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Editorial

Welcome to the second issue of the UTCC International Journal of Business and Economics (UTCC IJBE). We, the editors, appreciate greatly the support of the University of the Thai Chamber of Commerce and the Thailand Management Association (TMA) in asking us to become involved in this endeavor as editors of the UTCC IJBE.

Over the past few years, we have noticed the rapid development of business, economics, and accountancy within the industrial, academic and governmental sectors. More and more people are talking, researching and applying business, economics, and accountancy within a myriad of contexts. There is much excitement in the field.

The UTCC IJBE has been established in response to this increased interest in business, economics, and accountancy issues as a forum for interested parties to advance their knowledge and science of the said discipline. The geographical scope of the journal is not solely limited to Thailand and the surrounding region.

This second issue of the UTCC IJBE represents a compilation of submitted papers. It is hoped that this issue will set a new benchmark in terms of academic publications in Thailand, especially in the field of business, economics, and accountancy.

The Editors would like to invite academicians, practitioners and policy makers to submit their manuscripts on business, economics, accountancy, and other related disciplines. Through the support of our Editorial and Advisory Board, we hope to be able to provide academic articles of the highest quality to all our readers.

Ungul Laptaned
Frederic Tournemaine
Suthawan Chirapanda
Editors

The Editors

Editors-In-Chief

Dr. Ungul Laptaned is an Assistant Professor in the Department of Logistics Engineering at the School of Engineering, University of the Thai Chamber of Commerce. He graduated with a Ph.D. in 2003 from the University of Nottingham, United Kingdom in the field of Manufacturing Engineering and Operations Management. Ungul has published over 40 proceedings and journal papers; for instances, Industrial Engineering Network, Asia Pacific Industrial Engineering and Management, International Association of Science and Technology for Development, Operations and Supply Chain Management, Intelligent Manufacturing System, Business and Information, etc. He served as a program chair and a steering committee for several domestic and international conferences. He is a journal editor of International Journal of Logistics and Transport, and Thai Researchers' Consortium of Value Chain Management and Logistics Journal, and has consulted for several public organizations and industrial firms on logistics and supply chain management such as Thailand Research Fund, Phitsanulok Province, Public Warehouse Organization, Amatanakorn Industrial Estate, Wyncoast Industrial Park, Iron and Steel Institute of Thailand, and Chacheongsao Province.

Dr. Frederic Tournemaine is a lecturer at the School of Economics, and a researcher at the University of Chicago-UTCC Research Center at the University of the Thai Chamber of Commerce. He graduated with a Ph.D. in Economics in 2004 from the University of Toulouse (France), with MPhil in Mathematics Economics and Econometrics. Dr. Frederic Tournemaine has published several articles in peer-reviewed journals such as Oxford Economic Papers, Economics Letters, Journal of Population Economics, Economics Bulletin, Ecological Economics, Scottish Journal of Political Economy, Revue d'Economie Politique, Chulalongkorn Journal of Economics, Journal of International Development. His research interests include Growth Theory, Sustainable development, Behavioral Economics and Industrial Organization.

Associate Editors

Dr. Suthawan Chirapanda is a full-time lecturer at School of Business, University of the Thai Chamber of Commerce. She obtained her PhD in International Management and Marketing Strategy from Leeds University Business School, University of Leeds, UK. Her research interests are in (1) marketing strategy, (2) strategic management, (3) international business and (4) business performance. She also had attended academic conferences such as American Marketing Association (AMA), Business and Information (BAI) and Research and Development, Innovation and Design (R&DID),

Foreword

Welcome to the 2nd edition of the 1st volume of the UTCC International Journal of Business and Economics (UTCC IJBE), the Editors received a number of papers from different countries such as India, Indonesia, Japan, Philippines, Portugal, Taiwan, Thailand, and United Kingdom. The submitted manuscripts for academic coverage represented the diverse scope of marketing, banking, economics, insurance and risk management, industrial and operation management, strategic management, and international and global business management. After the review process, a total of ten manuscripts were selected for publication.

The first article entitled ***"The Short-Run Relation between the Thai Stock Market and Some Other Stock Markets"*** was conducted by ***Wanrapee Banchuenvijit***. This study investigates the short-run relation between the Thai stock market and some other stock markets. The daily data are used for a period of "pre-crisis" and a period of "post-crisis" where a cut-off date is the subprime mortgage bankruptcy of Lehman Brothers. Referring to the Granger causality tests, Dow Jones, NASDAQ, and S&P500 Granger cause SET during the pre-crisis period. However, Dow Jones, NASDAQ, S&P500, FTSE100, DAX, CAC40, and Hang Seng Granger cause SET, and SET Granger causes Nikkei during the post-crisis period. Therefore, after crisis, there is more short-run integration between the Thai stock market and the stock markets in the US, Europe, and Asia.

The second paper is examined by ***Benjamin Botchway***. His paper is entitled ***"Initiating Key Account Management (KAM) in a Thai Freight-Forwarding Company"***. This case study seeks to identify the critical Key Account Management (KAM) criteria and key accounts for profitability, and develop a strategic tool for managing Key Accounts (KAs) in a Thai freight forwarding company. Freight-forwarding is a relatively new and fast-growing Thai services sector. With increasing power of customers and globalisation, and maturity of industry-to-industry markets, business organisations have begun to rethink their approach to services delivery by adopting KAM as a tool for satisfying key customers and long-term business success.

The third article is co-authored by ***Susana Garrido Azevedo and João Ferreira***, and is entitled ***"Deployment of RFID Technology in Two International Fashion Retailers"***. This paper aims to present the potentials, requirements, advantages, disadvantages and challenges associated with the deployment of RFID in two international fashion retailers. It intends to emphasize the importance of this technology to business perform faster, with more quality, cheaper and with more responsiveness in retailers. Two case studies are presented, one Portuguese and the other American.

The fourth article deals with supply chain management issues. This paper is authored by ***Shusaku Hiraki***, and is entitled ***"SCM Approach to the Mixed-Model Assembly Line Systems"***. This paper deals with the problem of sequencing products for a mixed-model assembly line in just-in-time production system. From the standpoint of supply chain management, the author proposed a production scheduling procedure that contains (1) maintaining a constant rate of production of every part in upstream external preceding processes and (2) realizing the smoothed production in the mixed-model assembly line, as well as (3) meeting the date of delivery to dealers in downstream processes when the final products are delivered by car-carriers.

Article number five is entitled ***"Explore the Corporate Governance Quality: PZB Model Theory and Zone of Tolerance Implication for a Shipping Industry"***, and is written by ***Wen-Cheng Lin***. This paper focuses on applying Fuzzy Zone of Tolerance (FZOT) to systematically explore the overall governance quality of Taiwanese open-market shipping firms. There are four dimensions observed: board of directors, audit committee, compensation and nomination committees, and ownership structure. Based on these factors, the FZOT is utilized to explore investor's needs on the governance quality.

The sixth article entitled ***"Work-In-Process Inventory Management in a Decentralized Production System under a Constrained Layout"***, is written by ***Elnora Lucero***. This experiential study tries to assess the production performance, minimize delays (in the transfer of WIP from and to machines and storage areas, or in machine idle time) under human factor and layout limitations, improve production systems, and to timely meet commitments with production and with customers at minimal idle time, backtracking, rework or returns.

Article number seven is conducted by ***Atthapong Sakunsriprasert***, and is entitled ***"University-Industry Interaction and Project's Performance on Innovation: Perspective of University's Researcher"***. This research studies effect of University-Industry Interaction (UII) to Project's performance on innovation in perspective of university's researcher. The main objectives are: 1) to identify main factors on project performance that will benefit to private firms, 2) to investigate the power of University-Industry Interaction (UII) on project's performance, and 3) to test the model of University-Industry Interaction (UII) and project's performance as well as their relationship of all factors in the model.

The eighth article is written by ***Luciana Spica Almilia and Sasongko Budisusetyo***, and is entitled ***"The Impact of Internet Financial and Sustainability Reporting on Profitability, Stock Price and Return in Indonesia Stock Exchange"***. This study examines whether internet financial and sustainability reporting (IFSR) provides information that is reflected in profitability, and investigates whether IFR provides financial information that has a significant impact on stock prices and return, and explores whether the information provided with extended IFSR has a significant impact on stock prices and return.

The ninth article is co-authored by ***A. Caroline Sutandi and L. Lestiyaningtyas***, and is entitled ***"Electric Train as an Alternative Public Transportation Mode in Congested Area in Developing Country: A Case Study in Padalarang – Bandung – Cicalengka in Indonesia"***. The purpose of this paper is to analyze the use of electric train in changing existing diesel train. In more details are to determine time headway between two trains in order to fullfill passenger demand, appropriate load factor, limit of train speed, safe stopping distance, and dwell time factor, during peak and off peak hours.

The last but not the least, the article entitled ***"Foreign Direct Investment (FDI) Inflows and Economic Integration - A Comparative Study of SAARC Countries"*** is examined by ***Sankar Thappa and Padmanath Sarmah Bhawan***. This paper highlights on an initial study of economic integration, the nature of Intra-SAARC investment flows and presenting the results of study of the emerging trade and investments linkages within the SAARC. It also focuses on pattern of FDI inflows in SAARC countries, sectors attracting FDIs as well as problems in attracting FDI etc.

May you find these articles informative and substantial for further discussion to advance our existing knowledge in the application of Business, Economics, and Accountancy.

The UTCC International Journal of Business and Economics' Editorial Board and its Editors would like to welcome future submission from interested parties to make this journal your forum in sharing ideas and research findings

Ungul Laptaned
Frederic Tournemaine
Editors-In-Chief

Suthawan Chirapandu
Associate Editor

Contents

The Short-Run Relation between the Thai Stock Market And Some Other Stock Markets

by

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The Short-Run Relation between the Thai Stock Market And Some Other Stock Markets

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Abstract

This study investigates the short-run relation between the Thai stock market and some other stock markets. The daily data are used for a period of "pre-crisis" (March 19, 2008-September 17, 2008) and a period of "post-crisis" (September 18, 2008-March 13, 2009) where a cut-off date (September 17, 2008) is the subprime mortgage bankruptcy of Lehman Brothers. Referring to the Granger causality tests, Dow Jones, NASDAQ, and S&P500 Granger cause SET during the pre-crisis period. However, Dow Jones, NASDAQ, S&P500, FTSE100, DAX, CAC40, and Hang Seng Granger cause SET, and SET Granger causes Nikkei during the post-crisis period. Therefore, after crisis, there is more short-run integration between the Thai stock market and the stock markets in the US, Europe, and Asia.

Keywords: Thai Stock Market, Lehman Brothers, Dow Jones, NASDAQ, S&P500 Granger

1. Introduction

The development of computer technology has brought the world to the new era of world globalization. The connectivity between countries has been through the computer network which helps investors around the world trade across countries. According to the international trade, foreign direct investment, capital flows, and portfolio diversification, the world economic has been joined together making the global market integration. Since the high rate of return of emerging markets due to the high economic growth rate, investors around the world expect higher rate of return as well as greater risk reduction by diversifying their portfolios in these markets.

In the past decade, foreign direct investment must be done by large firms in the forms of green field, jointed venture, or takeover. With the enhancement of nowadays technology, individual investors are able to invest their money via the stock market located in other countries. This might be the world cheapest way to invest in foreign countries. However, it is essential for investors to know the relation or linkage between various stock markets in order to manage their investment strategies. Therefore, the global market integration has serious implication for investors to understand the interdependence of stock markets around the world.

As mentioned above, there are some benefits of investment allocation in difference markets in various countries. Unfortunately, the global capital market integration has shown the impact of financial crisis in the way that the capital markets with the close linkage to the US market are

affected more than those capital markets with no linkage to the US market. Accordingly, the objective of this study is to investigate the short-run relation between the Thai stock market and some other selected stock markets by hypothesizing that the short-run relation should increase after the financial crisis.

2. Literature Review

Several studies on the market interdependence and linkage among various stock markets are reviewed and summarized by Mukherjee (2004). The author reviews the sample size, period of study, and techniques used in each related previous studies. Three approaches are conducted to describe the co-movement among different stock markets, namely "contagion", "economic integration", and "stock market characteristics". The finding is that the market integration has been increasing after the crisis.

Foo et al. (2008) study the impact of the 1997 Asian financial crisis on the linkage between the Singapore and other five stock markets, including Hong Kong, Japan, Malaysia, Thailand, and Dow Jones. The monthly data are obtained during the period from 1990 to 2001, and July 1, 1997 is used as the cut-off date for the pre- and post-crisis period. The DF and ADF tests are used for unit root tests, and the cointegration tests are employed to determine the integration between these stock markets. Then, the Granger causality test is carried out using Error Correction Model (ECM) and Vector Autoregressive (VAR) model for the cointegration and non-cointegration series, respectively. The authors conclude that the interdependence among these markets has intensified after crisis.

3. Methodology

The data of stock price indices of Dow Jones, NASDAQ, S&P500, FTSE100, DAX, CAC40, Nikkei, Hang Seng, and SET (Stock Exchange of Thailand) are used in this study. Dow Jones, NASDAQ, and S&P500 are representatives for the US market whereas FTSE100 (UK), DAX (Germany), and CAC40 (France) are representatives for the European market. In addition, Nikkei (Japan) and Hang Seng (Hong Kong) are representatives for the Asia market. Most data are obtained from yahoo finance except the data of SET index, which are obtained from SCBAM.

The daily data are defined into two subperiods covering a period of "pre-crisis" (March 19, 2008 to September 17, 2008) and "post-crisis" (September 18, 2008 to March 13, 2009). September 17, 2008 is employed as a cut-off date for the crisis because it was the subprime mortgage bankruptcy of Lehman Brothers. All data are normalized by taking logarithm.

Before testing a causality relationship between the time series of nine stock price indices, it is necessary to test for their stationary by employing the Unit Root test with the statistic test of Augmented Dickey-Fuller tests (ADF) and Phillips-Perron tests (PP) at level and the first difference. The Augmented Dickey- Fuller tests (ADF) can be summarized in three forms as follows.

(None) $$\Delta Y_t = \theta Y_{t-1} + \sum_{i=1}^{\rho} \phi \Delta Y_{t-1} + \varepsilon_t \quad (1)$$

(Intercept) $$\Delta Y_t = \alpha + \theta Y_{t-1} + \sum_{i=1}^{\rho} \phi_i \Delta Y_{t-1} + \varepsilon_t \quad (2)$$

(Intercept & Trend) $$\Delta Y_t = \alpha + \beta T + \theta Y_{t-1} + \sum_{i=1}^{\rho} \phi_i \Delta Y_{t-1} + \varepsilon_t \quad (3)$$

Besides the Autoregressive processes included in Augmented Dickey-Fuller test, Phillips and Perron provide a generalization of Dickey-Fuller procedure which allows for fairly mild assumption concerning the distribution of errors as the following equation:

$$Y_t = \alpha + \theta Y_{t-1} + \bar{a}_2 \left(t - \frac{n}{2} \right) + \mu_t \quad (4)$$

Where n is the number of observations and the disturbance term μ_t is such that $E\mu_t = 0$, but there is no requirement that the disturbance term is serially uncorrelated or homogeneous. The PP test allows the disturbances to be weakly dependent and heterogeneously distributed. (Ender, 1995, p. 239)

In this study, the ADF and PP tests involve three models, without intercept and trend, with intercept but no trend, and with both intercept and trend. The number of lag length is determined by using Akaike Information Criterion (AIC) in the unrestricted VAR test.

Then, the pairwise Granger causality tests are conducted with determined lag length. In the Granger causality test, the regression can be performed by the following equations:

(Unrestricted regression) $$Y_t = \sum_{i=1}^{p} \theta_i Y_{t-1} + \sum_{i=1}^{p} \gamma_i X_{t-1} + \varepsilon_t \quad (5)$$

(Restricted regression) $$Y_t = \sum_{i=1}^{p} \theta_i Y_{t-1} + \varepsilon_t \quad (6)$$

RSSr = Residual sum of squares from restricted regression
RSSur = Residual sum of squares from unrestricted regression
The null hypothesis and alternative hypothesis are shown as follows.

$H_0 : \gamma_1 = \gamma_2 = \ldots = \gamma_p = 0$
$H_a : H_0$ is rejected.

The F-statistic can be calculated from following equation:

$$F_{q,(n-k)} = \frac{(RSS_r - RSS_{ur})/q}{RSS_{ur}/(n-k)}$$

If calculated F-statistic is greater than critical value (Prob.$< \alpha$) the null hypothesis (H_0) is rejected, meaning that X Granger causes Y. Similarly, the null hypothesis that Y does not Granger cause X can be interpreted in the same manner.

4. Results

The results of unit root test for the pre-crisis period and post-crisis period are presented in Table 1 and Table 2, respectively. For both periods, all indices are not stationary at level; however, all nine series are stationary at the first difference at the 99 percent level of significance.

Table 1 Unit Root Test for the Pre-Crisis Period

		ADF Test			PP Test		
		None	**Intercept**	**Intercept & Trend**	**None**	**Intercept**	**Intercept & Trend**
DOW	Level	-0.309596	-1.506301	-2.098376	-0.337506	-1.386560	-1.895814
	Difference	-12.60174*	-12.56201*	-12.85467*	-12.61320*	-12.56347*	-12.85784*
NAS	Level	-1.128515	-0.515115	-2.843891	-0.942039	-0.176867	-2.674336
	Difference	-13.12607*	-13.18153*	-13.26501*	-13.21744*	-13.18153*	-13.26501*
S&P	Level	-1.009347	-0.004405	-2.060931	-0.822472	-0.060996	-2.488476
	Difference	-13.53200*	-13.56240*	-13.76723*	-13.53200*	-13.56240*	-13.93770*
FTSE	Level	-0.773147	-0.171877	-2.208983	-0.794671	-0.106153	-2.208983
	Difference	-11.59692*	-11.59903*	-11.96138*	-11.59739*	-11.59975*	-11.96138*
DAX	Level	-0.593954	-0.519820	-2.168412	-0.608389	-0.488076	-2.101315
	Difference	-12.08488*	-12.06705*	-12.44445*	-12.06852*	-12.05133*	-12.44340*
CAC	Level	-0.806947	-0.288678	-2.329640	-0.832384	-0.231391	-2.282030
	Difference	-11.98861*	-12.00081*	-12.24595*	-11.97574*	-11.99064*	-12.23575*
NIK	Level	-0.253089	-1.277034	-2.213351	-0.292280	-1.124272	-1.915771
	Difference	-13.14397*	-13.10026*	-13.63670*	-13.19815*	-13.15414*	-14.87630*
HS	Level	-1.035824	0.700124	-1.694735	-1.035252	0.743325	-1.610619
	Difference	-11.49305*	-11.51920*	-12.27745*	-11.52058*	-11.52783*	-12.28351*
SET	Level	-1.884243	0.862445	-1.998416	-1.957816	0.978913	-1.932198
	Difference	-11.70751*	-11.98798*	-12.36315*	-11.73272*	-11.97900*	-12.36198*

* indicates the significance at the 99 percent level

Table 2 Unit Root Test for the Post-Crisis Period

		ADF Test			PP Test		
		None	**Intercept**	**Intercept & Trend**	**None**	**Intercept**	**Intercept & Trend**
DOW	Level	-1.069966	-2.876283	-3.101759	-1.256330	-2.848668	-3.101759
	Difference	-12.91420*	-13.00251*	-13.14399*	-12.91420*	-13.09529*	-13.34407*
NAS	Level	-1.162572	-2.167612	-3.341942	-1.408301	-2.042963	-3.181935
	Difference	-13.11758*	-13.24190*	-13.25228*	-13.11758*	-13.42744*	-13.43431*
S&P	Level	-1.160275	-2.447757	-3.292688	-1.386261	-2.372416	-3.085116
	Difference	-12.90139*	-13.01697*	-13.07612*	-12.90139*	-13.16596*	-13.25917*
FTSE	Level	-1.089372	-2.363379	-2.894432	-0.808769	-2.220724	-2.847415
	Difference	-5.396001*	-5.503306*	-5.539175*	-12.19765*	-12.24016*	-12.25922*
DAX	Level	-1.032594	-2.101389	-2.867609	-1.125673	-2.041854	-2.879108
	Difference	-11.60430*	-11.67744*	-11.68775*	-11.63905*	-11.73845*	-11.78643*
CAC	Level	-0.949749	-1.979306	-3.357663	-1.138117	-1.824207	-3.318002
	Difference	-5.415658*	-5.625050*	-5.704524*	-12.67598*	-12.81251*	-12.86510*
NIK	Level	-0.907975	-2.548838	-2.744715	-1.004068	-2.492183	-2.801420
	Difference	-11.05345*	-11.08808*	-11.15439*	-11.08419*	-11.14920*	-11.34231*
HS	Level	-0.753719	-2.266653	-2.673354	-0.870887	-2.166246	-2.687044
	Difference	-12.22704*	-12.26441*	-12.29658*	-12.28928*	-12.38909*	-12.56170*
SET	Level	-1.150044	-2.579377	-2.135062	-1.067911	-2.580027	-2.150569
	Difference	-6.425986*	-10.93239*	-11.12240*	-10.89068*	-10.93244*	-11.12244*

* indicates the significance at the 99 percent level

The unrestricted VAR is utilized in order to determine the number of lag length. The lag length used is four since the short-run relationship is examined. The results of Akaike Information Criterion (AIC) at each lag length are shown in Table 3. Lag 1 and Lag 2 are employed for the pre-crisis and post-crisis sample, respectively.

