first order factors—credibility, benevolence, commitments, norms, compatibility, and top management support—which are determined directly from its indicators. The definitions of these dimensions have been stated somewhere in this study. Four items for each were generated to measure credibility and benevolence, three items for each were developed to capture commitments, norms, and compatibility, and five for top management support. All together, 22 items were generated. All items were assessed through respondents' perceptual evaluation on the degree to which the items were consistent with the qualities/ characteristics of their company by using a five point Liker scale; the response categories for each item were numbered by 1 (strongly disagree) and 5 (strongly agree). The midpoint was anchored by 3 (neither agree nor disagree). The mean scores of the measurement were calculated to determine the degree of SCO adopted by each company.

Transformational leadership style

The study measured the four dimensions- idealized influence, individualized consideration, intellectual stimulation, and inspirational motivation- of TL style by employing 39 items from Form 5-X of the Multifactor Leadership Questionnaire (Bass and Avolio, 1990). The 39 TL items include 10 each for measuring idealized influence, individualized consideration, and intellectual stimulation, and 9 for inspirational motivation. Respondents rated each of the 39 items on the degree to which they perceived the items were consistent with the qualities/ characteristics of their strategic leadership. Response choices ranged from one (strongly disagree) to five (strongly agree), midpoint being 3 (neither agree nor disagree). The mean scores of the measurement were calculated to determine the degree to which the strategic leaders of the respective firms reflect the characteristics of TL style. Decision criteria are given in Table 01.

Table 01: Decision Criteria- Degree of Reflection of TL style

Mean value	Decision
Between 1 and 2.59	Low degree of reflection
Between 2.6 and 3.59	Moderate degree of reflection
Between 3.6 and 5	High degree of reflection

Source: Author constructed

Validation of measurement properties

An important aspect of increased rigor in conducting scientific research in the modern positivist paradigm is the testing for content and construct validity.

Content validity

The content validity ensures that the measure includes an adequate and representative set of items that tap the domain of the concept (Malhotra 2005, Sekaran 2004). A rigorous literature review was carried out to ensure the content validity of both constructs- TL and supply chain orientation-. The dimensions and items of the TL and supply chain orientation were arrived at priori and tested against data by using confirmatory factor analysis (CFA).

Construct validity

Construct validity depends on how well the scale of a construct actually measures that construct (Peter 1981). The sub dimensions of construct validity are unidimensionality, reliability, convergent validity, and discriminant validity (Peter 1981). This study employed the measurement model in structural equation modeling (SEM) to test for construct validity and its sub dimensions of the TL and the SCO scales. The SEM is a powerful statistical technique that combines the measurement model (confirmatory factor analysis) and the structural model (regression or path model) into a simultaneous statistical test (Aaker and Bagozzi 19779; Garver and Mentzer 1999). The purpose of the measurement model is to describe how well the observed indicators serve as a measurement instrument for the latent constructs (Garver and Mentzer 1999).

Unidimensionality

A scale is unidimensional when the items of a scale estimate one factor (Dunn et al. 1994). The model proposed for this study for measuring TL and SCO is a multiple indicator measurement model. To ensure that each construct is measured by multiple indicators and each of the indicators measures only a single construct, the TL and the SCO scales were examined for unidimensionality through CFA provided by the AMOS program. The CFA, which describes how well the observed indicators serve as a measurement instrument for the latent variables, provides a more rigorous test of unidimensionality (Garver and Mentzer 1999). The indices such as the ratio of χ^2 to degree of freedom (CMIN/DF), Goodness of Fit (GFI), Adjusted Goodness of Fit (AGFI), Comparative Fix Index (CFI), Tucker-Lewis Index (TLI) (also known as Non-normed Fit Index-NNFI) and Root Mean Squared Approximation of Error (RMSEA) were employed in this study for ensuring the overall measurement model fit. Concerning CMIN/DF, a ratio of equal to 1 or less than 1 indicates the hypothetical model is over fitted (Hair et al 1998), and a ratio of 2 to 1 or 3 to 1 shows an acceptable hypothetical model (Min and Mentzer 2004). GFI ranges from 0 to 1, with .90 or greater representing an acceptable fit (Hair et al. 1998). AGFI values falling between .9 to 1 indicates a good fit (Hair et al 1998). CFI ranges from 0 to 1, with .9 or greater representing an acceptable fit. An acceptable threshold for NNFI/TLI is also .9 or greater. RMSEA values run on a continuum from 0 to 1, with values falling between 0 .05 to 0.08 deemed acceptable (Hair et al 1998). The TLI, CFI and RMSEA are relatively independent of sample size effect (Hair et al. 1998). Final deletion of measurement items was identified through examination of such indicators as offending estimates, squared multiple correlations, standardized residual covariance, and modification indices. Offending estimates such as negative error terms, standardized coefficients exceeding or very close to one, and very large standard errors associated with any estimated coefficients were checked (Hair et al. 1998). Squared multiple correlations were also reviewed to locate any relatively small values that indicate the portion of a variable's variance that is accounted for by its predictor that is minimal at best. The overall measurement model fit indices for both TL and SCO constructs are summarized in Table 02.