Table 3 AIC for Lag Length Structure Criteria

Lag	Pre-Crisis Sample	Post-Crisis Sample
0	-62.23151	-49.76087
1	-62.55193*	-50.67494
2	-62.29074	-50.82301*
3	-61.97016	-50.77190
4	-61.46758	-50.65762

* indicates the significance at the 99 percent level

Table 4 Pairwise Granger Causality Tests

Sample	**Pre-Crisis period 3/19/2007-9/17/2008**		**Post-Crisis period 9/18/2008-3/20/2009**	
Lag	**1**		**2**	
Null Hypothesis:	**F-Statistic**	**Prob.**	**F-Statistic**	**Prob.**
DDOW does not Granger Cause DSET	12.7448	0.0005*	11.0911	0.0000*
DSET does not Granger Cause DDOW	0.64330	0.4240	0.75307	0.4731
DNAS does not Granger Cause DSET	12.5296	0.0006*	6.50156	0.0021*
DSET does not Granger Cause DNAS	0.66189	0.4174	0.40411	0.6685
DSP does not Granger Cause DSET	15.1787	0.0002*	6.99486	0.0013*
DSET does not Granger Cause DSP	0.92969	0.3368	0.33391	0.7168
DFTSE does not Granger Cause DSET	2.72199	0.1015	2.92005	0.0577***
DSET does not Granger Cause DFTSE	0.63806	0.4259	0.98854	0.3751
DDAX does not Granger Cause DSET	1.65074	0.2012	3.24517	0.0423**
DSET does not Granger Cause DDAX	0.23180	0.6310	0.09955	0.9053
DCAC does not Granger Cause DSET	2.13569	0.1464	2.44430	0.0910***
DSET does not Granger Cause DCAC	0.19442	0.6600	1.87512	0.1577
DNIK does not Granger Cause DSET	1.29456	0.2574	0.66919	0.5140
DSET does not Granger Cause DNIK	0.81672	0.3679	3.01072	0.0529***
DHS does not Granger Cause DSET	1.00268	0.3186	2.40297	0.0947***
DSET does not Granger Cause DHS	0.50375	0.4792	0.40900	0.6652

* indicates the significance at the 99 percent level
** indicates the significance at the 95 percent level
*** indicates the significance at the 90 percent level

The Granger causality tests are executed on two sets of sample: pre-crisis and post-crisis. Table 4 demonstrates the pairwise Granger Causality tests. For the pre-crisis period, Dow Jones, NASDAQ, and S&P500 Granger cause SET at the 99 percent levels. Nonetheless, there is no relation between SET and FTSE100, DAX, CAC40, Nikkei, and Hang Seng. Thus, only the linkage between the Thai stock market and the US market is found.

For the post-crisis period, Dow Jones, NASDAQ, and S&P500 Granger cause SET at the 99 percent level. DAX Granger causes SET at the 95 percent level. FTSE100 and CAC40 Granger cause SET at the 90 percent level. Hang Seng Granger causes SET at the 90 percent level. SET Granger causes Nikkei at the 90 percent level. Thus, the linkage between the Thai stock market and the US market, the European market, and the Asian market is found after the crisis.

5. Conclusions

This study examines the short-run relation between the Thai stock market and the US market, the European market, and the Asian market during the period before and after the subprime mortgage bankruptcy of Lehman Brothers. According to the Granger causality tests, for the pre-crisis period, only Dow Jones, NASDAQ, and S&P500 Granger cause SET, meaning that there is a linkage between the Thai stock market and the US market.

However, after the crisis, Dow Jones, NASDAQ, S&P500, FTSE100, DAX, CAC40, and Hang Seng Granger cause SET. Additionally, SET Granger causes Nikkei. Thus, there is the short-run relation between the Thai stock market and the US market, the European market, and the Asian market. The findings also exhibit that the global capital market is more integrated after the crisis with the higher level of statistical significance.

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Initiating Key Account Management (KAM) In A Thai Freight-Forwarding Company

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Abstract

This case study seeks to identify the critical Key Account Management (KAM) criteria and key accounts for profitability, and develop a strategic tool for managing Key Accounts (KAs) in a Thai freight forwarding company. Freight-forwarding is a relatively new and fast-growing Thai services sector. With increasing power of customers and globalisation, and maturity of industry-to-industry markets, business organisations have begun to rethink their approach to services delivery by adopting KAM as a tool for satisfying key customers and long-term business success. Findings of the study show that the freight-forwarding company has recognised the need for KAM strategy for sustainability and competitiveness, but lacks adequate skills and knowledge about KAM and KAs who account for a larger share of turnover. Profit, customer power, creditworthiness, frequency of freight, and information exchange stood out as the most important critical criteria for identifying company KAs. The KAs perceived inadequate freight forwarding skills among staff, and lack of personalised, online, and after market support services as major weakness in services delivery. However, most managers were enthusiastic about KAM development programme. The findings informed the design and launch of a pilot and consequent KAM programme which embodied the development of customer data, improvement of internal process through team working, training, better personalised and after market support services, and increased communication and strategic partnerships with KAs.

Keywords: Freight-Forwarding, Key Accounts Management, Key Accounts, Logistics, Supply Chain Management.

1. Introduction

Companies need to continuously improve core competencies and resource capabilities for sustainability and profitability. Logistics businesses are undergoing radical changes in order to meet and exceed customer needs, and closely encounter and win customer loyalty (Goudin, 1998) having recognised that not all customers are the same; some are important than others, hence, prioritisation and KAM (Fiocca, 1982).

Key Accounts Management (KAM) is the theory and practice of winning 'customers' hearts' (McDonald et al, 2000). Like Pareto's 20/80 rule, KAM can be used to prioritise and manage vital

few customers to increase sales and business. It is a relatively new management tool, but has wide application across countries, organisations and industry.

Logistics is a thriving and vibrant Thai service sector, but Thai freight forwarding, let alone KAM seem obscure in literature. The three-fold purpose of this case study are to investigate how Speedfreight a Bangkok-based freight forwarding company identifies KA (Key Account) criteria and who their KAs are, and develops strategies for KAM programme.

The problem issues concern critical KA criteria, KA characteristics, and KAM strategies. This work comprises six sections: introductory; review of literature; research methodology; overview of Thai freight forwarding industry; research findings, discussion and implications, and; summary and conclusions. Table 1 shows null hypotheses posited for testing in this research.

Table 1 Research Hypotheses

Ho 1:	Profit is the most important critical criteria for identifying key accounts
Ho 2:	Five companies - RH, RIC, ARC, DPT, and PRM – are major KAs.
Ho 3:	There is no difference in perceptions about delivery performance among staff and account managers.
Ho 4:	There is no significant difference in the opinions of staff and accounts' managers on price levels.
Ho 5:	There is no significant difference in the opinions of Speedfreight managers and account managers about order service.
Ho 6:	There is no significant difference in perceptions of Speedfreight's managers and accounts managers about Speedfreights customer service performance.

2. Review of Literature

KAM concept origins in the mid 1970's are in industrial marketing, purchasing and procurement, and strategy management (Bragg, 1982; McDonald et al., 1999). The impact of globalisation (McDonald et al., 2000), maturity of markets, ICT (information and communication technologies) development, customer assertiveness (Maher, 1984), and increased competition (Shapiro & Wyman, 1981) caused companies to revise their attitude to customers (Platzer 1984). Companies designated salespersons to interface with few and key accounts, resolve transactional issues and ensure reliable delivery of products/services (Pegram, 1972, Shapiro & Posner, 1976; Stevenson & Page, 1979).

Evolution and dynamics of KAM's development is depicted in Figure 1. Today, KAM finds application in both industrial and consumer markets (Barrett, 1986), transcends selling, and creates institutional long-term relationships between seller and buyer companies (McDonald et al., 1999).

Stevenson (1981:119) describes KAM process thus: '……. *very large and /or important customers are accorded special treatment and special status by the marketer. Once designated as a key account, the customer will generally be called on by a special sales force, and may receive inventory concessions, better prices, and special service arrangements.'*

Verra (1999) defines KAM as: 'a philosophy and a set of instruments and techniques which are used to monitor the relationship with major and/or potential customers and improve them through activities with the overall aim to increase the turnover and profits'. The goal of KAM (Shapiro & Moriarty, 1982) is to generate incremental profits from large or potentially large complex accounts

over an extended period of time through long-term 'institutional' relationship (Stevenson, 1981), which cuts across multiple levels, functions, and operating units in both the buying and the selling organisation.

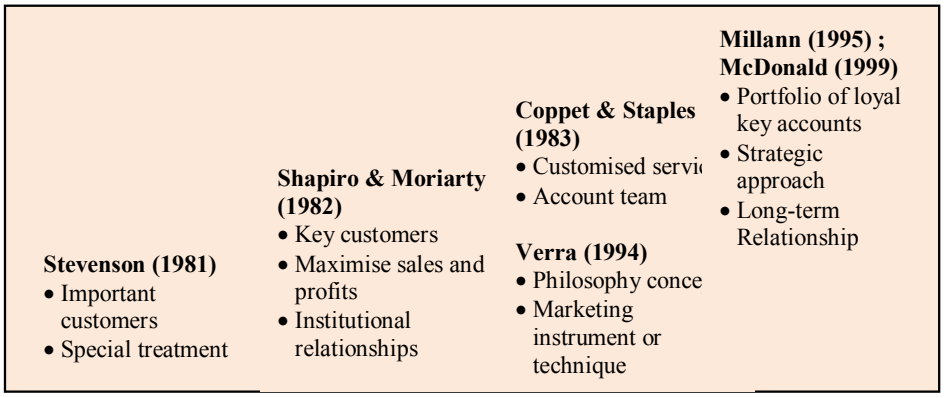
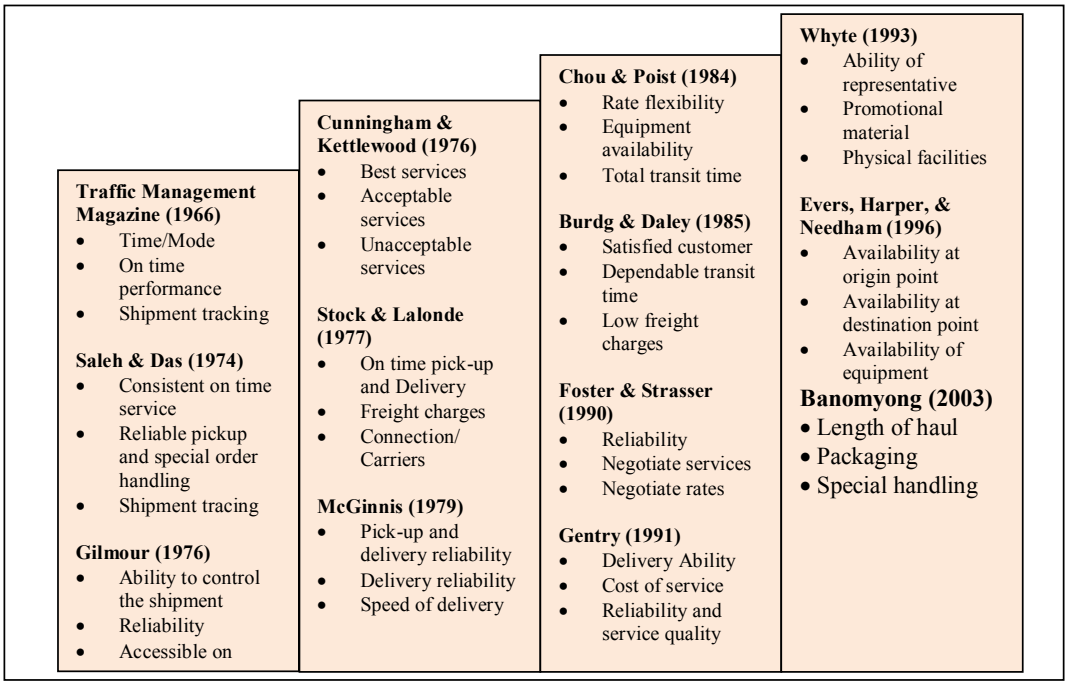


Figure 1 Evolution and Dynamics of Kam Philosophy

Peppers and Rogers (1997) note two important stages in development of a successful KAM programme: identifying KAs, and; developing KA-centred strategies. KA criteria for identifying KAs are complex and varied including profit; age of relationship; trust; cost; customer power; perspective similarity; information exchange; creditworthiness; commitment, and; co-operation. (Bjerre, 1995); Campbell & Cunningham, 1983; Fukuyama, 1995; McDonald et al., 1999; Millman, 1995; Pels, 1991; Sullivan & Peterson, 1982). Buyers develop KAM strategies specific to each KA's circumstances (Pepper & Rogers, 1999). Some criteria organisational buyers use to evaluate freight forwarders' performance is contained in 'Freight Forwarding Selection' publication (Webster & Wind, 1972). Figure 2 can present taxonomy for sourcing freight transportation services (McGinnis, 1990).



Source: Adapted, McGinnis, M. A. (1990)

Figure 2 Criteria for Freight Forwarding Service Selection

Murphy and Hall (1995) believe 'reliability' and 'freight rate' impact delivery leadtime (Christopher, 1998). Davies (1984) and Frazelle (2001) see cost of freight, reliability, reputation, responsiveness, willingness to improve service quality, commitment to service excellence as key service selection criteria. Similarly, Brand and Grabner (1985) consider 'tracking ability' via e-commerce, and freight charges as criteria for selecting a freighter. It seems Hewlett Packard's 'TQRDCE' metrics (technology, quality, responsiveness, dependability, cost and environmental management) appear to be robust criteria (Cox, 1997).

KAM assumes KAs represent the vital few (20 percent) clients that contribute the largest share (80 percent) to turnover; failure to prioritise and disregard of KAs can spell loss of important business and profitability. Allocation of special and adequate resources to satisfy KA's needs, maintain long-term relationship and KAs' loyalty may be profitable.

3. Research Methodology

Figure 3 explains the methodology of research which addresses three issues: key criteria for KAM; identification of KAs, and; KAM strategies for Speedfreight.

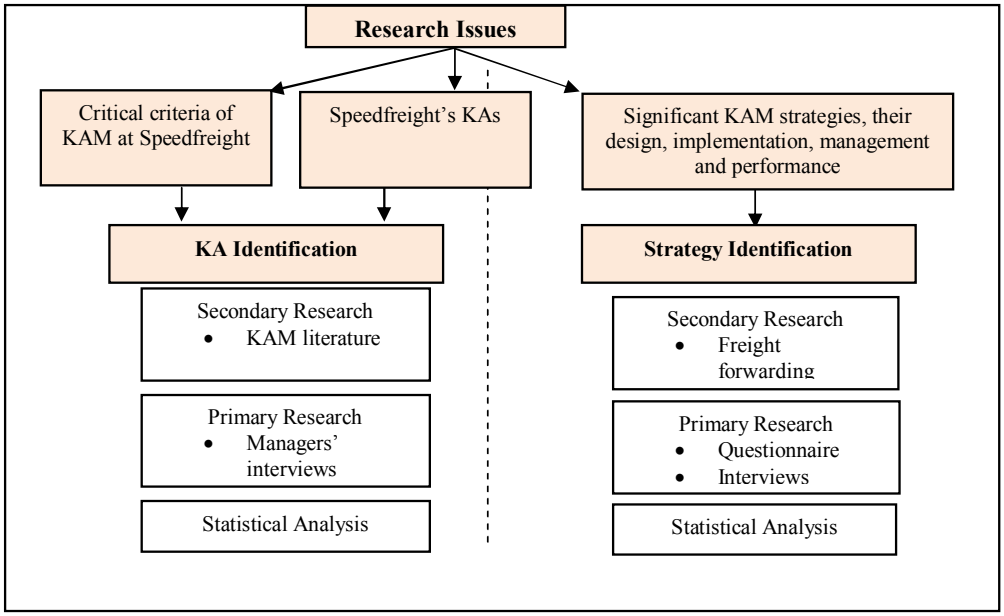


Figure 3 The Research Model

3.1 Key Account Identification

Secondary research (literature review), and Speedfreight's customer database configured on the basis of preferred criteria list in Figure 4 were used. The list isolates two groups of criteria for KAs' classification: 'Profit group' (Profit, Cost, Profit and Cost ratio, Frequency of freight and Creditworthiness), and; 'Relationship group' (Customer power, Information exchange, Commitment, Co-operation, Trust and Age of relationship). Company documents were the main source of information on 'Profit Group' criteria for 86 active customers. Structured Likert-scale type

questionnaire administered to a random sample of 4 Speedfreight managers provided information for the 'Relationship group' criteria.

A 'Critical Criteria' questionnaire was used to gather opinions of 4 Speedfrieght's managers as to which client qualify as a KA. Data gathered were collated and analysed by using descriptive, correlation, regression, and factor analyses, and *t*-Tests (Bohrnstedt & Knoke, 1982; Kinnear & Gray, 1999; McCormack & Hill, 1997).

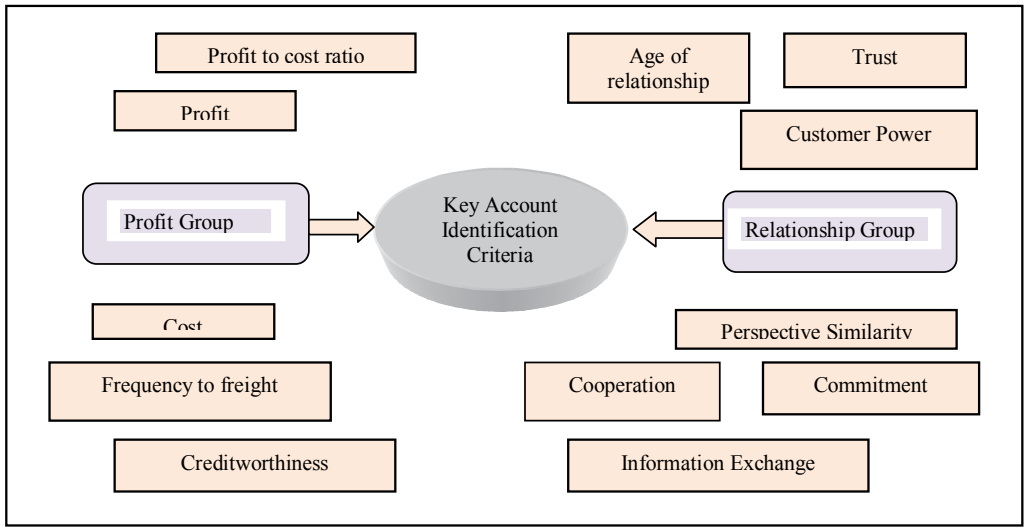


Figure 4 Preferred Final Key Account Identification Criteria

3.2 Strategy Identification

Literature on freight forwarding was secondary source of information KAM strategy identification. Also, two sets of 13-Likert-scale-statement questionnaires (Customer Satisfaction and Performance Evaluation) were designed, piloted and refined (Douglas, 1995). The former was used to ascertain opinions of the 4 managers on quality of Speedfreight's services, and the latter staff perception about operational performance and service gaps. *T*-Test was used to test hypotheses posited in the research.

3.3 Limitations of Research

This research applied triangulation techniques (Merriam, 1998) and Cronbach (1951) coefficient α to ensure validity (Yin, 1994) and reliability of research. However, limitation arising from constraints of time, cost, language and cultural, small sample size and measurement need not be overlooked. For instance, KAM programme development is costly, procedural and requires time, which in this case study is short-circuited (Millman & Wilson, 1995). Though greater awareness of cultural sensitivity was shown, the researcher's perceived respondents were reticent; a limitation corroborate by the Thai Institute of Research (2002) and. Laosethakul (2002). Ostensibly, the small size of sample population is a limitation to research. Speedfreight, a small family-owned Thai freight forwarding company with 16 employees is a typical SME (small and medium size enterprise), so a survey sample of 4 top managers seems to be a fairly good representative sample.

4. Thai Freight Transport Sector

4.1 Overview

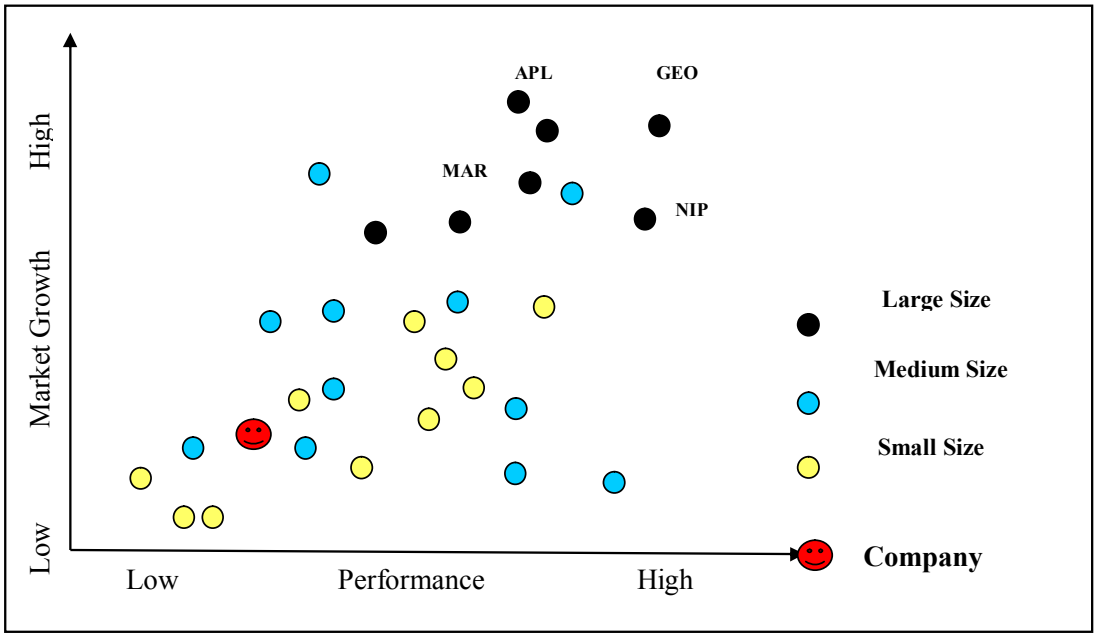
Thai's transport and communications sector will account 8.7 percent (US$26.2 billion in nominal terms) of GDP in 2011. In 2006, it employed 1.03 million people (3 percent of total labour force) (Thailand Freight Transport Report 2009). But, since 2006, the industry is facing uncertainties over rising energy costs, road-building budget constraints, and tense security situation, particularly in the south of the country. The Government is, therefore, looking to enhance efficiency, productive use, and management of urban transport (especially, in Bangkok), subways, ports (Bangkok, Laem Chabang, Ranong, Phuket, Songkhla, and strategic new Pak Bara and Songkhla ports), and international airport network (Bangkok, Chiangmai, Chiangrai, Hat-Yai, Phuket, and Suvarnabhumi airports). The Thailand Freight Transport Report (2009) forecasts that total freight across all modes will experience 5.0 percent growth annually between 2007 and 2011. Road haulage constrained but budgetary cuts in infrastructure will grow by 4.8 percent (measured in tonne-km). Notwithstanding high jet-fuel costs, airfreight turnover will experience the strongest growth thanks expansion in new commercial lines and deregulation of routes and airport slots. Over 40 million ton-kilometres of goods go through Thai air transport yearly. Maritime cargo is expected to grow 5.0 percent yearly during the forecast period. Container traffic will expand somewhat faster and railway freight traffic will expand at a lower rate of 4.3 percent per annum (Thailand Freight Transport Report 2009).

Thailand is second in terms of freight and infrastructure growth, and transport intensity index (a measure of dynamism of foreign trade) among regional peers, but trails top performers like Australia, China, Malaysia and Singapore. Thailand's logistic cost/GDP (19 percent in 2007) is still higher than trading partners like India, Japan, EU, and USA (Keretho, 2008). This can continuously climb down through increasing awareness and companies' efforts toward improving logistics management efficiency. Companies in the supply chain can reduce logistics cost, increase business responsiveness, reliability and security, and consequently create value added. A freight forwarder is more than 'an agent who arranges transport and prepares shipping documentation' (Minahan, 1996). In today's global, competitive and knowledge-driven economy, a freight forwarder can provide additional value-added and integrated logistics services to clients. Over 450 Thai freight forwarding companies can be grouped into large, medium and small size companies in terms of characteristics, size, and scopes of services. Large freight forwarders employ 200 to 300 people provide wide range of services such as distribution, customs, warehousing, and air, ocean and overland transport and use appropriate logistics technology to meet the needs of particular groups of customers. Hence, they market services under global logistics providers or suppliers of supply-chain management solution labels. They account roughly 30 percent of total freight forwarding turnover. Some of the top multimodal freight services providers are Geologistics, UPS, APL Logistics, and Maersk. About 30 percent of Thai freight forwarders are medium size businesses employing 50 to 100 people and accounting 25 percent of the total freight GDP. Although their scope and services are somewhat similar to the larger companies, their capability to deploy high technology is relatively limited. Freight Master, Ekasert, Sea Lam Chabang and Bangkok Freight Forwarders Co. are examples. Over half of all freight forwarding companies is small employing up to 50 people. They are dominantly local and provide all freight forwarding services except warehousing. Examples include Opensea Cargo, Arrow Freight and Fast Freight Forwarding.

4.2 Speedfreight Company

Speedfreight is Bangkok-based established in 2000. It is somewhat financially sound, a World Freight Group member, and provides both domestics and international air, sea and

documentation services. Speedfreight does consolidation, co-ordination, containerisation and direct cargo shipment. Figure 5 shows the relative market position of the Company.



Note: GEO - Geologistics Co.,Ltd, APL - APL Logistics Co.,Ltd, NIP - Nippon Express Co.,Ltd, and MRK - Maersk Logistics Co.,Ltd.

Figure 5 Company Position in The Market

Figure 6 is a SWOT analysis of Speedfreight (Johnson et al., 1989). One of the business' challenges is lack of customer-focus; greater attention is given to 'cost cutting' and efficiency to the detriment of KAM, relationship management and clients' lifetime value reward. Competitors like APL Logistics have recognised the benefits of KAM and its impact on profitability and competitiveness (Capon, 2001; Laosethakul, 2002).

Strengths	**Weaknesses**
• Adequate financial resources • Average performance standard • Cost/price advantages • Motivated and open-minded CEO • Experienced staff • Strong customer service vision • On time delivery	• Lack of adequate ICT • Lower standard of web site interface • Policies not up-to-dated • Lack of teamwork and communication • Limited knowledge of junior staff • Little knowledge about customers needs and expectations
Opportunities	**Threats**
• Ability to serve additional customers • Falling trade barriers • High agriculture products exports • Assistance from Thai government • Expansion of IT in Thailand • Expansion in maritime transport	• Global economic downturn, political uncertainty • International competition • Highly competitive freight forwarding sector • Adverse shifts in government infrastructural investment and transportation policy

Figure 6 SWOT Analysis of the Company

5. Research Results, Discussion and Implications

5.1 Key Account Criteria

Figure 4 shows the 12 KA critical criteria identified in the manager survey (Cronbach coefficient α 0.734). Table 7 depicts descriptive statistics: 'Profit level', 'Frequency of freight', 'Creditworthiness', 'Customer power' and 'Information exchange' emerged as important criteria.

'Information exchange' and 'Age of relationship' (r = 0.707); 'Information exchange' and 'Profit' (r =0.577), 'Trust' and 'Age of relationship' (r = 0.853); 'Trust' and 'Profit' (r = 0.807), and; 'Age of relationship' and 'Frequency of freight' (r =0.817) correlated strongly and positively. But, they do not show causality. Which of these relationships is representative?

Table 7 Descriptive Statistics

The answer lie in Principal Components Analysis (PCA) (Bryman & Cramer, 1997; Cramer, 1994) which isolated three components that accounts about 100 percent of total variance (Table 2).

Table 2 Varimax Orthogonal Factor Loadings – Identifying KAM Critical

KAM Criteria	**PC 1**	**PC 2**	**PC 3**
Profit	**.987**	-.158	**-0.038**
Cost	.486	-.732	.477
Frequency of Freight	.425	**.687**	-.589
Creditworthiness	.486	-.732	**.477**
Profit to Cost ratio	**.987**	-.158	**-0.11**
Customer Power	**-.178**	**.912**	.370
Information	.600	**.853**	.288
Level of Trust	.630	-.199	-.521
Commitment	.384	0.067	**.400**
Co-Operation	.700	.653	.288
Age of Relationship	**.765**	.324	**-.384**
Perceptive Similarity	.178	**-.912**	-.370
Extraction Sums of Squared Loadings (% cumulative)	*43.584*	*35.493*	*20.923*
Rotation Sums of Squared Loadings(% cumulative)	*43.584*	*79.077*	*100.000*

Factor 1, labelled 'Profit–Cost–Ratio' (PCR) factor has strong positive loadings on the variables 'Profit' (r = 0.987) and 'Profit to Cost ratio' (r = 0.987). Profit was viewed by many managers as the most important KAM critical criteria for identifying KAs. Benefits of higher profit margins included: increased company attractiveness and investment; reduce debt and borrowing; increased liquidity, creditworthiness, flexibility and financial stability, and; increased employee motivation. Seybold (1998) and Smith (2000) confirm small businesses regard profit as the most important business survival factor. Hunt (1998) sees profit as a nutrient for survival, Gene (1997) the blood and factor of growth and longevity, and Atrill and McLaney (2001) the ingredient of corporate health. Also, Gene (1997) suggests profitability is a symptom of corporate health both physically and mentally. From the deductions and results, it is conceivable that the most important KAM critical criteria in identifying KAs at Speedfreight are 'Profit'. Thus, Ho 1 hypothesis that 'Profit' is the most important critical criteria for identifying KAs is accepted:

Ho 1 Accepted:	Profit is the most important critical criteria for identifying key accounts (KAs).

Factor 2 dubbed 'Power - Information' (PI) factor explains Speedfreight's efforts to tap into Government funds for information and communication technologies (ICTs) development so as to serve better the needs of KAs. Majority of managers (75 percent) perceived 'Customer power' as important criteria.

Smith (2000) argues that it is not particularly bad to have big customers with a lot of power, but it can be worse when they use their bargaining power of leverage fair or foul to obtain large and disproportionate reductions in price. However, relationships with large and powerful accounts can offer many opportunities such as customer reference (Smith, 2000), positive impact on employee perceptions and perceptions of new and prospective customers (Armstrong, 2000), and marketing strategy guide. 'Information exchange' refers to accounts' willingness to provide information to Speedfreight as when desired in the transaction process of meeting potential customer's needs, making proposal, and finally clinching the deal (Figure 8). Inaccurate information exchange can increase processing leadtime which impacts negatively on business deals.

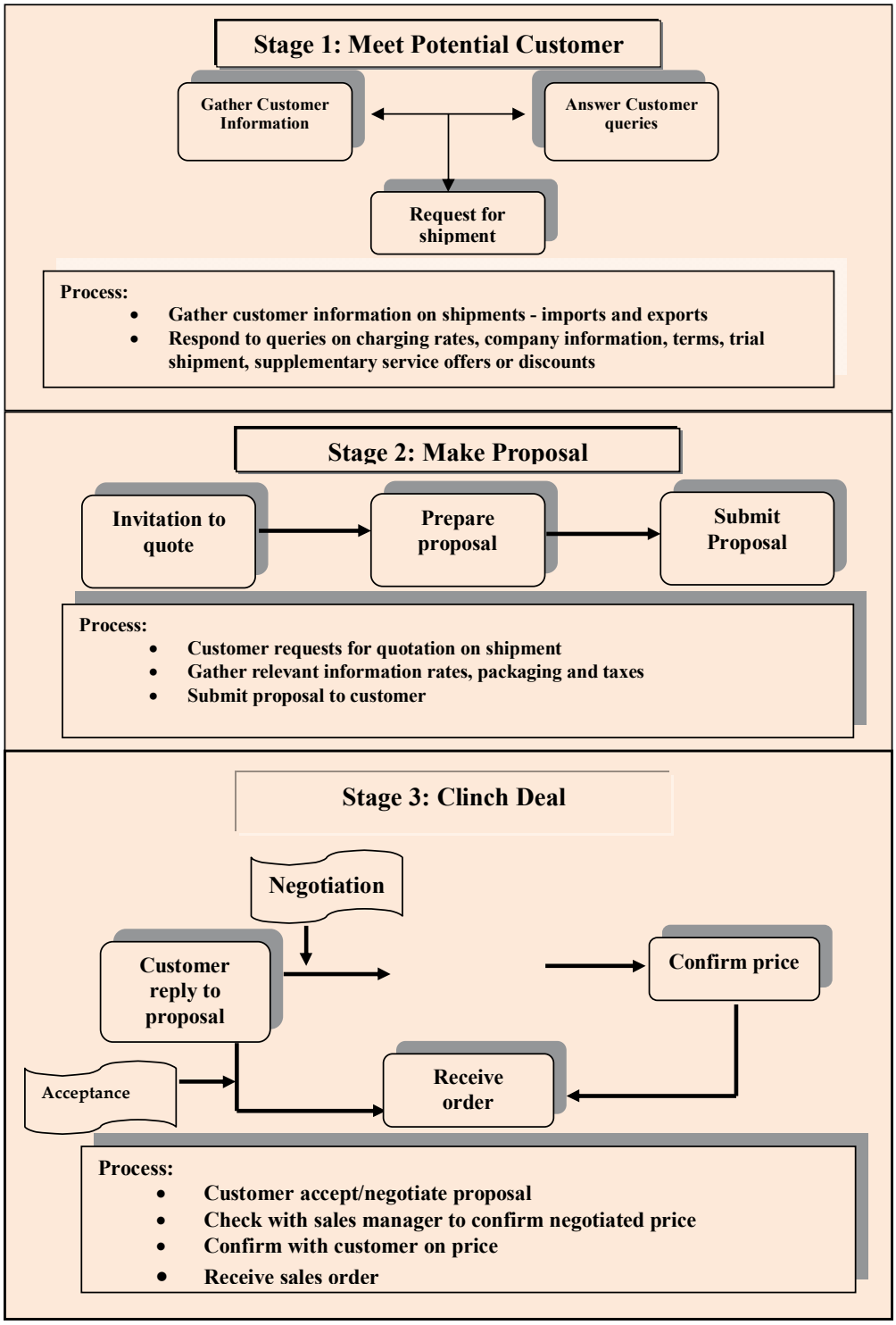


Figure 8 Business Transaction Process

Factor 3 -'Creditworthiness - Commitment' (CC) - alludes to KAs ability to pay credit within 15 to 30 days period. The length of business relationship has little correlation with KA's creditworthiness and commitment. 'Creditworthiness' can impact positively efficiency and cash flow (Atrill & McLaney, 2001).

Average settlement period of debtors is as high as 42 days compared to the industry average of only 36 days. Delays in debtor payments can risk cash flow cycle and consequently creditworthiness, reputation and relationships with creditors such as banks and suppliers. Some established customers default on credit payments. KAM can enhance debt collection strategies and trust.

5.2 Identifying Company's KAs

A two-stage KA selection process was based on scores on five critical criteria ('Customer power', 'Creditworthiness', 'Frequency of freight' and 'Information exchange'). First 86 candidate accounts were reduced to 44 and then 18 (Table 3).

Table 3 Eighteen KAs

	Abbreviated Name of KA	Industry Sector
	RH	Chemicals
	RIC	Food
	YUS	Electronics and parts
	EVG	Textiles
	MEGAC	Chemicals
	IPD	Packaging and food
	BOS	Electronics and parts
	RUSK	Electronics and parts
	ARC	Chemicals
	RADI	Electronics and parts
	SW	Food
	DOCS	Food
	KIM	Electronics and parts
	APX	Plastics and chemicals
	RONX	Logistics
	EV	Textiles
	KTP	Food
	HI	Chemicals

Further analysis based on logistics and transportation services that accounts use (Slater, 1980, 1990) targeted 5 clients for investigation and hypothesising.

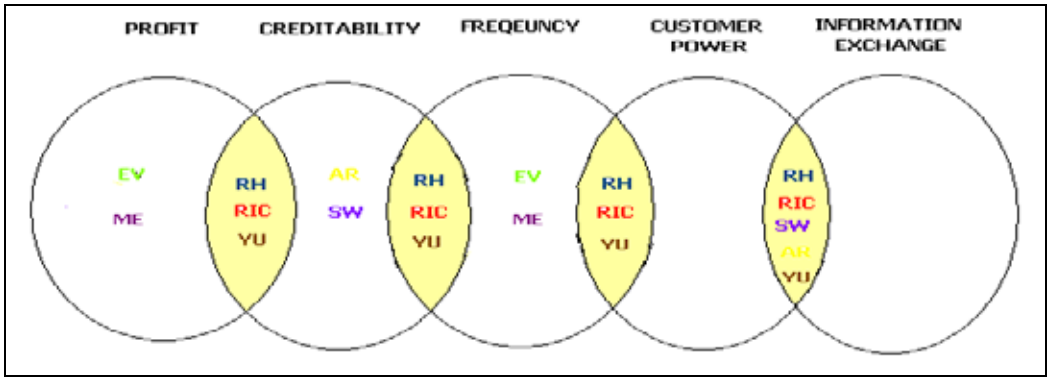
Ho 2: Five companies - RH, RIC, ARC, DPT, and PRM – are the major KAs.

Results of group *t*-Test show marked differences in the means of two accounts and consequent reject of hypotheses and exclusion of DPT and PRM from the top-five KA candidate list (Table 4). DPT a relatively large entity pays credit late and PRM provides very limited business and rarely shares information.

Table 4 Summary of T-Test Results, 5 Accounts

Company	*t*-value and *p*-value	Acceptance or Rejection
RHM	t(14) = 1, $p = 0.347$	If $p > 0.05$, **H_0 is accepted**, the result is not significant.
RICL	t(14) = 1, $p = 0.347$	If $p > 0.05$, **H_0 is accepted**, the result is not significant.
ARMC	t(14) = 1, $p = 0.347$	If $p > 0.05$, **H_0 is accepted**, the result is not significant.
DPT	t(14) = -4.0, $p = 0.04$	If $0.05 < p > 0.01$, **H_0 is rejected**, the result is significant.
PRM	t(14) = -4.0, $p = 0.04$	If $0.05 < p > 0.01$, **H_0 is rejected**, the result is significant.

Final analysis of statistics and use of the Key Account Identification Matrix resulted in isolation of priority top 5 KAs (Figure 9).



	Abbreviated Name	Industry Sector
1.	**RH**	Chemicals
2.	**RIC**	Food
3.	**YU**	Electronics and parts
4.	**ARC**	Chemicals
5.	**SW**	Food
6.	**EV**	Textiles
7.	**ME**	Chemicals

Figure 9 Five Top KAs of Company

5.3 Strategy Identification Result

Table 5 is based on Customer Satisfaction and Service Performance surveys. Aspects of the thematic measures of delivery, order, price, and customer service performance were individually investigated using *t*-Tests to examine differences between mean values.

Table 5 Performance Measures

Delivery Performance Tracking ability (IT capability) Delivery reliability (On time, Safety) Order status information (notice on late delivery)	**Price Performance** Reasonable price compared to other competitors
Order services Ordering convenience (by phone) Ordering convenience (by Internet)	**Customer Service Performance (Staff)** Acknowledgement of customer representative meet/talk with (Mode of transport) Attitude of representative of the company (helpfulness, politeness) Response time (on time) Staff accessibility (availability of staff) (7*24*356) Document accuracy/Quality Quality of customer services Customisation/Personalisation After services support: Cards, reminder of special offers or promotion

1. Delivery Performance

Delivery performance of Speedfreight was measured in terms of 'Tracking ability', 'Delivery reliability', and the ability to inform on 'Order status'. It was posited that that there is no difference in perceptions about delivery performance among staff and account managers.

Ho 3: There is no difference in perceptions about delivery performance among staff and account managers.

Results of *t*-test analysis summarised in Table 6 show no significant difference between perceptions about ability to track services and inform on order status, thus there is need for strategy in the short-run.

Table 6 Summary *T*-Test Results, Delivery

Delivery	*t*-value and *p*-value	Acceptance or Rejection
Tracking Ability	t(21) = .514, p = .533	If $p > 0.05$, **H_0 is accepted**, the result is not significant.
Delivery Reliability	t(21) = -2.456, p = .002	If $0.05 < p > 0.01$, **H_0 is rejected**, the result is significant.
Order Notice	t(21) = .614, p = .546	If $p > 0.05$, **H_0 is accepted**, the result is not significant.

'Tracking ability' was perceived as outstanding; Speedfreieght selects carefully technically and managerially capable third party logistics providers (3PLs). E-commerce adoption is a strategic option that the company and KAs look for unrestricted and real time transaction and convenience.

KAs underestimated delivery performance, because they do not really know how good Speedfreight's services have been.

2. Price Performance

Price performance is another important area of analysis for hypothesis building and testing.

Ho 4: There is no significant difference in the opinions of staff and accounts' managers on price levels.

T-Test results presented in Table 7 show that there is no difference in perceptions about Speedfreight's price levels.

Table 7 *T*-Test Results, Price Level

Price	*t*-value and *p*-value	Acceptance or Rejection
Price Comparison	t(34) = 1.711, p = .096	If $p > 0.05$, **H_0 is accepted**, the result is not significant.

Speedfreight adopts flexible pricing strategy; frequent and large-volume shippers' enjoy price rebates (5-10 percent reduction) and relaxed debtor settlement period during off-peak seasons (June and August) in order to sweeten relationship with accounts.

3. Order Service

To the hypothesis concerning order service performance, Table 8 reveals the *t*-Test results.

Ho 5: There is no significant difference in the opinions of Speedfreight managers and account managers about order service.

Seven phone lines, personal cellular phones and two fax connections are dedicated to customer ordering services. Accounts prefer ordering by phone while some prefer ordering online and the company seeks to adopt e-commerce.

Table 8 Summary Result of T-Test, Order Service

Order	*t*-value and *p*-value	Acceptance or Rejection
Order By	t(34) = 1.711, p =	If $p > 0.05$, **Ho is accepted**, the result is not
Order By Internet	t(34) = -5.872, $p \approx$ 0.004	If $p < 0.05$, **Ho is rejected**, the result is significant.

4. Customer Service Performance

T-Test is used to test hypotheses on 8 areas of Speedfreight's customer service performance: 'Sale staff attitude', 'Responsive time', 'Document Accuracy', 'Skill of staff', 'Accessibility', 'Quality service', 'Personalised services' and 'After market support'.

Ho 6: There is no significant difference in perceptions of Speedfreight's managers and accounts managers about Speedfreights customer service performance.

T-Test results in Table 9 indicate acceptance of three of the 8 null hypotheses ('Attitude', 'Responsiveness', and 'Documentation') and rejection of the rest.

Table 9 Summary Results of *T*-Test on Customer Services

Customer Service	*t*-value and *p*-value	Acceptance or Rejection
Skill	t(34) = -5.745, *p* =	If 0.05 < *p* > 0.01, **H_0 is rejected**, the result is
Attitude	t(34) = -.718, *p* = 0.678	If *p* > 0.05, **H_0 is accepted**, the result is not
Response	t(34) = 1.844, *p* = 0.074	If *p* > 0.05, **H_0 is accepted**, the result is not
Personalisation	t(34) = -4.449, *p* = 0.001	If 0.05 < *p* > 0.01, **H_0 is rejected**, the result is
After Market	t(34) = -8.135, *p* = 0.001	If 0.05 < *p* > 0.01, **H_0 is rejected**, the result is
Accessibility	t(34) = -6.724, *p* = 0.001	If 0.05 < *p* > 0.01, **H_0 is rejected**, the result is
Document	t(34) = 0, *p* = 0	If *p* > 0.05, **H_0 is accepted**, the result is not
Quality	t(34) = -2.507, *p* = 0.014	If 0.05 < *p* > 0.01, **H_0 is rejected**, the result is

Staff attitude to accounts is written in the customer services manual. Furthermore, staff are asked to be polite towards customers (Armstrong, 2000).

Average response lead-time to customer enquiry) ranges from 15 to 30 minutes. In the event that the leadtime should be more than the average, an apology is given the customer. Errors in freight forwarding documentation are very low. Quality of documentation was ranked high by both staff and accounts.