Table 02: Model Fit Indices TL and SCO

Fit indices	TL	SCO	Acceptable limit
CMIN/DF	2.466	1.916	Ratio of 3 to 1
GFI	.918	.966	0.90 or greater
AGFI	.921	.951	0.90 or greater
CFI	.942	.918	0.90 or greater
NNFI/TLI	.913	.906	0.90 or greater
RMSEA	.046	.041	0.05 or less

Source: Author constructed

According to the results in Table 02, all model fit indices are in acceptable limit (i.e. CMIN/DF, GFI, AGFI, CFI, TLI, and RMSEA value for TL are 2.464, 0.918, 0.921, 0.942, 0.913 and 0.046 respectively. CMIN/DF, GFI, AGFI, CFI, TLI, and RMSEA value for SCO are 1.913, 0.966, 0.951, 0.918, 0.906, and 0.041 respectively) suggesting a satisfactory overall fit of both measurement models.

Diagnosis indicators for evaluating components of the measurement model such as standardized residuals and modification indices, and the direction, magnitude, and statistical significance of the parameter estimates between indicators and latent variables were also examined (Garver and Mentzer 1999) for both TL and SO measurements. For both of the measurement models, standardized residuals are below 2.58 at 0.05 alpha level and modification indices are below 7.88, (results are not shown due to space limitation) (Garver and Mentzer 1999). The standardized parameter estimates for both of the measurement models are more or less close to 0.70 and exhibit the correct sign and magnitude. Critical ratios of regression weight of the items are statistically significant ($\alpha \leq 0.05$) for every first and second order latent variables. Strong evidence that the constructs are unidimensional exists when the parameter estimates are greater than .70, are statistically significant, and are in the right direction (Garver and Mentzer 1999).

Reliability

The internal consistency of the first order factors of TL and SCO was assessed through reliability analysis (Malhotra 2005). The standardized Cronbach's Alpha for all the dimensions exceeds threshold value 0.7 (Results are not reported in the text). Scales that receive alpha score over 0.7 are considered to be reliable (Malhotra 2005).

Convergent and discriminant validity

The convergent and discriminant validity for the TL and SCO scales were evaluated by the three comparison models suggested by Widaman (1985). The three comparison models are referred to as model 1, model 2 and model 3. Model 1 was developed with individual measurement items as unique factors in a construct (39 for TL and 22 for SCO), model 2 with individual items loaded on one unique trait (items of TL on TL and items of SCO on SCO), and model 3 with individual items loaded on any one of the appropriate first order factors that, in turn, are loaded on the respective second order factors. The comparison of these models yields evidence of convergent (Model 1 with Model 2) and discriminant (Model 2 with Model 3) validity if the differences in chi-square values are significant (Widaman (1985); Binstock et al 1997; Mentzer et al 1999; Min and Mentzer 2004).