The five alternative hypotheses suggest the need for medium and long term strategy formulations: staff skills shortages – recruitment and training; accessibility – make contact persons available on 24X7X365 basis; quality of service – practice continuous improvement techniques; personalisation of service - delivery a one-to-one business solution designed and tailored to meet individual account's needs, and; after-market support- put in place better after-market support (AMS) services.

6. Summary and Conclusion

Speedfreight is perceived to be in Pre-KAM stage of development as it becomes aware and prepares for KAM programme (Figure 10) (Eisenfeld, 2002).

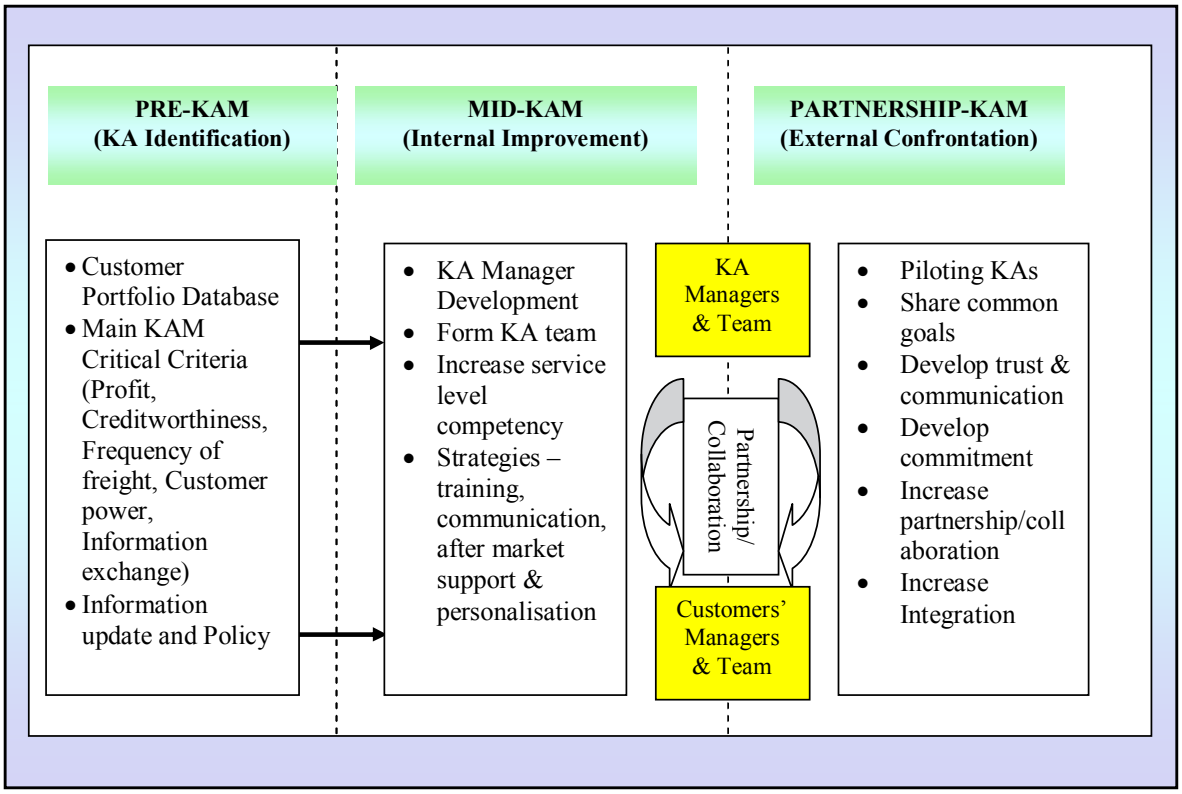


Figure 10 KAM Stages and Progress

6.1 Pre-KAM Strategies

At the Pre-KAM stage strategies for development may include: upgrading 'Customer Portfolio' database to capture all customers; developing robust KAM critical factors ('Profit', 'Creditworthiness', 'Information exchange', 'Customer power', and 'Frequency of freight'); developing 'Customer Matrix' (ranking tool) for KA identification; updating continuously information on all accounts to increase reliability and consistency, and; setting periodic meetings to review KAs status.

6.2 Mid-KAM Strategies

When reaches the Mid-KAM stage, Speedfreight may consider: leveraging existing competences, and improving internal processes and performance in order to meet KAs' requirements; selecting and appointing KAM 'champions' to further develop, implement and monitor KAM strategies, and; developing management skills, attributes (Davies, 1993) and styles (Armstrong, 2000) that foster co-operation, participation and 'political entrepreneurship' (Wilson, 1995).

Results of *t*-Tests and analysis indicated process areas worth improving such as ordering services online, accessibility to contact persons, staff skills, and quality of service, personalisation/customisation, and AMS. KAM training programmes can help KA managers to develop requisite team competences and skills. Continuous improvement techniques and benchmarking will assist best practice development.

Accounts expected Speedfreight's quick response and passion when meeting their needs preferably on one-to-one and personalised basis. The practice of e-commerce is rudimentary, but it can be adopted to promote increased real-time and unrestricted accessibility, dialogue and personalisation of service, customer retention and lasting relationship, customer satisfaction and lifetime value.

6.3 Partnership KAM Strategies

Partnership (Lamming, 1993), alliance and win-win situation seem best for both parties at this stage. KAM implementation needs to emphasise customer lifetime and enhanced value relationship, and devotion and commitment staff.

Strategies needed to ensure successful KAM implementation are depicted in Figure 11. These may entail piloting KA programme, building trust and partnerships, and integration.

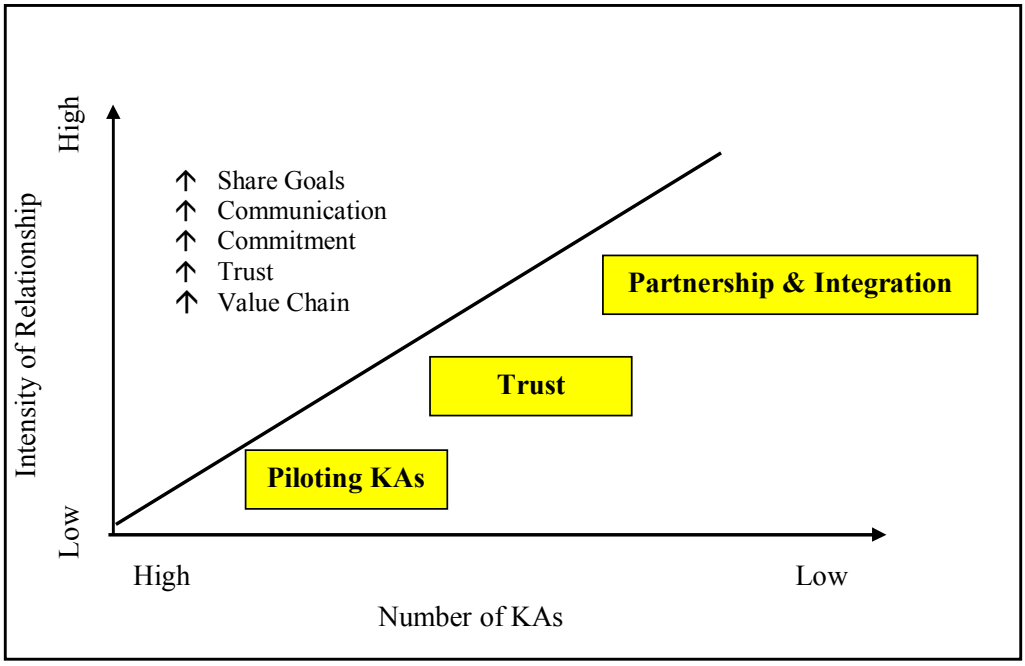


Figure 11 Partnership/Integration Process

The 18 KA candidates will have to be informed about the programme. First, piloting it an enthusiastic and strategic few will be essential. Speedfreight and KAs can work to: review goals or common interests and aspirations (Krapfel et al., 1991); set objectives and targets, and demonstrate commitment to the programme, and; mandate and share information about organisational structures, needs, and resources willingly and in a timely manner.

Openness, transparency, devotion and commitment can foster trust and co-operation, and increased formal and informal communication higher trust levels. KA managers will perform boundary-spanning role of 'relationship builders' and play concurrently negotiator, consultant, and interpreter of customer needs, mediator, and customers 'advocate/friend, and informational broker functions.

To progress from trust to partnership and integration stages, both parties need to increase co-ordination of activities, and avoid conflicts by seeking to understand and address common problems. Figure 12 shows an integrated KAM network. It can be realised when synchronised and collaborative channels exist between Speedfreight's KA managers and KAs.

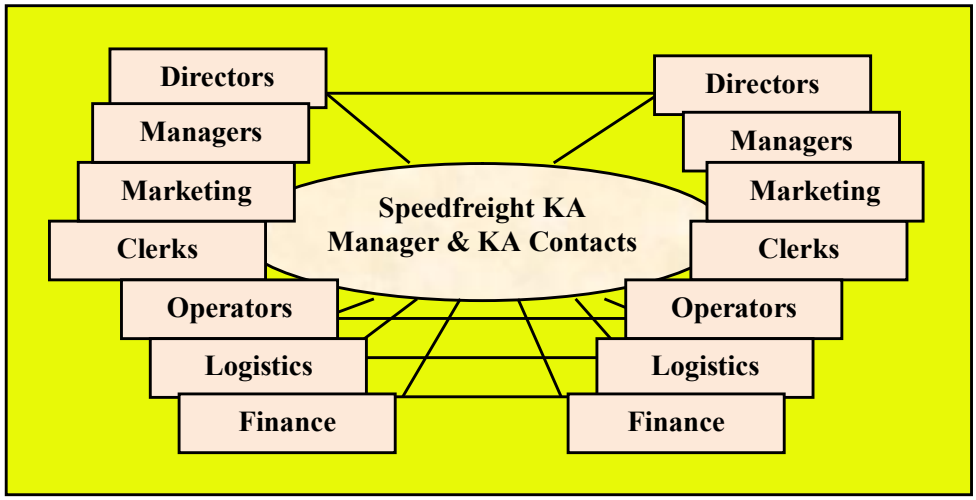


Figure 12 Integrated KAM Network

Speedfreight may find KAM very time-consuming, but the benefits accruing may include: better management overview and customer portfolio management; efficient resources' use; better understanding of clients; experience what clients feel; steep learning curve; information sharing; visibility of expectations concerning KA activities, and; increased profitability through higher turnover. (Ryals & Rogers, 2007).

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Dr. Benjamin Botchway is currently is a manager of a renewable energy technology company. He has been a pioneer faculty and Associate Professor of Business and Entrepreneurship at the American University of Nigeria (a 'greenfield' institution), where he taught Operations Management and Entrepreneurship and contributed to strategy and curriculum development of the School of Business and Entrepreneurship. Dr. Botchway also taught as a senior lecturer Supply Chain Management, Logistics and Business at both undergraduate and postgraduate levels at Birmingham City University, UK. He has worked as an industrial development expert with the United Nations Industrial Development Organization (UNIDO- Vienna), and contributed to a number of practical problems solving initiatives in both upstream and downstream automotive industry supply chains. Areas of his research interests include Supply Chain Integration and Rationalization, and Entrepreneurship Education. Dr. Botchway received his PhD and MA in International Trade/Economics from University of Augsburg, MA in European Law and Economics from the, Technical University of Vienna, and MSc in Supply Chain Management/Logistics from the Birmingham City University respectively.

Deployment of RFID Technology in Two International Fashion Retailers

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Abstract

Customers are more demanding in terms of responsiveness, level of service, quality of products and costs. Firms only could reach these goals simultaneously if they invest in new technologies. A new technology that has received considerable attention from academics and practitioners, especially among retailers, is the Radio Frequency Identification (RFID) because of its large scope of application, advantages and potentialities. This paper aims to present the potentials, requirements, advantages, disadvantages and challenges associated with the deployment of RFID in two international fashion retailers. It intends to emphasize the importance of this technology to business perform faster, with more quality, cheaper and with more responsiveness in retailers. Two case studies are presented, one Portuguese and the other American.

Keywords: Radio Frequency Identification (RFID), Fashion retailers; Case Studies

1. Introduction

The Radio Frequency Identification (RFID) is the generic name to the technologies that use the waves radio (Jones, *et al*., 2005) for the automatic identification of objects, positions or persons through electromagnet answers and at a considerable distances (So and Liu, 2006). It allows that firms produce, store and deliver a high quantity of data quickly (Bange, 2006).

RFID is an emerging technology that intends to complement or replace traditional barcode technology to identify, track, and trace items automatically. RFID is claimed to add intelligence and to minimize human intervention in the item identification process by using electronic tags. The tags are significantly different from printed barcodes in their capacity to hold data, the range at which the tags can be read, and the absence of line-of-sight constraints (Meyerson, 2007).

This paper aims to highlight the potentialities of the RFID technology in a fashion retailing context. That is, it seeks to emphasize the importance of this technology to firms perform their logistics activities faster, with more quality, cheaper and with more responsiveness. To attain this and as a way of illustrating, the main motivations, gains and difficulties that could be involved in the deployment of this technology two fashion retailer case studies are presented, one Portuguese and other American.

The paper is structured as follows; first, the characterization of the RFID System in terms of the elements that constitute it (readers, tags, software, and security programs) is presented. The following section focuses on the main advantages and disadvantages associated with the use of the RFID technology to all firms in general and to retailers in particular. Next, two case studies about the deployment of the RFID technology in a Portuguese and American fashion retailers (Throttleman and American Apparel) are described. Finally a discussion and some conclusions are drawn.

2. The RFID System

A RFID system is composed by several elements: readers, tags, software, and security programs for the readers (Atkinson, 2004). Instead of visible light used in ordinary bar code labels, these tags use radio waves to communicate with the readers. The readers generate signs that are able, by one hand to supply energy to the tag in order to generate data and, on the other hand, to send a sign of interrogation.

To produce radio waves tags require some source of energy to power its electronics. Active tags use a tiny battery, a microchip, and a tiny antenna built into them. The operating frequency of radio waves employed also varies. Low-frequency RFID tags operate at 125 to 134 kHz, for US and international use. High-frequency systems use 13.56 MHz. Frequencies of 866 to 960 MHz are used in UHF (ultra-high-frequency) systems, while microwave systems operate at 2.4 to 5.8 GHz (Dipert, 2004).

The key component of an RFID system is the tag itself. Tags come in a large variety of forms and functional characteristics. One useful way of classifying tags is to divide them into active and passive classes. Active tags whose read/write range is longer and passive tags with shorter range. However, passive tags are much cheaper than the active tags and are therefore more widely used. The active tags have more possibilities and bigger flexibility than the passive ones. This is because, they

have their own internal power source which is used to power the integrated circuits and broadcast the signal to the reader

To distinguish tag types from each other, Electronic Product Code (EPC) Global has established five tag classes to indicate capabilities a tag can perform. For instance, Class 0 tags are factory programmable. The EPC number is encoded onto those tags during manufacture and can be read by a reader. Class 1 tags can be programmed by the retailer and supplier. They are manufactured without the EPC number which can be encoded onto the tag later in the field (i.e., by retailer and supplier). The Class 3 tags have the Class 2 capabilities plus a power source to provide increased range or advanced functionality. The Class 4 tags have the Class 3 capabilities plus active communication and the ability to communicate with other active tags. The Class 5 tags have the Class 4 capabilities plus the ability to communicate with passive tags as well.

Antennas also come in a diverse range of form and technical factors. They are used in both the tags and the reader. The size could vary from under a square centimetre to several square meters. Technically speaking, UHF reader antennas can be classified as circular-polarised or linear-polarized antenna. The former emit and receive radio waves from all directions, while the later work best in one particular direction. Therefore circular-polarized antennas are less sensitive to transmit Readers could come in four types: handheld, vehicle-mount, post-mount, and hybrid (Meyerson, 2007). The first three are dedicated to reading of the tags, active or passive. The fourth type has the active/passive mode allowing it to switch from the passive to active mode and vice versa. Both handheld and hybrid readers are more expensive than the vehicle-mount and post-mount. Next generation readers are expected to have less power consumption and fewer voltage requirements.

Passive RFID readers create a radio frequency field when they are turned on. When a reader detects passive tags, it activates them. These tags draw their power from the radio frequency field; they do not require battery power. Because they have no battery, the passive tags are smaller and lighter in weight than active tags. Some are as light as or even lighter than the bar-coded labels (Meyerson, 2007). When the active tags with power come into the reader's field, the reader switches to the read mode and interrogates the tag. However, the operating range of a linear-polarised antenna is more than that of a circular-polarised antenna (Intermec, 2004). When a tag communicates with an antenna, the radio frequency portion of the circuit between the tag and the antenna is called the air interface. This radio communication takes place under a certain set of rules called air interface protocol. Propriety protocols may cause interoperability problems with equipment from different vendors.

Readers read or interrogate the tags. In reading, the signal is sent out continually by the (active) tag whereas in interrogation, the reader sends a signal to the tag and listens. To read passive tags, the reader sends radio waves to them, which energise them and they start broadcasting their data. The reader reads all the tags within its read range in a quick succession. This automatic process reduces read times. In a field test, Marks & Spencer, UK, tagged 3.5 million bins with RFID tags. While it used to take 17.4 minutes to read 25 trays with bar codes, on 36 dollies, RFID reduced that to just three minutes. This result was in an 83% reduction in reading time for each tagged dolly (Wilding and Delgado, 2004). Software is the glue that integrates an RFID system which depends upon the industry context, but usually a front end component manages the readers and the antennas and a middleware component routes this information to servers that run the backbone database applications. For example, in a

manufacturing context, the enterprise software will need to be made aware of RFID at various levels depending on how far downstream into manufacturing and out into the supply chain RFID is implemented. The middleware technologies could be into three levels: (i) software applications which solve connectivity problems and monitoring in specific vertical industries; (ii) application managers that connect disparate applications within an enterprise; and (iii) device brokers that connect applications to devices like shop-floor machines and RFID readers (RAGMS, 2004).

The enormous advantages associated with this technology, has justified its large application in several functional areas. We can find the RFID technology in different contexts mainly in: i) anti-terrorism initiatives (Albright, 2005); ii) electronic keys; iii) warehouses (Meyerson, 2007); iv) centres of distribution (Borck, 2006); v) points of sales and; v) security applications in the transport (Kevan, 2004), demotic (Kelly and Erickson, 2005); vi) e-business; vii) Supply Chain Execution Applications; E-business (Meyerson, 2007).

2.1 Advantages and Disadvantages of the RFID Technology

There is a high investment in the development and improvement of the RFID systems because of the important advantages that firms can reach with it when compared with bar code tags where the reading must be done by a visual contact using optical readers. In this context, one of the advantages pointed out to the utilisation of the tags is its power of reading. The tags can be read independently of the environment conditions. They can be read in aggressive environments such as fire, ice, ink, noise and different temperatures (Knill, 2002). This system presents also a high, rigorous and simultaneous capacity of reading (So and Liu, 2006), what could become an important source of competitive advantage in the logistics field. This characteristic, contribute to increase the efficiency of the transport in terms of loads and unloads of cargo once the warehouse operators do not have to use optical reader for collect data about the products that are loaded or discharged in the vehicles. Moreover, this technology allows collecting information of objects in movement (Knill, 2002; Bange, 2006).

The application of the RFID technology can brings also some advantages to the warehousing activity. The collection of the information put in each tag, allows the automatic and rigorous replacement of the stocks' levels (Atkinson, 2004; Kelly and Erickson, 2005), a easier identification of the places where products are stored in the warehouses (Kelly and Erickson, 2005; Kinsella and Elliot, 2005) and a quicker collect of data (Sullivan, 2004; So and Liu, 2006) without any kind of visual contact with the products (Borck, 2006). Knowing that on average, and in case of bar codes, the warehouse operators read the bar code labels around 25 times, it is comprehensible the high productivity than can be achieved when in its substitution smart labels are used with all the processes' automation that it could involve (Kinsella and Elliot, 2005).

In terms of economics, security and marketing, the RFID technology can bring also some advantages. Economically we assist a decrease on stock levels due to a higher control of it and also a better productivity (Witt, 2006; Sullivan, 2004). Thanks to the application of this system, the firms in general and the retailers in particular can reach, by one hand, a decrease on stockouts, a better control of procurement and a development on cross-selling in a more efficient way (Kinsella and Elliot, 2005). The RFID technology makes also possible a better control of the packaging conditions from upstream to downstream of the supply chain (Kevan, 2004; So and Liu, 2006). This last question is related with the

rastreability which is imposed by the European regulations to the products agro-food. In the development of the Picking activity the RFID can also contribute to increase its efficiency and productivity. Several antennas RFID, put strategically in the zones of picking, permit that a set of products references will be identified and transferred for expedition, leaving a rigourness on the pick-and-pack sequence while provides a complete final listing of the references of each order (Trunick and Williams, 2005).

In the activity of transport, this technology can be used to identify a specific product or to monitor the temperature of the products during the transport. More, the RFID makes possible to verify also if the temperature or humidity of the products was broken during the transport chain (Kevan, 2004). In this way, it is possible to have access to all conditions under which the products were submitted during the transport and also to use security mechanisms (Kinsella and Elliot, 2005).

In the case of retailers, the tags allow them to do a more efficient management of stocks levels (Borck, 2006) since becomes much easier and quicker the identification of the products and also the control of products' life-cycle. The permanent control of the products putted in the shelves of the stores allows the development of specific marketing decisions to each product (Atkinson, 2004; Kelly and Erickson, 2005). Under a widened viewpoint, the RFID permits a better visibility of all the supply chain, necessary for a better management of it (Witt, 2006). Among organisations, a supply network characterised by rich information exchange, which can be enabled by RFID, increases the feasibility of implementing alliances of firms that exchange information to coordinate production and distribution, outsource functions and services, and partner with suppliers and intermediaries (Lee *et al.*, 1997; Straub *et a*l., 2004). In cases in which the RFID System adopts a more open and integrated configuration, allowing that the information flows through all partners of the same supply chain, a lot of bottlenecks of information reading can be avoid.

In a supply chain the products can be tracked at various locations as they move from one end of the supply chain to another in the central warehouse and for the delivery and storage of goods and shelf filing. Using the data captured from the RFID tags, goods can be reordered according to demand and inventory safety check. All goods are sorted on RFID-tagged pallets in a central warehouse before they are delivered to the Future Store. Data captured from RFID tags are transferred to an electronic RFID merchandise management system, allowing the goods to be registered with the respective information in the system. Once registered, the locations of goods can be tracked throughout the entire logistic chain. When ready, the loaded pallets are moved to the exit zone of the central warehouse, where an electronic gate is installed with an RFID reading device.

When passing this gate, the data in the chips of the tags affixed to the cartons and pallets is transmitted to the merchandise management system. When goods are received at the Future Store, employees transport the pallets from the truck through an RFID gate at the backstore entrance. The data of the chips on each pallet and crate are read. Once the merchandise management system is updated, the supermarket employees can compare the received goods with the order to determine if the order was met or if the items were over-shipped, under-shipped, or missing. After the goods are delivered for storage in the back room of the Future Store, each storage position is affixed with an RFID tag. When storing the goods, the employees use a handheld scanner to read this tag into the system. When taking goods to the sales room to refill the shelves, the employees pass an RFID gate at the exit of the backstore area, where

the data on the RFID chips affixed to the cartons is captured for transmission to the merchandise management system. Cartons that could not be emptied due to a lack of shelf space are returned to the backstore area. As they pass at the gate, tag data is updated and then transferred to the system. When the merchandise is emptied from the carton, the RFID tags are deactivated

According to Atkinson (2004), in the U.S.A. billions of dollars are lost annually, with the inefficiencies that occur on the supply chains motivated, to a great extent, by the incorrect locations of products in the store shelves or by a bad management of the information.

A wide range of benefits is being claimed for RFID technology within retailing including: (i) tighter control and management of the supply chain and of inventory management with attendant cost savings (Jones *et al*., 2004; Coltman et al., 2008); reduced labour costs; improvements in customer service; reduction in shrinkage and theft (Jones *et al*., 2004, Coltman *et al*., 2008; Veeramani *et al*., 2008); and clear targeting of customers and tracking of their purchasing behaviour (Jones *et. al*, 2004). Also, the real time data generated by the tags can provide manufactures, suppliers, distributors and retailers with up to the minute information on inventory, logistics and freshness (Jones *et. al*, 2004). RFID technology does not require a line of sight, since it can read many tags simultaneous. RFID will facilitate improved use of warehouse and distribution centre space in that goods will not need to be stored according to product type for manual location, but they can be stored in the most efficient manner. Retailers will be able to know where pallets and cases of goods are to (Coltman *et al*., 2008), to identify products that may have been recalled, to respond rapidly to unforeseen changes in the supply chain, to react quickly to problems within the supply chain, to check on expiry dates and to determine when products will arrive in store (Jones *et al*., 2004). RFID within a retailer enables a reduction in the number of incorrect manual counts, unreported stock loss, mislabelling, and inaccessible/misplaced inventory (Veeramani, *et al*., 2008).

Within stores many other benefits are also predicted for RFID. Many manufacturers have indicated as much as a 7% increase in sales because of the greater visibility of the inventory on the shop floor. RFID can not only detect if items are being moved from the store without being paid for but also they can alert security guards if a large volume of particular products have suddenly been removed from store's shelves. It also reduce check out times in that customers will able to push their trolley of carry their basket past a reader and get a complete list of all items purchased automatically charged to the customer's credit card (Jones *et al*., 2004). Retailers will also be able to track products that are selling rapidly and to restock shelves several times a day with such fast moving items. RFID can also be used to promote products and stimulate upselling. It could be also used to trigger an interactive display of related products (Jones *et a*l., 2004)

In general, the widespread adoption of RFID will allow retailers to spend more time selling products rather than stocking or tracking them. As it can be seen, the new application of the RFID technology in a business and logistics context can bring a lot of advantages for the firms in terms of optimization and of efficiency. However, some problems have also been identified by the firms. Despite of the enormous advantages attributed to the RFID technology, some disadvantages are also pointed out. In this context, the main disadvantage attributed to the use of this technology is its cost. It involves a big investment (Borck, 2006) and the return of this investment is only recuperated in a long time (Kinsella and Elliot, 2005). If a short Return-on-Investment (ROI) was verified it could promote the use of this

technology because according to Trunick and Williams (2005) this type of technologies presents a great level of obsolescence and innovation. Furthermore, the cost of each smart label is higher than the bar code one which lead firms with millions of SKUs to think about it.

Coltman *et al*. (2008) make the following questions related with the use of this technology: (i) can the cost per RFID tag reach feasible economies of scale for individual level tagging?; (ii) who will bear the cost of deployment in the supply chain and how will these costs be distributed in an equitable manner? In this context also Veeramani *et al*. (2008) refer that one of the barriers to the adoption of RFID by organisations is the difficulty in assessing the potential return on investment (ROI). Besides a set of authors had analysed the impact of the implementation of the RFID technology in ROI (Hardgrave *et al*., 2005; Rekik *et al*., 2008), there is a lack of a good understanding of the impact of RFID upper echelons of the supply chain. RFID can greatly affect the retailers and suppliers that manufacture and distribute goods for them (Veeramani *et al*., 2008).

The level of security provided by the RFID represents another disadvantage. From the point of view of Atkinson (2004) is relatively easy to have access to the information that flows in a RFID systems in a warehouse or in a centre of distribution centre of a competitor. It is only necessary to use a radio telescope in a relatively near distance. This can explain the fear of the firms to adhere to the RFID technology. The complexity of this technology, the lack of know-how and standardisation are some obstacles referred by firms for not use the RFID technology (Albright, 2005).

Once analysed the main characteristics, advantages and disadvantages associated with the RFID technology in a retailing context, we will focus on the challenges the firms are facing to implement this technology. There are many technical challenges associated with the deployment of RFID based solutions. Among the main technical challenges faced by firms could be highlighted the erroneous reads, the read collisions and the cost of handling large amounts of data generated by RFID (Coltman *et al*., 2008). Retailers are starting to drive the introduction of RFID and it would seem to have the potential to revolutionise. Wal-Mart the world's largest retailer has introduced its top suppliers to place RFID tags on all its pallets and cases in order to improve the efficiency, effectiveness and security through the supply chain. Also, within the UK a growing number of major retailers such as Sainsbury, Marks & Spencer, ASDA and Tesco have been experimenting with RFID technology (Jones *et al*., 2004).

RFID is poised to fundamentally change the way companies in a supply chain track, trace and mange assets. This will have major impact on manufacturing, transportation, distribution and retail industries (Veeramani, *et al*., 2008). The introduction of RFID will generate major training needs for retailers and their suppliers and distributors to allow their employees to use the new systems and master new job functions. Before the introduction of the RFID technology retailers will need to undertake a fundamental strategic review of their business process and of their relationships with suppliers and distributors. Retailers will also need to integrate their RFID systems and the data they generate with their other functional databases and applications such as accounts and customer relationship management (Jones *et al*., 2005).

3. Case Studies: Throttleman and American Apparel

The main objective of this section is to present two case studies (one Portuguese and other American) to illustrate the deployment of the RFID in fashion retailers with a special highlight on its challenges, advantages and disadvantages. The data necessary to elaborate both case studies was gathered by secondary sources specially newspapers, conference presentations and companies' website. The firms focused in this research are the Throttleman and the American Apparel.

3.1 Throttleman Case

As regards Throttleman, it is a Portuguese company that initially (1991) in its start up phase adopted the brand of BOXER SHORTS and after 2000 changed to the Throttleman. In the beginning the brand focused on mans apparel especially in underwear and after 2003 widespread its assortment to kid's apparel and in 2005 to women collections. Throttleman's manufacturer supplies 1.5 million men's and women's fashion items yearly.

3.1.1 Why the adoption of the RFID?

In the world of fashion retailing, the start up processes of a collection assume, more and more, a determinant role in what concerns the determination of invoicing. When the number of pieces begin to increase, as was the case of Throttleman, it is indispensable that firms find forms of become their processes more agile in order to avoid delays in the reception of pieces in warehouse and the bottlenecks in the lunching phase of a collections.

Prior to installing the RFID system the distribution process was handled manually. When shipments from the manufacturer in India arrived at the retailer's distribution centre, employees had to open each box and visually check to ensure the items listed on the advance shipping notice were in fact inside the box. When shipments were sent to the stores, the items were hand packed and manually recorded. In the development of all of these processes a lot of mistakes were identified. Beyond the internal problems Throttleman faces also others related with the supply chain management, mainly the high lead time with orders reception, the lack of capacity to do the reposition of the stores in time; the overstocks in warehouses; the lack of reliability on stocks levels; and the difficulty to synchronise the reality with the ERP adopted.

In this context, the firm fells the necessity to find a solution fitted to its requirements and necessities. The solution chosen was the RFID technology. This solution divides itself in three different areas: Edgeware, Integration and RetailID Solutions. The Edgeware is composed by the physical platform of RFID which includes the passive and active tags, manual readers, antennas and fixed readers, porticos and tunnels of reading. The integration aggregates the functionalities of the Edgeware and the solutions of the RetailID. The RFID is responsible by the management, of the information filtration that comes from the physical layer and by the combination of this one with the integration. The solution RetailID, was disposed by the Sybase in partnership with the Paxar and the CreativeSystems. The first partner, entrusts-itself with the supply and the impression of the labels RFID and the second one with the supply, support and integration of the hardware. The firm advanced with the placement of

tags RFID in some pieces of the winter collection, willing to extend the process to all the collection in the next year. In the warehouses, it is working already the process of orders control through RFID and his subsequent sending for the stores.

Throttleman started the first phase of the RFID pilot in March 2007. The garments are tagged with EPC Gen2 RFID tickets that are printed with variable data at Avery Dennison Service Bureau facilities (global network for printing variable data labels and tags). The garments with the RFID tags attached are packed in boxes and shipped from the manufacturer in India to the Throttleman distribution centre (DC) in Portugal. At the distribution centre the RFID tags inside the boxes are read and confirmed simultaneously in just a few seconds providing immediate information on quantity, style, size and colour.

With the new system, Throttleman's clothing manufacturer in India applies a RFID label to each item. The manufacturer programs and verifies tags at the site before shipping the goods, and sends the retailer an advance shipping notice listing which items are being shipped. When the boxed garments arrive at Throttleman's DC, they are placed on a conveyor and sent through the Tagsys 3-D tunnel interrogator. The interrogator captures the tag ID numbers with an accuracy of 99.9 percent, and sends that data through a wired LAN connection to the retailer's software system. The software then matches those numbers with the advance shipping notice, confirming that the correct items have been received. If it determines that ID numbers are incorrect or missing, the system illuminates a warning light on the warehouse floor alerting the employees to check the contents of the box. Later, when items are repacked in boxes for shipment to stores, the tags are scanned in the same tunnel reader to compare the ID numbers against the pick list, before being loaded on trucks. Throttleman then sends an advance shipping notice to the stores.

Actually Throttleman is using the system only to verify the accuracy of the shipments its distribution centre receives from India and sends to its stores. However, the clothing seller intends to equip its nearly 100 stores in Portugal and Spain with RFID readers at the receiving docks during the next two years. At that time, stores will also verify the receipt of each shipment as it arrives from the DC, before moving the items to the sales floor. Throttleman does not have yet plans to read the tags at the point of sale.

3.1.2 Advantages and disadvantages with RFID deployment

With the deployment of the RFID technology the Throttleman enhances a lot of advantages. Since does not become necessary open all the boxes and verify piece by piece, the firm is reaching a good performance as regards the life cycle of products, any thing as four days of sales in store. On the other hand, the stock static decreased 60% contributing to a reduction on the warehouse space needed.

Moreover, the option of Throttleman by the RFID technology permits its integration with the logistics process of the brand being, at the same time, a quick project in terms of development and implementation. The Portuguese fashion retailer has reduced also the time items spend in the supply chain by seven to five days and a quickly identification of them as they arrive from the manufacturer in India ensuring that the right items are shipped to its stores throughout Portugal and Spain. After the implementation of this solution the reception lead time improved a lot. Before this the average of this

indicator was 4,97 days and after RFID it reached an improvement to less than 24 hours. Furthermore, the stock levels in warehouse decreased 60%.

Beyond all the important advantages identified and according to the Throttleman' CEO, the investment in all the project RFID is low, not arriving even to the six digits. The big cost is associated with the smart tags, since it costs four times more than the traditional. Each tag costs 30 cents to the firm.

3.1.3 Challenges faced by Throttleman

After having successfully achieved the first objective of improving the supply chain process, Throttleman has now started a second phase that will involve tagging 60% of the current collections, 371,234 articles, with the RFID tickets. Throttleman is considering the possibility of creating a new shopping experience in their retail stores by installing one of the most innovative solutions from Avery Dennison, the Magicmirror. Magicmirror is an interactive mirror that informs the user about the garments that they are trying on. Information about the garment is read from the tag and appears simply by putting the garment in front of the mirror. In addition a touch screen option offers the client the possibility of requesting a different size or colour from the shop assistant without having to leave the cubicle.

The tagging of all the garments will allow the firm to attain the following advantages: (i) complete online inventory in the warehouse and stores; (ii) decrease the error' levels in the system; (iii) improve thrust and accuracy of data; (iv) get better capabilities in terms of anti-theft and fraud (in the supply chain); (v) complete ITL (Item Level Tracking); (vi) complete supply chain traceability; (vii) smart Identification of the client needs; (viii) personalised contact and Direct Marketing; (ix) customer experience solution; and (x) cross selling.

3.2 American Apparel Case

American Apparel starts manufacturing its own products in 1997 in Los Angeles. The factory has the capacity to produce 1 million shirts per week, 275,000 pieces a day and around 100 millions pieces yearly.

It is a vertically-integrated manufacturer, wholesaler and fashion retailer that also performs its own design, advertising, and marketing. It begins retail operations in October 2003 and at this moment the brand has around two hundred stores in quite diversified locations such as: United States, Canada, Mexico, Brazil, United Kingdom, Ireland, Germany. France, Belgium, Netherland, Switzerland, Austria, Sweden, Spain, Italy, Israel, Japan, Korea, China and Austria.

3.2.1 Why the adoption of the RFID?

The deployment of RFID system by American Apparel was motivated mainly by its business characteristics associated with its products, processes and customer's requirements. American Apparel displays only one of each size, style and color of a particular item on its sales floor which contributes to increase the stocks management complexity. Each item in each of its color and size variations has a

place on the salesroom floor, and the company does not load up the racks with multiples items of the same kind. So, as soon as an item has been taken off the rack to be tried on, or purchased or just carried around the store as the customer is browsing, the item is not identified being considered as unavailable.

There are also a lot of items that look similar to each other, and because of that the probability of items get misplaced or misidentified was very high. Besides, the high sales volume often means that more than 1,000 items a day are moving back and forth between stockrooms and salesrooms provoking that in average 10% of the items that should be on the salesroom are lost in the stockroom. Being so, accuracy was a problem. Moreover, taking manual count of around 10,000 items on the sales floor and 30,000 stocked in the basement means have to ask employees to work more hours a day. These factors have been pointed out as main reasons to the investment of American Apparel in the RFID System.

The main architectural characteristics of the RFID system used in the American Apparel are described next. Motorola's Enterprise Mobility business, together with Vue Technology and Avery Dennison were the solution used by this company. In this company were used the Motorola MC9090-G RFID handheld readers for cycle counting and Motorola XR440 fixed readers with AN480 antennas to track stock moving from the backroom to the sales floor, and also at the point of sale to indicate a sale, a decrease in inventory, and trigger a product replenish. The tags from Avery Dennison's Retail Information Services combined with Vue Technologies' TrueVUE Platform were also used. The Avery Dennison AD-222 tags were chosen for their consistency and accuracy in tracking merchandise.

The integrated solution delivered by Vue Technology is comprised of TrueVUE hardware and software products (TrueVUE Site Manager, Enterprise Manager, Essentials, Essentials Mobile, Commissioning, and Exchange) to provide the enterprise-wide device and network management, desktop and mobile workflows, EPC commissioning, and developer interfaces to RFID.

For the pilot, employees at the New York tested store used a pool of tags, attaching them to items of clothing as they were received from its manufacturing center in Los Angeles. But as the company rolls out the system, item-level tagging will be applied and centrally managed at the Los Angeles manufacturing facility as each item of clothing is packaged. The initial deployment of American Apparel's pilot system placed RFID tags on each item of clothing and merchandise within American Apparel's Columbia University area store in New York City. As the tags were affixed to product, the tags were associated with the particular SKU in the TrueVUE software platform. From then on, mobile and fixed RFID readers were used by store associates to stock, inventory and replenish its 40,000 piece pilot store inventory. Fixed and mobile RFID readers were then used by store personnel to check inventory on a real-time basis.

As shipments leave the manufacturing center, Motorola XR440 fixed readers at the dock doors read an RFID shipping label attached to each case of items, which will then be associated with electronic product codes (EPCs) on all item tags within that case. Recorded data includes the case and item EPC numbers, and all read events showing time stamps and reader locations. When the tagged cases are received at a retail store, another Motorola XR440 fixed reader will collect the data and send it to Vue's TrueVue software, which will reconcile the received goods with the advance shipment notice that was sent by the factory. The Vue software will then add the goods to the store inventory. Employees will then use Motorola's MC9090-G RFID handheld readers to take periodic inventories of all items on

the sales floor, as they did during the initial store pilot. In the rollout phase of the RFID system each of its seventeen stores in New York were equipped for RFID during three months and an additional of 120 locations in North America were followed.

3.2.3 Advantages and disadvantages with RFID deployment

The American Apparel decision on investing in RFID system was motivated not only by its business characteristics associated with its products, processes and customer's requirements but also because the advantages are higher than the disadvantages associated with it.The main advantages pointed out by American Apparel associated with the RFID system are presented next.

By using an item-level RFID system, American Apparel is able to fulfill its vision of consistently offering merchandise in every size and color on store floors at all times, creating a more rewarding customer experience and simplifying the inventory process for in-store staff. American' stores can now take inventory much more quickly and with greater accuracy.

With the deploying of the RFID system, American Apparel is able to improve the efficiency and accuracy resulting in the right products in the right place at the right time, enhancing the overall customer experience. Inventory accuracy is going from 80% to 99% and the RFID is reducing the cost of managing inventory substantially. So, its logistics is improved and retailers are able to respond more efficiently to market behavior by using RFID to record and report on purchases, not only within one location, but across a set of stores.

This system also contributes to improve the productivity of some tasks. For example, the use of automatic reading process for stock-taking made possible that this process was reduced from thirty two man-hours to only four hours. As well, weekly inventory can now be accomplished with just two people in two hours instead of requiring four people working for eight hours. That also makes possible to free up sales associates to spend more time with customers and improve store sales. Replenishment activities have also been dramatically improved resulting in on-floor availability at over 99%.

The solution allows also a better visibility, since it enables American Apparel to track individual items as they are tagged at the company's manufacturing facility in Los Angeles, received in its retail stores, stored in the stock rooms at the stores, and then placed onto the sales floor and ultimately sold at the point-of-sale (POS). This visibility gave rise to an increase in sales and customer service by having real-time information about its product levels at nearby stores, and expedites the intra-store transfer process to balance stock. RFID also recorded and reported on purchases all across a region of stores helping the retailer understand trends better and more quickly. The American Apparel benefits also from a security point of view. This system contributes to a decrease in losses and in the number of potential thieves, since the smart tags put on the items make possible that they could be identified anywhere inside warehouses, stock rooms and store floors.

Besides the several and important advantages associated with the use of RFID technology also some disadvantages are identified by the focused company. The main disadvantage identified by the focused company with RFID system is its costs. American Apparel paid between US$50,000 and

$60,000 to get the pilot project up and running. The investment was about equivalent to the salaries of two full-time sales employees per store.

Another disadvantage associated with the RFID is the customers' privacy. American Apparel argues however that it puts the RFID chip (smart tag) only on the price tag, not sewn into the garments themselves which could be easily removable at any point by the customer. One more disadvantage identified is related with the environment where the system works on. During the RFID system' tests some work movements were re-evaluated so RFID readers were not blocked. It can be difficult to read smart tags around metal, for example. To overcome this, new gates (portals to capture theft) were designed.

3.2.4 Challenges faced by American Apparel

RFID has been proposed as a replacement for bar codes, allowing tags to be read without requiring line of sight, but the cost has generally limited deployments to boxes of products rather than individual items. American Apparel have a particular stocking challenge as they insist on having at least one of every item, in every size, out on display at all times. This complicates restocking and makes RFID a more worthwhile investment.

The company looks forward to deploy the technology on a larger scale so that all the entire organization can leverage the value of RFID to improve overall inventory management processes and enhance customers' shopping experience. Another challenge faced by American Apparel is to control the pieces that go inside the fitting rooms. They have a problem with customers trying on clothes and then leaving them in the fitting rooms. Right now, their RFID system doesn't alert them to this issue but it is something they want to address soon.

4. Discussion

After the analysis of both cases focused in this research (Throttleman and American Apparel) a discussion is done about the main differences having as reference Table 1.