Table 03 contains the chi-square statistics for Models 1, 2 and 3 and the results of a comparison of the three models to assess the significance of the differences between the fit for the three models. Of the three comparison models, Model 3 provides the best overall fit, in terms of chi-square. The difference in the chi-square statistics for Model 1 and Model 2 (For TL, $\chi^2 = 629.8$ and $df = 60$, for SCO $\chi^2 = 581.5$ and $df = 141$) is significant at the $\alpha = 0.0001$, thereby demonstrating evidence of the convergent validity of the TL and SCO items. The difference in the chi-square statistics for Model 2 and Model 3 (For TL, $\chi^2 = 221.1$ and $df = 130$, and for SCO $\chi^2 = 144.4$ and $df = 68$) is also significant at the $\alpha = 0.0001$, thereby demonstrating evidence of the discriminant validity of the dimensions of the TL and the SCO.

Table 03: Three Comparison Models–Convergent and Discriminant Validity-Test

	TL	SCO
Model 1		
χ^2_1	1265.2	1124.6
DF_1	358	317
Model 2		
χ^2_2	635.4	543.1
DF_2	298	276
Model 3		
χ^2_3	414.3	398.7
DF_3	168	208
Model 1- Model 2		
$\chi^2_1 - \chi^2_2$	629.8	581.5
$DF_1 - DF_2$	60	141
Model 2 - Model 3		
$\chi^2_2 - \chi^2_3$	221.1	144.4
$DF_2 - DF_3$	130	68

Source: Author constructed

DISCUSSION

The central purpose of this study is to answer the fundamental question that arises as to whether the TL has been instrumental for the manufacturing related business firms to cultivate supply chain oriented culture in Sri Lankan context. In line with this purpose, the objective of this study is set to examine the association between the TL style and the degree of SCO in manufacturing related business firms in Sri Lanka. In line with the objective, the hypothesis “there is a strong positive association between the TL style and the degree of supply chain orientated culture in the manufacturing related business firms in Sri Lanka.” was developed.

The criteria in the Table 01 were adopted to determine the degree to which the strategic leaders of the respective firms reflect the characteristics of TL style. Multiple Discriminant Analysis (MDA) was performed to test whether the groups were correctly classified. The MDA is appropriate when the dependent variable is nonmetric and independent variables are metric (Malhotra 2005). To run the MDA, the sample was divided into two parts - analysis sample (32 firms) and validation sample (13 firms). The analysis sample was used for estimation of Discriminant function and the validation sample was reserved for validating the Discriminant function (Malhotra 2005). The results of

MDA are given in Table 04 and 05. The results in Table 04 show the Canonical Discriminant function – eigenvalues. The eigenvalue associated with the first function is 19.718, and this function accounts for 99.5 percent of the explained variance. The canonical correlation associated with this function is 0.976. The square of this correlation indicates that 95 percent of the variance in the TL qualities is explained or accounted for by this model. The second function has a small eigenvalue of 0.089 and accounts for only 0.286 percent of the explained variance. The square of canonical correlation of this function indicates that 0.082 percent of the variance in the TL qualities is explained or accounted for by this model. Because the eigenvalue and canonical correlation are larger, the first function is likely to be superior.

Table 04: Canonical Discriminant Function-Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	19.718 ^a	99.5	99.5	.976
2	.089 ^a	.5	100.0	.286

First 2 canonical discriminant functions were used in the analysis.

Source: Author constructed

Table 05 reports the results that are used to determine the significance of the discriminant function. The value of Wilks' λ is 0.044 if no function is removed. The Wilks' λ transform to a chi-square of 85.704, with 8 degrees of freedom, which is significant beyond the 0.01 level. The Wilks' λ is near to zero and, thus, the two functions together significantly discriminate among the three groups.

Table 05: Canonical Discriminant Function- Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	.044	85.704	8	.000
2	.918	2.351	3	.503

Source: Author constructed

However, when the first function is removed, the Wilks' λ associated with the second function is 0.918, which is close to 1 and, even, is not significant at the 0.05 level. Therefore, the second function does not contribute significantly to group differences. Some idea about the relative importance of predictors in discriminating the degree of reflection can be obtained by examining the absolute magnitude of the standardized discriminant function coefficients and the structure correlations (Malhotra 2005). Generally, predictors with relatively large coefficients contribute more to the discriminating power of the function, as compared with predictors with smaller coefficients, and are, therefore, more important (Malhotra 2005).