Table 1 Main Features on RFID Deployment by Throttleman and American Apparel

	Throttleman	American Apparel
Architectural characteristics of the RFID system used	-Critical areas covered by RFID system used: Edgeware, Integration and RetailID Solutions. -The Edgeware is composed by the physical platform of RFID The solution RetailID, was disposed by the Sybase in partnership with the Paxar and the CreativeSystems. The garments are tagged with EPC Gen2 RFID tickets that are printed with variable data at Avery Dennison	-Motorola MC9090-G RFID handheld readers for cycle counting and Motorola XR440 fixed readers with AN480 antennas are used. -The Avery Dennison AD-222 tags with Vue Technologies' TrueVUE Platform are deployed to provide the enterprise-wide device and network management, desktop and mobile workflows, EPC commissioning, and developer interfaces to RFID.
Reasons to use RFID	-To avoid mistakes associated with human handling of some tasks -Poor performance in terms of lead times, replenishment lead times, stocks reliability on	-Business characteristics associated with products, processes and customer's requirements. -Stocks management complexity (large quantity of SKUs, items that look similar, high turnover of pieces in the stores) -Accuracy problem. -Lack of visibility.
Advantages	-Good performance as regards the life cycle of products -Stock static decreased 60% contributing to a reduction on the warehouse space needed. -Integration with the logistics process -Improvement in products throughput -Reduction in the time items spend in the supply chain - Decrease in the reception lead time. -Decrease in warehouse' stock levels.	-More visibility about sizes and colors of garments on store floors and also along the distribution channel -Efficiency and Accuracy improved -More productivity of same tasks - Decrease in losses and potential thieves.
Disadvantages	-Cost associated with the smart tags	-High costs associated with all the investment -Customer privacy -Misreading because of surrounded environment
Challenges associated	-To tag 60% of the current collections, 371,234 articles, with smart tags. -To install one of the most innovative solutions from Avery Dennison - the Magicmirror based also in RFID technology.	-To Put smart tags at each individual item level and not boxes level. -To apply the RFID system on the entire organization. -To track pieces inside fitting room.

The illustration of both case studies and the analysis of the table above show that the characteristics of the RFID systems deployed in the two companies are quite similar. Both companies highlight the need to reach a better performance as an important factor to invest in the RFID system. Also the complexity associated with stocks management, the need for a better visibility and an improvement in accuracy has justified their deployment in this technology. The investment in this technology seems to be a good making decision since, by one hand, the advantages pointed out by the two companies are almost of them related with an improvement in performance, by the other hand the disadvantages referred are related mainly with costs. This disadvantage could be minimized if

companies reach a good ROI (return on investment) smoothing by this way this disadvantage and making then a positive measurement of the decision made.

The challenges associated with RFID reflect companies' growth and answers in order to reach a better competitive position. Throttleman wants to achieve a better costumer satisfaction with the Magicmirror and a better visibility of all items flows and American apparel desires to improve also visibility on the entire organization and stores.

5. Conclusions

In the business context the smart labels have reached many adepts by the huge potentials that it presents for firms considered individually or integrated in a supply chain. The drive toward adopting RFID is being further enhanced by mandates from large retailers such as Wal-Mart and Target, and the Department of Defence of many countries, who require all suppliers to implement this technology.

The RFID technology has received considerable attention from academics and practitioners because of its potentialities and diverse fields of deployment in organisations such as: manufacturing, transportation, distribution, information systems, store operations, sales. The increased use of RFID has been also pointed out by different types of firms mainly by retailers because of the advantages reached with it. Through the RFID we may assist a decrease on the stock levels, a better productivity, a decrease on stockouts, a more efficient cross-selling, a better visibility and rastreability along the supply chains, more efficient logistics activities. The adoption of this kind of technology allows a quicker flow of information, an improvement in the quality of the information that crosses the different types of logistics activities and a better synchronisation of the information among the supply chain' members. To the retailers, the RFID allows to become easier and quicker the identification of the products. However some disadvantages are also pointed out. The one that is most referred is its cost. Apart from this, the lack of security, the complexity and a lack of knowledge about the technology are also identified.

In order to illustrate the application of the RFID technology in retailing and more precisely in fashion retailer, two case studies were presented. The Throttleman, a Portuguese fashion' retailer and the American Apparel, also an American fashion retailer. These firms are pioneer in the implementation of this technology in the fashion sector. They feel the necessity to implement a solution based on RFID technology because of the increased number of pieces processed manually. This situation associated with the geographical scope of theirs supply chains were giving rise to delays and inefficiencies in almost all the processes. With the RFID deployment the performance of both companies were improved essentially in term of products' life cycle, stocks level, throughput time, reception lead time and so on. However, besides the important advantages reached with this technology a significant disadvantage is also identified. This disadvantage is the one associated with its costs, mainly the smart labels costs.

This research is a first attempt to alert managers and academics to RFID' potentialities in general and in a fashion retailing context in particular. Future studies should therefore be developed in other realities and contexts. Also it will be interesting to study the deployment of the RFID systems upstream the Fashion supply chain in a context where the smart tags are put in raw materials (textiles).

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SCM Approach to the Mixed-Model Assembly Line Systems

by

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Abstract

This paper deals with the problem of sequencing products for a mixed-model assembly line in just-in-time production system. From the standpoint of supply chain management, we propose a production scheduling procedure that contains (1) maintaining a constant rate of production of every part in upstream external preceding processes and (2) realizing the smoothed production in the mixed-model assembly line, as well as (3) meeting the date of delivery to dealers in downstream processes when the final products are delivered by car-carriers. In order to simultaneously satisfy these three goals, we introduce a two-stage approach. First, by dividing the production period into shorter periods, we determine the production volume of each product for each period to maintain a constant rate of parts usage and meet the date of delivery to dealers. We formulate a mathematical programming problem that minimizes the sum of the absolute value of the difference between the average necessary quantity and the withdrawal quantity of all parts in each withdrawal position under the consideration that the car-carriers adhere to the predetermined start time. Next, we establish a production schedule for each divided period that realizes the smoothed production in the assembly line. Finally, we display numerical examples to explain and clarify the effectiveness of the proposed production scheduling procedure. Varying the value of parameter that ensures that the car-carriers adhere to the predetermined start time, we investigate the way for managing the supply chain process of the mixed-model assembly line systems.

Keywords: SCM Approach, Mixed-Model Assembly Line, Sequencing Problem, JIT Production System, Delivery Time

1. Introduction

When we determine the sequence of a mixed- model assembly line, we have considered the following two goals: (1) leveling the load (total assembly time) on each process within the line and (2) maintaining a constant speed in consuming each part in the line. For the first goal, we determined the sequence that minimizes maximum work congestion (Mitsumori,1967; Thomopolos, 1969; Tsai, et al., 1995). For the second goal, we selected a sequence in which the quantity used per hour (i.e. consumption speed) for each part in the mixed-model assembly line is kept as constant as possible (Cabir, et al., 1993; Miltenburg, 1989; Monden, 1998). Some studies have considered these two goals simultaneously (Bard, et al., 1994; Miltenburg, et al., 1991; Zeramdini, et al., 2000). In this paper, from the standpoint of supply chain management, we propose a new sequencing method that considers not only the two aforementioned traditional goals, but also a third goal, that is, shortening

the delivery time to a dealer when the final products are delivered by car-carriers. In order to simultaneously satisfy these three goals, we introduce a two-stage approach. First, by dividing the production period into shorter periods, we determine the production volume of each product for each period in order to maintain a constant rate of parts usage and meet the date of delivery in stage one. Next, we determine a production schedule for each period that realizes the smoothed production in the assembly line in stage two. Finally, we display a numerical example to explain and clarify the effectiveness of the proposed sequencing procedure

2. Assumptions and Notation

2.1 Assumptions

(1) The conveyor speed is constant, that is, the cycle time of the conveyor line is fixed.
(2) Line balancing of the conveyor line is performed appropriately.
(3) Parts withdrawals are performed at fixed intervals.
(4) Final products are delivered to dealers by car-carriers.
(5) The date of delivery to the dealer is predetermined, that is, the start time of each car-carrier is provided.

2.2 Notation

m : the number of product types. $I = \{1, \cdots, m\}$

n : the number of part types. $J = \{1, \cdots, n\}$

d_i : total production quantity of product i.

a_{ij} : necessary quantity of part to be utilized for producing product i.

n_j : total necessary quantity of part j to be consumed for producing all products.

$$n_j = \sum_{i \in I} a_{ij} * d_i \quad (j \in J)$$

p : total production quantity of all products. $p = \sum_{i \in I} d_i$, $K = \{1, \cdots, p\}$

k : position of a unit in the sequence.

r_j : average necessary quantity of part j per unit product. $r_j = n_j / p$ (□@□@□@□@$j \in J$)

Z_{jk} : it takes one when j is withdrawal in position k, otherwise it takes zero.

Q : the set of k that one or more types of part are withdrawn in position k.

$$Q = \{k \mid Z_{jk} = 1 \text{ (□@□@□@□@} j \in J; k \in K)\}, \; q = |Q|$$

We divide the production period into k shorter period.

Q' : ordered set of Q.

X_{ik} : cumulative production volume of product i sequenced from position one to $k \in Q$.

Y_{jk} : total volume of part j required to assemble the products sequenced from position one to $k \in Q$.

M_k : the set of part j withdrawn in position k. $M_k = \{j \mid Z_{jk} = 1 \text{ (□@□@□@□@} j \in J)\}$ $(k \in Q)$

V_k : the set of car-carriers that has to start when the products sequenced from position one to k are loaded.

v_{hik} : the number of products i to be carried by the vehicle $h \in V_k$.

s_{ik} : the number of products i to be sequenced before it is possible to carry the product positioned at k. $s_{ik} = \sum_{h \in V_k} v_{hik} \quad (i \in I; k \in Q)$

3. Formulation

3.1 Stage one

We propose an approach utilizing a two-stage sequencing method. In stage one, we will attempt to determine the production volume of each product in each period in order to maintain both a constant rate of parts usage and to meet the date of delivery to dealers by solving a mathematical programming problem. We have the following constraints.

$$X_{ik} \le X_{ik'} \quad (i \in I; k, k' \in Q', k \ne q) \qquad \text{.....(1)}$$

where, k' is the next element of k in the ordered set Q'.

$$X_{ip} = d_i \quad (i \in I) \qquad \text{.....(2)}$$

$$\sum_{i \in I} X_{ik} = k \quad (k \in Q) \qquad \text{.....(3)}$$

$$Y_{jk} = \sum_{i=1,\cdots,I} a_{ij} * X_{ik} \quad (j \in M_k; k \in Q) \qquad \text{.....(4)}$$

$$X_{ik} \ge (1 - \alpha_k) * s_{ik} \quad (i \in I; k \in Q) \qquad \text{.....(5)}$$

where, α_k is a parameter that satisfies $1 \ge \alpha_k \ge 0$.

$X_{ik}, Y_{jk} \ (i \in I; j \in J; k \in Q)$ non-negative integer.....(6)

Under these constraints, we decided to minimize the objective function (7) that assumes the sum of the absolute value of the difference between the average necessary quantity and the withdrawal quantity of all parts in each withdrawal position.

$$f_1 = \sum_{k \in Q} \sum_{j \in V_k} \left| k * r_j - Y_{jk} \right| \qquad (7)$$

As function (7) is non-linear, we introduced the following two variables in order to transform the objective function (7) into a linear function.

$$b_{jk}^{+} = (1/2) * \{ \left| k * r_j - Y_{jk} \right| + (k * r_j - Y_{jk}) \}$$
$$b_{jk}^{-} = (1/2) * \{ \left| k * r_j - Y_{jk} \right| - (k * r_j - Y_{jk}) \}$$

Then, we can transform (7) into the following linear function (8) under the additional constraint (9).

$$f_1^{'} = \sum_{k \in Q} \sum_{j \in V_k} (b_{jk}^{+} - b_{jk}^{-}) \quad (8)$$

$$Y_{jk} + b_{jk}^{+} - b_{jk}^{-} = k * r_j \quad (9)$$

We call the mathematical programming problem that minimizes the objective function (8) under the constraints (1)-(6) and (9) stage one.

3.2 Stage two

After solving stage one, we determine a production schedule that realizes the smoothed production in the assembly line for each period in stage two. There are some studies with respect to this subject (Miltenburg, 1989; Muramatsu, 1977). In this paper, we utilize the cycle launching system by reciprocal ratio (Muramatsu, 1977) because of its simplicity.

4. Numerical Example

4.1 Input data

In order to clarify the characteristics and the effectiveness of the proposed sequencing procedure, we introduce simple numerical examples. Input data are given as follows:
The number of product types and part types are m = 4 and n = 6. Production quantities of products are given as follows: a) Case-1: $d_1 = 30$, $d_2 = 40$, $d_3 = 30$, $d_4 = 20$, b) Case-2: $d_1 = 40$, $d_2 = 30$, $d_3 = 30$, $d_4 = 20$. Then, total production quantity of all products becomes $p = 120$ for Case-1 and Case-2. Bill of materials is given by Table 1.

Table 1 Bill of Materials

i / j	1	2	3	4	Case-1 n_j	Case-2 n_j
1	1	0	1	3	120	130
2	0	1	1	1	90	80
3	1	2	1	0	140	130
4	1	3	2	1	230	210
5	2	1	0	1	120	130
6	2	1	1	3	190	200

The total necessary quantity of part *j* can be seen in the right-hand columns of Table 1. Average necessary quantity of parts becomes as follows: a) Case-1: $r_1 = 1$, $r_2 = 0.75$, $r_3 = 7/6$, $r_4 = 23/12$, $r_5 = 1$, $r_6 = 19/12$, b) Case-2: $r_1 = 13/12$, $r_2 = 2/3$, $r_3 = 13/12$, $r_4 = 7/4$, $r_5 = 13/12$, $r_6 = 5/3$. The set of position that one or more types of part are withdrawn is $Q = \{40,60,80,120\}$. The sets of parts withdrawn in position $k \in Q$ are $M_{40} = \{1,2\}$, $M_{60} = \{3,4,5\}$, $M_{80} = \{1,2\}$,

$M_{120} = \{1,2,3,4,5,6\}$. The sets of car-carriers that has to start before the products sequenced from position one to $k \in Q$ are loaded become as follows: V_k. $V_{40} = \{1,2,3,4,5,6,7,8\}$,

$V_{60} = \{1,2,3,4,5,6,7,8,9,10,11,12\}$,

$V_{80} = \{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16\}$,

$V_{120} = \{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24\}$.

The number of products to be carried by the car-carriers is given in Table 2**.**

Table 2 The Number of Products to Be Carried
(Case-1)

position								40				60
Vehicle no. / Product type	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	0	0	2	1	3	1	2	3	0
2	1	0	1	1	1	2	1	0	1	0	1	2
3	2	0	1	2	1	0	1	1	2	2	1	3
4	1	3	0	2	3	1	2	1	1	1	0	0

(continue)

position				80								120
Vehicle no. / Product type	13	14	15	16	17	18	19	20	21	22	23	24
1	0	2	1	3	1	1	1	0	0	1	1	1
2	3	2	2	0	2	2	3	3	2	4	3	3
3	1	0	2	1	2	2	1	2	1	0	1	1
4	1	1	0	1	0	0	0	0	2	0	0	0

(Case-2)

position								40				60
Vehicle no. / Product type	1	2	3	4	5	6	7	8	9	10	11	12
1	1	0	1	1	1	2	1	0	1	0	1	2
2	1	2	3	0	0	2	1	3	1	2	3	0
3	2	0	1	2	1	0	1	1	2	2	1	3
4	1	3	0	2	3	1	2	1	1	1	0	0

(continue)

position				80								120
Vehicle no. / Product type	13	14	15	16	17	18	19	20	21	22	23	24
1	3	2	2	0	2	2	3	3	2	4	3	3
2	0	2	1	3	1	1	1	0	0	1	1	1
3	1	0	2	1	2	2	1	2	1	0	1	1
4	1	1	0	1	0	0	0	0	2	0	0	0

Then, the number of product i to be sequenced before the product positioned k is possible to carry is given in Table 3.

Table 3 The Number of Products to Be Sequenced

(Case-1)					(Case-2)				
k□Q / i	40	60	80	120	k□Q / i	40	60	80	120
1	12	18	24	30	1	7	11	18	40
2	7	11	18	40	2	12	18	24	30
3	8	16	20	30	3	8	16	20	30
4	13	15	18	20	4	13	15	18	20

In order to clarify the effects of parameter α_k, we change α_k =0.1 and 0.5. Then, the value of right hand side of constraint (5), that is, the cumulative number of product i to be carried from position one to k is determined as shown in Table 4.

4.2 Output results

By solving stage one, we derive the following results. Cumulative production volumes of product i sequenced from position one to k are determined as shown in Table 5.

Table 4 Cumulative Number of Products to Be Carried

		(Case-1)				(Case-2)				
α_k	k□Q / i	40	60	80	120	k□Q / i	40	60	80	120
0.1	1	10.8	16.2	21.6	27.0	1	6.3	9.9	16.2	36.0
	2	6.3	9.9	16.2	36.0	2	10.8	16.2	21.6	27.0
	3	7.2	14.4	18.0	27.0	3	7.2	14.4	18.0	27.0
	4	11.7	13.5	16.2	18.0	4	11.7	13.5	16.2	18.0
0.5	1	6.0	9.0	12.0	15.0	1	3.5	5.5	9.0	20.0
	2	3.5	5.5	9.0	20.0	2	6.0	9.0	12.0	15.0
	3	4.0	8.0	10.0	15.0	3	4.0	8.0	10.0	15.0
	4	6.5	7.5	9.0	10.0	4	6.5	7.5	9.0	10.0

Table 5 Cumulative Production Volume of Products

		(Case-1)				(Case-2)				
α_k	k□Q / i	40	60	80	120	k□Q / i	40	60	80	120
0.1	1	11	17	22	30	1	9	14	23	40
	2	9	14	23	40	2	11	17	22	30
	3	8	15	18	30	3	8	15	18	30
	4	12	14	17	20	4	12	14	17	20
0.5	1	9	14	20	30	1	13	20	26	40
	2	15	20	28	40	2	11	15	16	30
	3	6	13	18	30	3	9	15	27	30
	4	10	12	14	20	4	7	10	11	20

Solving stage-two, we have following production schedule for the Case-1, α_k=0.1 and α_k=0.5. For the convenience of understanding, we denote the products i $(i = 1,2,3,4)$ as A, B, C, D, respectively.

(1) Case-1, α_k=0.1

a) 1-st period: DABCDABCDABDCADBACDABDCABCDABDADCBADABCD
b) 2-nd period: CABCABCADCBACBACABCD
c) 3-rd period: BABABCDBBABCDBABABCD
d) 4-th period: BCBACBBACBCDBABCBACBCABBCDBACBBCABCBABCD

(2) Case-1, α_k=0.5

a) 1-st period: BABDCBABDABCBDABABCDBABDCBABDABCBDABABCD
b) 2-nd period: CACDCACBDCACBCACABCD
c) 3-rd period: CCACCCACCCACCCACCCAC
d) 4-th period: BABDBABDBABDBABDBABDBABDBABDBABDBABDBABD

5. Conclusion

In this paper, we proposed a new sequencing method that considers (1) maintaining a constant rate of production of every part in preceding processes and (2) minimizing the maximal work congestion in the assembly line, as well as (3) meeting the date of delivery to dealers when the final products are delivered by car-carriers and displaying a numerical example to explain the effectiveness of the proposed sequencing procedure.

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Explore the Corporate Governance Quality: PZB Model Theory And Zone Of Tolerance Implication for a Shipping Industry

by

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Abstract

The transition to a knowledge-based economy has created challenges for organizational forms and governance. Shareholder demands on businesses have increased at such a dramatic rate that, given the immensity of these pressures, large and small firms find it increasingly difficult to avoid assuming their corporate governance. In some of these cases the problems have been attributed to a failure of corporate governance, or more specifically, to ineffective boards. This paper focuses on applying Fuzzy Zone of Tolerance (FZOT) to systematically explore the overall governance quality of Taiwanese open-market shipping firms. There are four dimensions observed: board of directors, audit committee, compensation and nomination committees, and ownership structure. Based on these factors, the FZOT is utilized to explore investor's needs on the governance quality. The results of this paper revealed that the five priority improved items are: high percentage of outside directors, frequency meetings of board of directors, high percentage of independents of audit committee, frequency meetings of audit committee, and CEO in the compensation committee. These improved items could provide management board of shipping industry for a effective corporate governance.

Keywords: Corporate Governance, Fuzzy Zone Of Tolerance, PZB Model, Fuzzy Set Theory

1. Introduction

The accounting scandals emanating from high-profile corporate collapses such as Enron and WorldCom led to an increasing questioning of accounting figures utility as a faithful mirror of the economic reality of the firms. Corporate governance has dominated policy agenda in board of direct for more than a decade. Stakeholder demands on businesses have increased at such a dramatic rate that, given the immensity of these pressures, large and small firms find it increasingly difficult to avoid assuming their corporate governance. Corporate governance is a major component of strategy formulation. Typically, a company's corporate strategy sets out the main areas that define the company and its business-helping the company in deciding what it wants to do and how to achieve results. This process has two major planks, the formulation and the implementation of corporate strategy. In formulating its corporate strategy, the company identifies its purposes, its opportunities and threats, strengths and weaknesses, the values of the people who make the choices and its obligations to investors.

Parasuraman *et al*. (1985, 1988) addressed "the gaps model of service quality" and SERVQUAL to observe the differences between customers' expectation and actual perceptions for judging whether or not customers' satisfaction (is consistent). Service quality is specified from comparing perceived service with expected service. In 1991 Parasuraman *et al*. suggested the dual-leveled and dynamic concepts to customer service expectation. They argued that customers' service expectation had two levels: desired and adequate. Besides, Parasuraman *et al*. consider the zone of tolerance (ZOT) as the area separating the desired service level from the adequate service level. The zone of tolerance can help the managers to develop customer franchise (Parasuraman *et al*., 1991). In precision-based ZOT, it is presented by crisp numeric. In real life, fuzziness and vagueness are very common in decision-making problems, and good decision-making models should tolerate vagueness or ambiguity (Yu, 2002).

This paper is organized as follows. In Section 2, the literatures and dimensions of corporate governance are introduced. Research designs and methods are proposed in Section 3. The fuzzy zone of tolerance is constructed and a real case of open-market in Taiwan is examined in Section 4. Some conclusion remarks and discussions are provided in the last section.

2. Literature Review

2.1 PZB model

Parasuraman *et al.* (1985) presented the integrated model of service quality which called PZB model. They differentiated between the qualities associated with the process of service delivery from the quality associated with the outcome of the service. The foundation of this model is the set of five gaps in which first four gaps are the main obstacles of service quality offered by business operation. Expected service(ES)-perceived service(PS)(gap 5) is the focus group unambiguously supported the notion that the key to ensuring good service quality is meeting or exceeding what consumers expect from the service. It appears that judgments of high and low service quality depend on how consumers perceive the actual service performance in the context of what they expected. When ES-PS>0, perceived quality is less than satisfactory and will tend toward totally unacceptable quality, when the gap between ES and PS is keep on expanding; when ES-PS=0, perceived quality is satisfied; when ES-PS<0, perceived quality is more than satisfactory and will move toward ideal quality when the gap between ES and PS is keep on expanding. Expected service would be influenced by a marketer's promotion and be shaped by word-of-mouth communications, personal needs, and past experience.

2.2 Zone of tolerance

Parasuraman *et al.* (1991) suggested that customers' service expectations have two levels: desired and adequate. The desired service level is the service the customer hopes to receive. The adequate service level reflects the minimum performance level expected by customers after they consider a variety of individual and situational factors. The zone of tolerance (ZOT) is the area separating the desired service level from the adequate service level. The conceptualization of adequate service level, zone of tolerance, and desired service level is useful for helping the managers to build the customer franchise through service. Based on the conceptualization, a firm can operate at a competitive disadvantage, a competitive advantage, or at a customer franchise level in terms of its service. If the customer perceptions of service performance fall below adequate service level, the firm is at a competitive disadvantage. If a firm is performing in ZOT, the firm is competitive advantage. Otherwise, if a firm's service performance exceeds the desired service level, the firm is

with high customer loyalty (Customer Franchise). To develop a true customer franchise, firms have to deliver service to not only the adequate service level but also the desired service level.

2.3 Corporate governance quantification

A number of definitions have been given to corporate governance. According to Mayer (1997), corporate governance is concerned with ways of bringing the interests of (investors and managers) into line and ensuring that firms are run for the benefit of investors. It has also been defined by Keasey *et al.* (1997) to include "the structures, processes, cultures and systems that engender the successful operation of the organizations". Many organizations have been interested in searching for governance standards that can militate in favor of an effective working of boards of directors and their specialized committees, respect of investors' rights, improvement of information disclosure, etc. Consequently, a firm is considered well governed if it respects these standards.

In 2002, Standard & Poor's developed an index based on transparency and good information disclosure. Standard & Poor's (S & P, 2002) supposed that the governance quality could be studied using ownership structure and its concentration, kind of relations between different actors, transparency, information disclosure and board of directors' structure. This index was computed using a scale from 1 to 10. An index equal to 1 is attributed to firms whose governance doesn't take into account enough actors' interest in the midst of the firm, while an index equal to 10 is attributed to firms whose governance practices are the best. Previous research have tried to quantify the governance suing a score, in order to test the relation between corporate governance and firm performance (Durnev and Kim, 2003; S & P, 2002). However, many critics were addressed to the index computation. The flaw resides in the choice of governance mechanisms forming the score computing. Abor and Adjasi (2007) identify the extent to which the corporate governance framework can be applied to small and medium enterprises (SMEs), and discuss these issue further within the Ghanian context. Corporate governance brings new strategic outlook through external independent directors and enhances firms' corporate entrepreneurship and competitiveness. (Zenger, 2002; Peltokorpi and Tsuyuki, 2007)

Much literature only concentrated on specific aspects of governance, such as takeover defenses (Gompers *et al.*, 2003), executive compensation (Loderer and Martin, 1997), blockholdings (Demsetz and Lehn, 1985), board size (Yermack, 1996) or board composition (Hermalin and Weisbach, 1991; Bhagat and Black, 2002). Nevertheless, it seems deficiency to take into account stockholders' conception or cognition that PZB model could fill this gap. Parasuraman *et al.* (1985) were the first to propose the PZB model and ZOT concept as an evaluation service quality between managers and customers. PZB model and ZOT has been applied successfully as a service quality evaluation tool in many fields including manufacturing, academic institutions, banks, pharmaceutical firms, small business development centers, and nursing home chains. Here, we apply this conceptual meaning to analyze corporate governance quality.

3. Research Designs and Methods

In this section, research designs and methods utilized in this paper are briefly introduced.

3.1 Corporate governance attributes

After a review of previous literature (Demsetz and Lehn, 1985; Hermalin and Weisbach, 1991; Yermack, 1996; Loderer and Martin, 1997; Bhagat and Black, 2002; S & P, 2002; Durnev and

Kim, 2003; Gompers *et al.*, 2003; Arpan, 2005; Ofori and Hinson, 2007) and conducting personal interviews with six executive from financial supervisory Commission in Taiwan, nineteen governance attributes were chosen for use in the questionnaire survey. These are listed below: board of directors size, high percentage of outside directors, board of director tenure, frequency meetings of board of directors, audit committee size, high percentage of independents of audit committee, frequency meetings of audit committee, sufficient experts in finance, the existence of compensation committee, CEO in the compensation committee, frequency meetings of compensation committee, complete incitation plan, the existence of nomination committee, CEO in the nomination committee, frequency meetings of nomination committee, appropriate directors ownership, appropriate managerial ownership, appropriate CEO ownership and appropriate institutional ownership. These corporate governance attributes could be categorized into board of directors, Audit committee, compensation and nomination committees and ownership structure.

3.2 Questionnaire design and sampling technique

Most literature on governance attributes had focused on the level of performance for corporate, not on the importance level of governance quality attributes. While some of the governance attributes are regarded as indices of satisfaction by managers, they are not necessary the attributes important to shareholders. In order to improve this shortcoming, questionnaire design of this study was constructed from questionnaire survey, previous literature and personal interviews with financial experts or practitioners. Questionnaire is consisted of two parts: open-market companies' background and information and importance-satisfaction level of governance attributes based upon questionnaire responses. Hence, this study used the IPA analysis to improve governance quality for managers. Attitudes to each of the variables in this study were assessed using a 5-point Likert scale anchored by the satisfaction (or importance) level of performance "1=very poor (or very unimportance)" to "5=excellent (or very important)".

An initial mailing included a covering letter, a three page questionnaire, and a postage-paid return envelope. This study was chosen based on the top 1-1000 firms in the 2007 "List of Leading Firms" published by the Financial Supervisory Executive Yuan in Taiwan. It was sent to 500 investors, 485 responses were recovered because of the contacts of investors had either left the companies contacted, or the businesses were no longer in existence. The valid population was further reduced to 460 as 25 of the responses were found completed inadequately and the overall recovering rate for this study is 92%.

3.3 Methodology

When the governance attributes are designated, research methods are applied, which include reliability and validity tests, factor analysis and fuzzy set theory. The factor analysis was conducted to summarize large number of governance attributes into a smaller number of underlying dimensions, which is call dimensions of governance quality. According to ZOT, the perceived governance of investors is categorized into 3 items in this design of questionnaire, they are: The level of adequate governance, the level of desired governance and the actual perceived governance.
Because investor's attitude provides highly uncertain answers inherently rather than precise values, the transformation of qualitative preferences to point estimates is difficult. To handle efficiently the fuzziness in human judgment and preference, triangular fuzzy numbers are utilized in this paper to describe the fuzzy perception levels of adequate governances, actual perceived governances, and desired governances to all responses.

4. Results of Empirical Analyses

In this section, we describe firstly reliability and validity tests, and the next is factor analysis and importance and satisfaction analysis.

4.1 Reliability and validity tests

Cronbach's α values were statistically determined to provide a summary measure of the inter-corrections that existed among a set of items. In this study, Cronbach's α value of all 19 governance attributes with respect to satisfaction degree is 0.95, which show that all 19 governance attributes achieve a satisfactory level of reliability in research. (Nunnally, 1978; Sekaran, 1992; Churchill, 1991). The content of questionnaire was constructed through literature review, and discussed with a number of executives and specialists in corporate governance field. In addition, a pretest was carried out. Therefore, the content validity of this questionnaire is very good.

4.2 Results of factor analysis

In this paper, principle component factor analysis with *VARIMAX* rotation technique was used to generate the underling factors of governance satisfaction. Using an eigenvalue greater than 1.0 as the criterion (Churchill, 1991), the factor analysis suggests that a four-factor solution explained 75.52% total variance for governance satisfaction. The Cronbach's α values for each factor are greater than 0.8. This shows that each factor achieves a satisfactory level of reliability in research (Nunnally, 1978; Sekaran, 1992; Churchill, 1991). The four governance characteristic are named as "board of directors,"audit committee", "compensation and nomination committees", and "ownership structure".

4.3 Satisfaction analysis of governance attributes

To effectively characterize the perceptions of all investors to the satisfaction and importance degrees of governance attributes provided by companies, the fuzzy perception levels to adequate governances, actual perceived governances, desired governances, and fuzzy zone of tolerance are proposed. The generalized means is a typical representation of many well-known averaging operations (Klir & Yuan, 1995), e.g., min, max, geometric mean, arithmetic mean, harmonic mean, etc. The min and max are the lower bound and upper bound of generalized means, respectively. Besides, the geometric mean is more effective in representing the consensus opinions of multiple decision makers (Saaty, 1980). To aggregate all information generated by different averaging operations, we use the grade of membership to demonstrate their strength after considering all approaches. For the above-mentioned reasons, the triangular fuzzy numbers characterized by using the min, max and geometric mean operations is used to convey the satisfactory degrees of all respondents. That is, let a_{jk}, $k = 1,2,\cdots, p,$ be the numerical perception levels (e.g. satisfaction degrees) given to governance attribute j by respondent k. Then, the fuzzy perception levels of the governance attribute j to all respondents is defined as

$$A_j = (c_j, a_j, b_j),$$

where

$$c_j = min\{a_{j1}, a_{j2}, \cdots, a_{jp}\},$$

$$a_j = \left(\prod_{k=1}^{p} a_{jk} \right)^{1/p},$$

$b_j = max\{a_{j1}, a_{j2}, \cdots, a_{jp}\}$.

Many fuzzy ranking methods have been proposed (Chen, 1985; Kim & Park, 1990; Chang & Chen, 1994; Chen & Hsieh, 2000). Because of the graded mean integration representation method (Chen & Hsieh, 2000) not only improve some drawbacks of the existing method, but also possess the advantage of easy implementation, and powerfulness in problem solving, it will be used to rank the final ratings of all fuzzy satisfactory degrees of adequate, actual perceived, and desired governances.

Let $A_i = (c_i, a_i, b_i), i = 1,2,...,n, be\ n$ triangular fuzzy numbers. The graded mean integration representation $P(A_i)$ of it is :

$$P(A_i) = \frac{c_i + 4a_i + b_i}{6}$$

Let $P(A_i)$ and $P(A_j)$ be the ranking values of triangular fuzzy numbers A_i and A_j, respectively. Define that:

$A_i > A_j \Leftrightarrow P(A_i) > P(A_j)$

$A_i = A_j \Leftrightarrow P(A_i) = P(A_j)$

$A_i < A_j \Leftrightarrow P(A_i) < P(A_j)$

By using the graded mean integration representation described above, the ranking values of adequate governances, actual perceived governances, and desired governances to all governance attributes can be easily calculated and related ranking of these items can be effectively determined. The results are shown as Table1.

Table 1 The Ranking Values of Adequate Governances, Actual Perceived Governances, And Desired Governances to All Governance Attributes

Governance attributes	adequate governances	actual perceived governances	desired governances	The remarks to actual perceived governances
board of directors size	2.1635	3.3363	3.9009	In FZOT
high percentage of outside directors	2.5637	2.4901	3.4081	Below the FZOT
board of director tenure	2.0375	2.3436	3.9197	In FZOT
frequency meetings of board of directors	2.7503	2.5952	3.9601	Below the FZOT
audit committee size	3.2351	2.4716	3.8569	Below the FZOT
high percentage of independents of audit committee	2.8459	2.4721	3.9681	Below the FZOT
frequency meetings of audit committee	2.9497	2.2350	3.4157	Below the FZOT
sufficient experts in finance	2.5023	2.8103	3.9698	In FZOT
the existence of compensation	2.5886	2.6027	3.7125	In FZOT

Governance attributes	adequate governances	actual perceived governances	desired governances	The remarks to actual perceived governances
committee				
CEO in the compensation committee	2.9023	2.3431	3.9674	Below the FZOT
frequency meetings of compensation committee	2.4677	2.8030	3.9957	In FZOT
complete incitation plan	2.9163	3.2725	3.9017	In FZOT
the existence of nomination committee	3.3839	3.3457	3.9601	Below the FZOT
CEO in the nomination committee	3.6341	2.5842	3.8609	Below the FZOT
frequency meetings of nomination committee	2.9365	3.0610	3.9067	In FZOT
appropriate directors ownership	3.0172	3.3983	3.9772	In FZOT
appropriate managerial ownership	2.8886	3.3676	3.6368	In FZOT
appropriate CEO ownership	3.0151	3.3465	3.4157	In FZOT
appropriate institutional ownership	2.9304	2.7214	3.7694	Below the FZOT

Based on Table 2, all perception levels of actual perceived governances to all governance attributes provided by managers are below the desired governances. That is, the investors' satisfaction degrees of all actual perceived governances are below desired governances. Especially, there are two governance quality attributes in the factor dimension of "Board of directors" below the FZOT. These are: high percentage of outside directors and simple and frequency meetings of board of directors. In the second factor dimension, there are three items below FZOT. These are: audit committee size, high percentage of independents of audit committee and frequency meetings of audit committee. In the third factor dimension, CEO in the compensation committee, the existence of nomination committee and CEO in the nomination committee are below FZOT. The factor dimension of "Ownership structure" comprised one items below FZOT. They are appropriate institutional ownership.

5. Conclusion

In this paper, the FZOT is developed to help investors or shareholders in understanding corporate governance quality for improving performance and maintaining high investors' satisfaction. This study has also examined the impact of open-market companies governance attributes on investors from a shareholder's perspective. The five most important governance attributes, according questionnaire survey on investors, were high percentage of outside directors, sufficient experts in finance, high percentage of outside directors, appropriate managerial ownership,

and appropriate directors' ownership. The FZOT analysis results indicated that ten governance attributes are below adequate governances. They are: high percentage of outside directors and simple, frequency meetings of board of directors, audit committee size, high percentage of independents of audit committee, frequency meetings of audit committee, CEO in the compensation committee, the existence of nomination committee, CEO in the nomination committee, and appropriate institutional ownership.

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Work-In-Process Inventory Management in a Decentralized Production System under a Constrained Layout

by

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Abstract

Trade inventories can be Raw Materials (RM), Work-in-Process (WIP), or Finished Goods (FG). WIP, the focus of this study, is the generic term for any stage production output after the RM is processed the first time, and in between before any final stage or FG state. In a decentralized production system (reverse of a centralized like an assembly-line), one unit of RM can be converted to multiple units of WIP and FG. The ratio of RM to WIP or FG is one-to-many. When a decentralized system is subjected to Process Layout-type, the machines are utilized for processing of various product types and designs at different stages. Process Layout adapts to limited floor area or constrained location and provides the flexibility of machines by rendering varied designs in every change of moulds or design. When plant layout's limitation is the space and permanent underground-mounting of machines, the problem on WIP storage area is expected. As WIP doubles or triples that of the volume covered by RM input, they multiply from plain RM to desired WIP (based on production target), excess WIP (good but not yet needed), and possible scrap. This experiential study tries to assess the production performance, minimize delays (in the transfer of WIP from and to machines and storage areas, or in machine idle time) under human factor and layout limitations, improve production systems, and to timely meet commitments with production and with customers at minimal idle time, backtracking, rework or returns. The movement of WIP from machine-to-machine, or machine-to-storage area, or from storage area to another machine causes much delay. Machines incurred about 70% idle time because of shortage of materials to work on (40%), Machine downtime (20%), and Change Mould (10%). This translates to 70% of unproductive time for the machine operator and his assistants. The company pays the whole-day of work with only 30% of the total time being productive while 70% waiting for 20 machines to run. Accountability and blame were either hurled towards the: Inventory Custodian; Supervisor; Machine Operator (who goes overboard assuming the work of the Inventory Staff to look for materials); the forklift Operator; the Maintenance Personnel; and even to the operators' misinterpretation of aggregate production plan entrusted to them. Cause and effect analysis, network analysis, information systems and methods analysis, cost accounting, planning techniques, human factors, and industrial psychology were beneficial for the improved policies, guidelines and procedures on how to operate the plant in productive ways.

Keywords: Decentralized Production, Work-In-Process Movement, Forklift Turn-Around, Operations Management

1. The Problem and Its Background

1.1 Introduction

A general classification of inventories can be either Trade or Non-Trade. Trade inventories (TrI) include the direct materials (e.g. raw materials, work-in-process materials, finished goods) and indirect materials (e.g. production supplies, production repair/maintenance parts, etc.) being used in producing a product/service intended for the customers/clients.

Trade Inventories are not depreciated in the books but may be valued higher once processed or may also be devalued if defective, spoiled, damaged, or obsolete. TrI is one of the current assets that go along its cohorts: Cash-on-Hand, Cash-in-Bank, Accounts Receivables, and Notes Receivables in the Balance Sheet.

Non-Trade inventories include the materials being used as support in carrying out the delivery of products or services. They may appear as fixed assets in the form of property and equipment, and also as current assets like office supplies or any administrative supplies.

In the case of production industry, TrI can be the Raw Materials (RM), Work-in-Process (WIP), or Finished Goods (FG). WIP is the generic term for any stage production output after the RM is processed the first time, and in between or before any final stage of FG state.

Going further, in a decentralized production system (reverse of a centralized system such as assembly-line), one unit of RM can be converted to multiple units of WIP and FG. The ratio of RM to WIP or FG is one-to-many (1:Many). Unwanted WIP inventories may build-up as predetermined FGs are being extracted from the pool of WIP.

The problem on WIP storage area is expected as WIP doubles or triples that of the volume of RM input. After any processing stage, inventories multiply from simple RM to any desired WIP (based on production target), excess WIP (good but not yet needed), and scrap. Production errors also occur when the WIP for Product A are mistakenly processed for Product B as all WIP have similar attributes during the early stages. They only differ in the last or few last stage/s of processing. A design or mould defines the difference of one FG from the other. But rough WIP can also be declared an FG if there is a demand from other sectors of the customer base.

In this study, the plant layout's limitation is the floor space and permanent underground-mounting of machines. The choice of plant layout may have been caused by past short-term planning or lapses in strategic planning. Process Layout also adapts to limited floor area or constrained location and provides the flexibility of machines by rendering varied designs in every change of pattern or design. Multiple usage of (or limited number of) machines and too much idle time of machines, may have caused the choice Layout-by-Process Type instead of a Layout-by-Product (Kumar, 2009).

The project was triggered by the owners being alarmed of the high operating costs and myriad of operational and delivery problems. Feedback from the workers included, but not limited to, the perennial out-of-stock materials despite continued and up-to-date importation of raw materials.

Given the current situation, there are no efforts that will convince the management to reposition the machines or extend the plant area. Operational efficiency and inventory movement initiatives were instead demanded. That calls for the productive collaboration among the operations and production staff, for systems and procedures improvement, and for support of human resource unit on policy reformulation and even on change management.

Thus, the required WIP Inventory Management System here shall tackle the said system plus its interface in the human aspect, production, and other support groups.

1.2 Objectives

General:

To develop a suitable and efficient system in the transfer of WIP inventories in/out of the storage area and in/out/within the production area.

Specific:

1. To identify a suggested WIP inventory system from/*to* the storage area to/*from* the machines.
2. To specify machine-to-machine transfers of WIP
3. To improve the policies, and systems pertaining to inventory movement of a decentralized production.

1.3 Scope and Delimitation

The study dealt with the inventory movement involved in the main line of the decentralized production. Inventory movement here means: from the time the WIP is brought in from warehouse to the production area and back; from the preceding machine to the succeeding machine along the process; and from the machine to the FG Area. The by-products and specialized products were not included.

It also considered the following limitations specified by the management: unchangeable location and number of machines at 20 units; existing number of forklifts at 3 units; number of manpower (freeze hiring policy); skills possessed by current workers; existing plant floor area and spaces remaining as aisle or passage ways; and temporary stoppage of incoming materials delivery for them to fully concentrate working on the accumulated RM and WIP stocks.

Efforts on how to create efficient flow of materials from RM state to WIP and up to FG state shall be the focus of this experiential study.

2. Review of Theoretical Framework

2.1 On Organizational Theory

Decentralization also called departmentalization is the policy of delegating decision-making authority down to the lower levels in an organization, relatively away from and lower in a central authority. A decentralized organization shows fewer tiers in the organizational structure, wider span of control, and a bottom-to-top flow of decision-making and flow of ideas.

In a centralized organization, the decisions are made by top executives or on the basis of pre-set policies. These decisions or policies are then enforced through several tiers of the organization after gradually broadening the span of control until it reaches the bottom tier.

In a more decentralized organization, the top executives delegate much of their decision-making authority to lower tiers of the organizational structure. As a correlation, the organization is likely to run on less rigid policies and wider spans of control among each officer of the organization. The wider spans of control also reduces the number of tiers within the organization, giving its structure a flat appearance. One advantage of this structure, if the correct controls are in place, will be the bottom-to-top flow of information, allowing all decisions among any official of the organization to be well informed about lower tier operations. For example, an experienced technician at the lowest tier of an organization might know how to increase the efficiency of the production, the bottom-to-top flow of information can allow for this knowledge to pass up to the executive officers. (http://en.wikipedia.org/wiki/Decentralized)

2.2 On Inventory Management

Inventory Management and Inventory Control must be designed to meet the dictates of the marketplace and support the company's strategic plan. The many changes in market demand, new opportunities due to worldwide marketing, global sourcing of materials, and new manufacturing technology, means many companies need to change their Inventory Management approach and change the process for Inventory Control.