Table 06: Standardized Canonical Discriminant Function Coefficients

	Function	
	1	2
LICMN	-.584	.167
LISMN	1.057	.502
LIMMN	.146	-1.691
LIIMN	.431	1.025

Source: Author constructed

LIIMN - idealized influence mean;

LICMN - individualized consideration mean;

LISMN - intellectual stimulation mean; and

LIMMN - inspirational motivation mean.

An examination of the absolute magnitude of the standardized discriminant function coefficients and the structure correlations reported in Table 06 and 07 respectively indicates that the intellectual stimulation and the inspirational motivation are the most important predictors in discriminating the three groups.

Table 07: Structure Matrix

	Function	
	1	2
LISMN	.852*	-.236
LIMMN	.638*	-.607
LIIMN	.569*	.164
LICMN	.410	-.458*

Source: Author constructed

*Largest absolute correlation between each variable and any discriminant function.

The mean values of the responses given for the supply chain orientation instrument were calculated to determine the degree of supply chain orientation the manufacturing related business firms have cultivated in their firms. Table 08 reports the mean value of the SCO classified by the categories of the TL style.

Table 08: Mean of SCO Classified by TL Categories.

DOTLR	SCO Mean	Std. Deviation
LDREF	2.0120	.14378
MDREF	3.1665	.17595
HDREF	3.8129	.35413
Total	3.2516	.73951

Source: Author constructed

Note: DOTLR = Degree of Transformational Leadership Reflection; LDREF=Low Degree of Reflection;

MDREF = Moderate Degree of reflection; and

HDREF= High Degree of reflection.

According to the table, the highest mean value of SCO (3.8129) appears in the firms where the managers reflect higher degree of TL qualities and the lowest (2.0120) appears in the firms where the managers reflect lower degree of TL characteristics. These

figures suggest that the differences among the mean values of the degree of SCO in the categories of TL style increase as the degree of TL qualities of managers increases. In order to test the statistical significance of these differences, One-way ANOVA was performed.

Table 09: Measures of Association

	Eta	Eta Squared
SCOMEAN DOTLR	.931	.867

Source: Author constructed

The results of the test are reported in Table 09 and 10. To determine whether the TL characteristics have an effect on the degree of SCO, the eta 2 (η^2) values in Table 09 was considered. The eta 2 is a measure of the variation in the dependent variable that is explained by the independent variable. The η^2 value (0.867) which is given in Table 09 is near to 1. It suggests that the degree of TL qualities has a strong effect on the degree of SCO.

The statistical significance of the effect of TL characteristics on the degree of SCO was determined by taking F value into account. The F value (136.839) of the test given in Table 10 is significant at $\alpha = 0.000$. Thus, the results clearly indicate the sign of statistically significant differences among the mean values.

Table 10: Results of ANOVA Test

			Sum of Squares	df	Mean Square	F	Sig.
SCOMEAN DOTLR	Between Groups	(Combined)	20.861	2	10.430	136.839	.000
	Within Groups		3.201	42	.076		
	Total		24.062	44			

Source: Author constructed

To determine among which groups the true difference lies, Scheffe's S was calculated. This test was selected since it is a conservative test that is robust to violations of assumptions (Cooper and Schindler 2003). The result of Scheffe's S test which is reported in Table 11 discloses that the true difference lies among all the three groups. This suggests that variations in SCO are explained by TL qualities of the managers. These results strongly support the hypotheses of the study.

Table 11- Scheffe Multiple Comparisons

(I) DOTLR	(J) DOTLR	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
DREF	L					
	M	-	.		-	-
	DREF	1.15443*	11796	.000	1.4538	.8551
	H	-	.		-	-
	DREF	1.80084*	10924	.000	2.0781	1.5236

M	L	1.	.		.8551	1.45
DREF	DREF	15443*	11796	000		38
	H	-	.		-.8859	-
	DREF	.64641*	09439	000		.4069

Source: Author constructed

*The mean difference is significant at the 0.05 level.

CONCLUSION

This study attempted to explore the association between TL and the degree of SCO in Sri Lankan context. It examined a descriptive hypothesis and did not examine the causal hypothesis, where the determination of degree of SCO by TL was inferred. The study discloses that TL style has a strong effect on the degree of SCO. The study also reveals that the intellectual stimulation and the inspirational motivation are instrumental for reflecting higher degree of TL qualities. Following implications and normative suggestions can be made for practical managers through this study. As TL style has a strong effect on the degree of SCO, managers should improve their TL qualities. However, since the intellectual stimulation and the inspirational motivation play a big role in TL qualities, managers must pay much attention to these two qualities. Major observational behaviours of inspirational motivation are setting high standards, visualizing exciting new possibilities, providing continuous encouragement for subordinates, focusing subordinates' attention on "what it takes" to be successful, making employees aware of essential work-related issues, showing determination to accomplish what managers set out to do, expressing managers' confidence on the ability to achieve organizational goals, talking optimistically about the future, talking enthusiastically about what needs to be accomplished, and articulating a compelling vision of the future. Moreover, the intellectual stimulation can be reflected through encouraging employees to express their ideas and opinions, encouraging to address problems by using reasoning and evidence, rather than unsupported opinion, questioning the traditional ways of doing things, emphasizing the value of questioning assumptions, re-examining critical assumptions to question whether they are appropriate, encouraging employees to rethink ideas which had never been questioned, seeking differing perspectives when solving problems, suggesting new ways of looking at how subordinates do their jobs, getting subordinates to look at problems from different angles, and encouraging non-traditional thinking to deal with traditional problems (Bass and Avolio, (1994). However, further research should be carried out to examine the causal hypothesis, where the determination of degree of SCO by TL is inferred.

REFERENCES

- Aaker, David A. and Richard P. Bagozzi (1979), "Unobservable variables in Structural Equation Models with an Application in Industrial Selling," *Journal of Marketing Research*, 16 (2):147-158.
- Avolio, B.J., Waldman, D.A. and Yammarino, F.J. (1991), "Leading in the 1990s: The four I's of Transformational Leadership," *Journal of European Industrial Training*, 15 (4), 9-16.
- Bass, B. M. (1985), *Leadership and Performance Beyond Expectations*, New York: Free Press.
- Bass, B.M. and Avolio, B.J. (1990), *Multifactor Leadership Questionnaire*, Consulting Psychologists Press, Palo Alto, CA.
- Bass, B.M. and Avolio, B.J. (1993), "Transformational Leadership and Organizational Culture," *Public Administration Quarterly*, 17 (1), 112 - 121

- Bass, B.M. and Avolio, B.J. (1994), *Improving Organizational Effectiveness through Transformational Leadership*, Sage, Thousand Oaks, CA.
- Bienstock, Carol C., John T. Mentzer and Monroe Murphy Bird (1997), "Measuring Physical Distribution Service Quality," *Journal of the Academy of Marketing Science*, 25 (Winter): 31-44.
- Burns, J.M. (1978), *Leadership*, Harper & Row, New York, NY.
- Cooper, Donald R., and Schindler, Pamela S. (2003), *Business Research Methods*, 8 ed. Tata McGraw – Hill Publishing Company Limited, New Delhi.
- Dunn Steven C., Rohert F. Seaker, and Matthew A. Waller (1994), "Latent Variables in Business Logistics Research: Scale Development and Validation," *Journal of Business Logistics*, 8 (4): 297-326.
- Garver, Michael S and John T. Mentzer (1999), "Logistic Research methods: Employing Structural Equation Modeling to Test for Construct Validity," *Journal of Business Logistics*, 20 (1): 33-57.
- Gatignon, Herbert and Jean Marc Xuereb (1997), "Strategic Orientation of the Firm and New Product Performance," *Journal of Marketing Research*, 34(Feb), 77-90.
- Grojean, M. W., Resick, C. J., Dickson, M.W. and Smith, D. B. (2004), "Leaders, Values, and Organizational Climate: Examining Leadership Strategies for Establishing an Organizational Climate Regarding Ethics," *Journal of Business Ethics*, 55, 223 – 241.
- Hair, Joseph F,Jr., Rolp E. Anderson, Ronald L. Tatham, and William C. Black (1998). *Multivariate Data Analysis*, 5th Ed. Upper Saddle River, NJ: Prentice Hall.
- Hambrick, D. C. (1983), "Some Tests of the Effectiveness and Functional Attributes of Miles and Snow's Strategic Types," *Academy of Management Journal*, 26 (1), 5-26.
- Hambrick, D. C. and Mason, P.A. (1984), "Upper Echelons: The Organization as a Reflection of Its Top Managers," *The Academy of Management Review*, 9 (2) 193 – 206.
- Hartog, Deanne N. Den., Jaap J. Van Muijen, and Paul L. Koopman (1997), "Transactional versus transformational leadership: An analysis of the MLQ," *Journal of Occupational and Organizational Psychology*, 70, 19-34.
- Hater, J. J. and Bass. B. (1988), "Superiors' evaluations and subordinates' perceptions of transformational and transactional leadership", *Journal of Applied Psychology*, Vol. 73, 695-702.
- House, R. J. and Shamir, B. (1993), "Toward the integration of Transformational, Charismatic, and Visionary Theories," in M.M. Chemers and R. Ayman ,eds, *Leadership Theory and Research: Perspectives and Qualities*, Academic Press, San Diego, CA, 81 –108.
- Kotter, J. P. (1988), *The Leadership Factor*, New York, The Free Press.
- Kotter, J. P. (1990), *A Force for Change: How Leadership Differs from Management*, New York, The Free Press.
- Lambert, D.M, Stock, J.R. and Ellram, L.M. (1998), *Fundamentals of Logistic management*, Boston, MA: Irwin/McGraw – Hill, Illinois.
- Loforte, A. J. (1991), "The Implications of Multicultural Relationships in a Transnational Supply Chain," *National Associations of Purchasing Management Annual Conference Proceedings*, 69-77.
- Malhotra, Naresh k. (2005), *Markeing Research, An Applied Orientation*, New Delhi, Printice Hall of India Private Limited.

- Manu, F.A. and Sriram, V. (1996), "Innovation, Marketing Strategy, Environment and Performance," *Journal of Business Research*, 35, 79 -91.
- Mellow, J.E. and Stank, T.P. (2005), "Linking Firm Culture and Orientation to Supply Chain Success," *International Journal of Physical Distribution and Logistics Management*, 35 (8), 542- 554.
- Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S. Nancy, W. N., Smith, C.D. and Zacharia, Z.G. (2001), "Defining Supply Chain Management," *Journal of Business Logistics*, 22 (2), 1-24.
- Min, S. and Mentzer, J.T. (2004), "Developing and Measuring Supply Chain Management Concept," *Journal of Business Logistics*, 25(1), 63-92.
- Peter, J.(1981) "Construct Validity: A Review of Basic Issues and Marketing Practices," *Journal of Marketing Research* 18: 133-145.
- Rowse, K. and Berry, T. (1993), "Leadership, Vision, Values and Systematic Wisdom," *Leadership and Organizational Development Journal*, 14 (7), 18-22.
- Sekaran, Uma (2004), *Research Method for Business, A skill Building Approach*, New Delhi, John Whiles and Sons.
- Widaman, Keith F. (1985), " Hierarchically Nested Covariance Structure Models for Multi-trait Multi-method Data," *Applied Psychological Measurement*, 9 (1) 1-26.
- Yammarino, F.J. and Dubinsky, A.J. (1994), "Transformational Leadership Theory: Using Level of Analysis to Determine Boundary Conditions," *Personnel Psychology* (winter), 47 (4), 787 – 811.
- Yukl, G.A. (1989), *Leadership in Organizations*, 2nd ed., Prentice-Hall, Englewood Cliffs, NJ.
- Yukl, G.A. (1994), *Leadership in Organizations*, 3rd ed., Prentice-Hall, Englewood Cliffs, NJ.
- Zaccaro, S. J. and Klimoski, R.J. (2001), "The Nature of Organizational Leadership: An Introduction," in S. J. Zaccaro, and R. J. Klimoski , eds, *The nature of Organizational Leadership*, San Francisco, Jossey Bass, 3 – 41.