Despite the many changes that companies go through, the basic principles of Inventory Management and Inventory Control remain the same. Some of the new approaches and techniques are wrapped in new terminology, but the underlying principles for accomplishing good Inventory Management and Inventory activities have not changed.

The Inventory Management system and the Inventory Control Process provides information to efficiently manage the flow of materials, effectively utilize people and equipment, coordinate internal activities, and communicate with customers. Inventory Management and the activities of Inventory Control do not make decisions or manage operations; they provide the information to Managers who make more accurate and timely decisions to manage their operations.

The basic building blocks for the Inventory Management System and Inventory Control activities are: Sales Forecasting or Demand Management; Sales and Operations Planning; Production Planning; Material Requirements Planning; and Inventory Reduction.

The emphases on each area will vary depending on the company and how it operates, and what requirements are placed on it due to market demands. Each of the areas above will need to be addressed in some form or another to have a successful program of Inventory Management and Inventory Control (http://www.invatol.com/mrp.html, 2009).

2.3 On Plant Layout

A plant layout can be defined as follows: Plant layout refers to the arrangement of physical facilities such as machinery, equipment, furniture etc. within the factory building in such a manner so as to have quickest flow of material at the lowest cost and with the least amount of handling in processing the product from the receipt of material to the shipment of the finished product.

Plant layout is an important decision as it represents long-term commitment. An ideal plant layout should provide the optimum relationship among output, floor area and manufacturing process. It facilitates the production process, minimizes material handling, time and cost, and allows flexibility of operations, easy production flow, makes economic use of the building, promotes effective utilization of manpower, and provides for employee's convenience, safety, comfort at work, maximum exposure to natural light and ventilation. It is also important because it affects the flow of material and processes, labor efficiency, supervision and control, use of space and expansion possibilities etc.

In case of manufacturing unit, plant layout may be of four types: (a) Product or line layout; (b) Process or functional layout; (c) Fixed position or location layout; and (d) Combined or group layout.

Advantages: Process layout provides the following benefits

a. Lower initial capital investment in machines and equipments. There is high degree of machine utilization, as a machine is not blocked for a single product
b. The overhead costs are relatively low
c. Change in output design and volume can be more easily adapted to the output of variety of products
d. Breakdown of one machine does not result in complete work stoppage
e. Supervision can be more effective and specialized
f. There is a greater flexibility of scope for expansion.

Disadvantages: Product layout suffers from following drawbacks

a. Material handling costs are high due to backtracking
b. More skilled labour is required resulting in higher cost.
c. Time gap or lag in production is higher
d. Work in progress inventory is high needing greater storage space
e. More frequent inspection is needed which results in costly supervision

Suitability: Process layout is adopted when

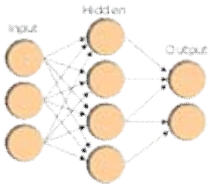
1. Products are not standardized
2. Quantity produced is small
3. There are frequent changes in design and style of product
4. Job shop type of work is done
5. Machines are very expensive

Thus, process layout or functional layout is suitable for job order production involving non-repetitive processes and customer specifications and nonstandardized products, e.g. tailoring, light and heavy engineering products, made to order furniture industries, jewelry (Kumar, 2009).

2.4 On Network Analysis

A **network diagram** is a general type of diagram, which represents some kind of network. A network in general is an interconnected group or system, or a fabric or structure of fibrous elements attached to each other at regular intervals, or formally: a graph.

A network diagram is a special kind of cluster diagram, which even more general represents any cluster or small group or bunch of something, structured or not. Both the flow diagram and the tree diagram can be seen as a specific type of network diagram (http://en.wikipedia.org/wiki/Network_diagram, 2009)



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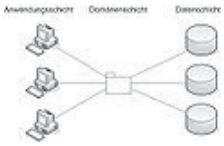
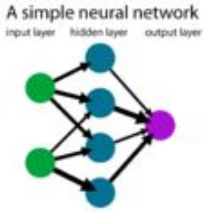
Artificial neural network

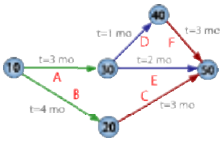


Computer network diagram

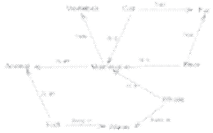


Neural network diagram

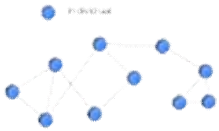
Project network



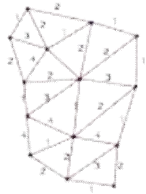
PERT diagram



Semantic network



Sociogram



Spin network

2.5 On Employee Productivity

A Philippine-based website revealed that monitoring employee productivity is an arduous task because it involves the most number of transactions in a Human Resource Information System- time based transactions. This requirement is commonly expounded by an organization's and the government's time-related policies and guidelines. Security issues must be considered also as employees data can be tampered or even represented by somebody else *(*http://www.aclt-computing.com*,* 2009*)*.

Further, this website presented some useful statistics as follows:

1. Workers waste about 1 hour in 5 dealing with politics and bureaucracy.
2. Labor productivity in 2004 grew only slightly from 2.7 percent in 2003 to 2.9 percent or in constant terms from Php 35,302 to Php 36,316. The biggest growth was experienced in industry, from 0.7 percent to 2 percent.
3. 85% of all productivity problems relate to management and only 15% relate to workers' performance.
4. It is important to note that not all employees will be top producers. In fact , as much as 40% of the employees may fall in the "less than acceptable" range when someone start looking at productivity levels.

2.6 On Operations Management

There are no bad soldiers, only bad generals (Bonaparte, 1815). If corporate generals don't know the field of human factors and its significance in this technology age, or if they don't pay attention to this field as they ought to, then I don't know how their "soldiers" can fight a (market) battle for them. In that case, I also do not know what management is all about and what all the managers get paid big bucks for... The other side of the coin is if people are misused or not fit (Job mismatch) to perform a specific task like flying a helicopter, or flying double shifts or something, then the design cannot cater to these conditions and it becomes an operational management problem (http://groups.google.com.ph/group/comp.human-factors/browse_thread, 2009).

3. Research Methodology

Cause and effect analysis, network analysis, information systems and methods analysis, cost accounting, planning techniques, human factors, and industrial psychology were useful in this 3-month study.

As to the procedures, an initial assessment was done during the first 3 days by collecting the results of the, initial interviews, ocular inspection and organizational familiarization. The Project Planning occurred after the third day. Execution of the plan started a week after the plan was submitted to the management.

The first 2 weeks of the 3 months were spent for more familiarization and in-depth problem detection. Another 2 weeks for the flow analysis. The next 5 weeks were consumed in analysis of production reports that affect material movement, review of policies and systems affecting material handling and processing as well, identification of the causes of the inventory build-up, and systems suggestions. The 6^{th} week was spent in formulation of solutions. The 7^{th} week was for validation (pilot testing) and the 8^{th} week was then allotted for the turnover and implementation.

3.1 Conceptual Framework

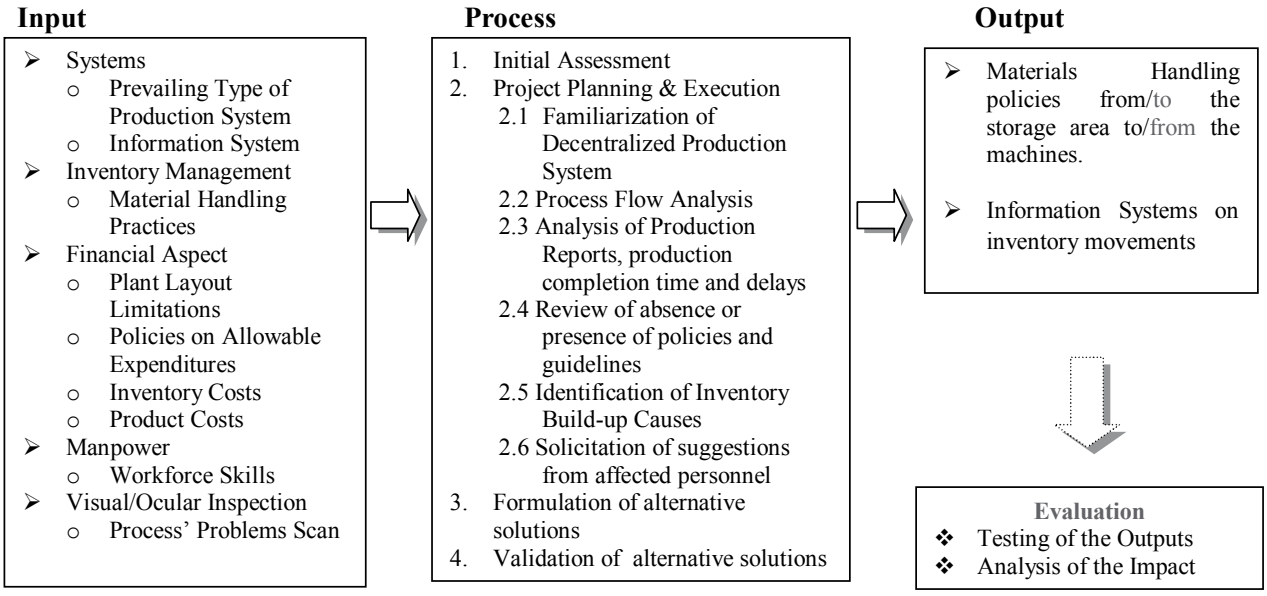


Figure 1 Conceptual Framework

4. Findings, Conclusion, and Recommendation

4.1 On Problem Scan

When problem scan was conducted for the first three days, a schedule of activities was drafted for project management purpose and as attachment to project contract. Part of the draft was the diagnostic recording system. This was a rough report format designed to reflect the real production and materials handling practice. The concept was coordinated with the management so as to get approval in getting more factual data from the concerned workers and not depend on hearsay.

The ratio of Forklift to Machine is 3 is to 20 (3:20). The manpower complement is: One Inventory Staff is to 3 Forklift Operators is to 20 Machines. The Inventory Staff cannot be present in multiple machines at one time, and the same with Forklift Operators. Thus, the Machine Personnel have the direct contact to the materials during transformation or conversion stage. Among the Forklift Operator, Inventory Staff, and Machine Personnel (Operator and Assistants), Machine Personnel are more in the position to record the in and out of WIP materials. Thus, Machine Operators, being the head of the team per machine, has the capacity and responsibility to identify the incoming and outgoing materials. In as much as the power to change design and process the materials depend on him.

The report draft was reproduced into 10 copies per machine to be used for 10 days at one copy per day per machine. Instruction was given individually to the Machine Operators with the consent of the Section Head. Operators were required to list down all the activities they will be doing. Whether it

was working on WIP-A into WIP-B, or Waiting for Instruction, Waiting for Materials (no materials), Talk to Supervisor/Inventory Staff or to any peer, Change Design or Parts, Waiting for Maintenance Staff, Machine Repair, Look for Materials, etc.

On a daily basis, the reports were collected from the 20 Machine Operators. After 10 days, the data were summarized similar to Table 1.

Table 1 Results of Problem Scan

Tally for 20 Machines	TWH = 80	TH for 20 M/C	LC of 2 Assistants (PhP)	LC of Operator (PhP)	Cost /2 weeks (PhP)	A. D. (PhP)	U.A.D. (PhP)	Monthly Cost (PhP)
No Materials	32	640	60,800	33,600	94,400			188,800
Machine Downtime	16	320	30,400	16,800	47,200	141,600		94,400
Change Design	8	160	15,200	8,400	23,600	23,600	165,200	47,200
Working on	24	480	45,600	25,200	70,800		70,800	141,600
Total			152,000	84,000	236,000	165,200	236,000	472,000

Legend:

TWH = Total Working Hrs in 10 days	Assistant's Rate = PhP 47.50/hr. Operator's Rate = PhP 52.50/hr	A.D. =Avoidable Delay
TH for M/C = Total Hrs for Machines	LC = Labor Cost	U.A.D.= Unavoidable Delay

The results in Table 1 translates to PhP94,400 labor cost paid for Machine Operator and his 2 Assistants while No Materials (waiting/doing nothing or looking for materials to work on). Out of 80 total working hours for a machine, it was idle at an average of 32 hours in a week because of No Materials. What was not clear was whether the machine was plugged ON even when idle. The 32 hours alone can escalate to 64 in a month, consuming PhP 188,800 labor cost if the same condition as that of 2 weeks ago continues.

Machine Downtime registered at 20% or half of the No Materials case. The labor cost of the Machine Operator and his 2 men is PhP47,200 in half month or PhP94,400 in a month. Looking at the Avoidable Delay column in Table 1 still, the amount is PhP141,600. If the two causes of idleness for the machine workers (excluding the maintenance personnel and other support group) be eliminated, the company may save such amount. That is, if machine downtime is closely studied and scheduled instead of too much unpredictability as the need arises.

The setting up of new design, labeled as Change Design, consumes 10% of the time. While the Machine Operator was doing that task, the assistants may or may not be working. The 10% or PhP47,200 in a month can still have room for improvement.

In effect, only 30% of the entire working time was spent in doing work on materials that were available. Though, the issue of effectiveness was yet unclear. It was not specified if they exactly produced what was required.

This diagnosis was shocking to the management since the company obviously pays the 3 immediate workers daily with 3.2 hours each while doing nothing. The No Materials reason may unfold to other logistical and operational management concerns that need adequate attention for the management. The Change Design may be planned ahead. Machine Downtime if a form of check-up, may be anticipated and scheduled. Repairs then may be minimized if check-up and conditioning of the machine is practiced regularly. If unavoidable, just like during start-up of the machine, the start-up may be performed ahead of the actual production time. Maintenance Personnel may be required to have an earlier shift so as to do his job without much interruption on the machine personnel.

With that quick fix for Machine Downtime and Change Blade, the No Materials shall be chased from the warehouse to anywhere in the production area. It has the biggest impact, surpassing even the productive hours by 10% more.

4.2 On No Materials Problem

The Inventory Staff, the Section Supervisor, the Machine Operator, and the Forklift Operator got the copy of the customer orders from the Production Manager. Each of them relied on the customer order and independently performs work at their own pacing and convenience.

It was unclear if from whom will each take instructions and to whom to report. The Inventory Staff gives instructions to the Forklift Operator and to the Machine Operators. If the Supervisors come to the loop and directly communicates to the operators, the flow may reverse. It could be the Inventory Staff who shall take instructions from the operators who may pressure him on material supply.

The overlapping of duties and criss-crossing of authorities like these also caused to redundant outputs. Nobody knows who was working on the same intended FG but started on separate WIPs. The succeeding processes may be simultaneously done. Since the instructions were dispersed, work errors may also be escalating and duplicated thereby reducing the availability of the WIP. Machine operators were then aware that their production outputs can be possibly monitored. They rummaged for materials to work on and even initiate work clashes but still cannot avoid leaving their workplaces to find for materials. Each of them became a lookout for one another.

This development made the Forklift Operators visible and the new object of blame. That Forklift Operators (FOs) had hearing problems requiring shout out instructions. Others accused the FOs of making too much backtracking and erroneous delivery of materials. Swapping of materials were then necessary and another idle time for the machine. The Inventory Staff can no longer catch up with the requirements of the machines. He had to ride the 3 forklifts alternately to assure correct delivery of delivery. The interaction among material handling and recipients were intensive in every move of the

pallets from source to destination. Verbal instructions were even prone to wrong reception or incorrect interpretation.

4.3 As Solutions

The information flow before production needs to be observed from top-to-bottom and bottom-to-top after production. The aggregate plan as summary of the all the customers plus pending undelivered orders plus allowance for fast-moving items, and capacity cushion shall constitute the overall production target for a specific period. A Production Plan (PP) shall communicate and mandate the breakdown of the materials per stage of production and schedule the transfer of each WIP based on the progress occurring on the WIP. This PP shall not be distributed to all Machine Operators. But the Inventory Staff shall get a copy of the PP. The Machine Operators shall instead receive a specific Work Order (WO) with only the specific activities for that machine. They do not need other machine's WO so as not to be misled. This WO shall be their basis in counter-checking the incoming materials delivered by the FO. If wrong materials were delivered, they have the right to refuse the materials. If in case they worked on the wrong materials, the policy shall penalize the Machine Operator who committed damage to the wrong material input.

The Inventory Staff shall have the overall coordination on the in and out of the materials by having the PP copy as reference. He shall be prohibited from roaming around with the FO. He shall identify the RM or WIP from stock, tag them with a color-coded and shape-coded label. This eliminates the verbal communication with the FO. That pallet shall be delivered the FO to the Machines with the same color and shape code and the WIP in and out features. The machine label may be in any form of digital signage or a crude plywood panel (shaped and painted with distinct shape and color per machine), big enough to be seen from a distance and hang atop the machine. No reason for interruption on the part of the Machine Operator or interaction between the FO and the Machine Operator. Swapping of wrong materials may also be eliminated assuming that the FO does his job well. No more shouting and miscommunication could be expected among cooperative workers. Figure 2 shows the possible shapes and colors that may be used as paper label to the pallet load with instructions on it and the bigger signage of the same nature hung atop the machine area.

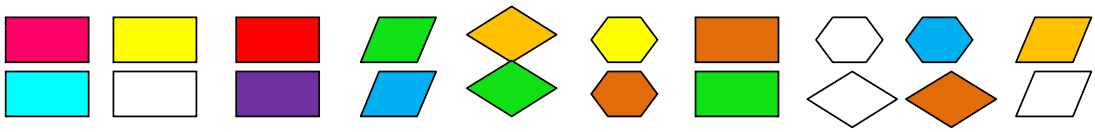


Figure 2 Color-Coded and Shape-Coded Material Labels and Machine Signages

The material labels shall be in 2 copies. Once delivered to the intended machine, the recipient (Machine Operator) signs both copies if the materials tally with his WO input list. Retain the first copy and return the 2nd copy to the FO. Both operators shall attach the material tag to their respective daily accomplishment reports. The more tags the FO has, the more delivery trips he has done. On the other hand, the Machine Operator shall report on all the tags he collected (Time In, Time Out, Input/Output Items and Quantity, Remarks) that follow the potential outcomes as illustrated in Figure 3.

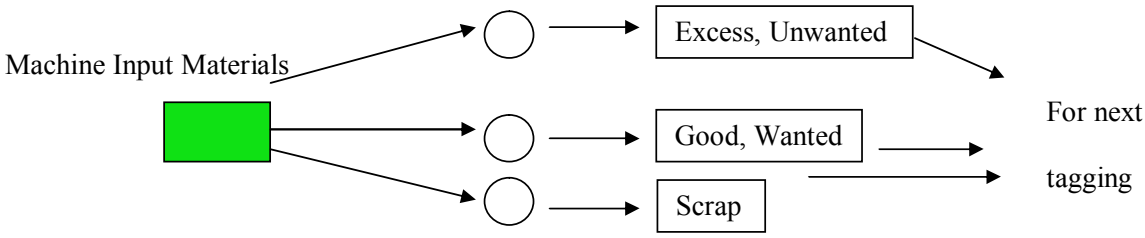


Figure 3 Material Input Transformation

The monitoring of accountabilities for each worker became clearer. The FO has his own report and activities. Machine Operators, being the team leader assumed responsibility on the processing of machines. Reporting of all the production jobs, delay or productive were monitored. Whatever wrong instruction or mishandling and damaged can be penalized by the human resource officer based on policies set-out according to the degree of violation.

Upon validation and evaluation of such systems, it was found out that there was indeed smooth flow of materials (No Materials reduced to 5%, Machine Downtime to 10%, Change Blade, 4%)and lesser backtracking flows and waiting time for the forklift operators; reduced unproductive moves; minimal output defects during production run; elimination of unwanted operating costs; and other undesired operational burden and reduced problems on handling spoilage/damages, human interaction, blaming or buck-passing among workers.

5. Acknowledgements

The author was indebted to Company ABC (which preferred to remain private more than being part of the private sector) for allowing an outsider to study their operations despite three failed attempts with others in the past, to Dr. Romulita Alto who have always been ready with her blunt and subtly articulated remarks, and to the supportive friends who were instrumental in concluding this study.

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About the Author

Elnora Lucero is the Corporate Researcher of Technological Institute of the Philippines. She is a researcher by inclination and Industrial Engineer by profession earned from Adamson University, Manila and graduate units from the University of the Philippines. Being an Industry Lecturer to Engineering and Logistics students, she also pursued Certificate in Teaching Program at Philippine Normal University. Majority of her experiences were spent in software industry, retail and trading, international port operations, selected production/manufacturing, and travel industry. Such exposure motivated her to conduct product research, productivity improvement, company-wide systems development/improvement in private or government setting, and management services on consultancy status with some service/product-oriented businesses in Metro Manila.

University-Industry Interaction and Project's Performance on Innovation: Perspective of University' S Researcher

by

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Abstract

This research studies affect of University-Industry Interaction (UII) to Project's performance on innovation in perspective of university's researcher. The main objectives are: 1) to identify main factors on project performance that will benefit to private firms. 2) to investigate the power of University-Industry Interaction (UII) on project's performance. 3) to test the model of University-Industry Interaction (UII) and project's performance as well as their relationship of all factors in the model. The author has distributed questionnaires to ask faculty members in two universities-Chulalongkorn University and Mahidol University. Those respondents were in the field of Science and Technology; and Engineering. 296 respondents answered questionnaire. The result of statistical testing shown that the factors affecting the project performance either directly or indirectly through University-Industry interactions (UII) are affecting project's performance which is University-Industry interaction (UII), Information and Communication Technology capabilities and social network. The indirect impacts are firm characteristics, researcher characteristics, and social network. The university-industry interaction (UII) has the most influence out of all of constructs that have the direct impact on the project's performance. The results can be concluded that all constructs have a positive impact on the performance of the project and have different values depending on the factors and relationships.

Keywords: Project's performance, University-Industry Interaction

1. Introduction

The National Innovation System was introduced in 1990s as the new economy that has altered the relationship between science, technology, innovation and economic performance. In Thailand, National Innovation System is reaching toward stronger and more synergistic. Changes in the government and private firms are noticeable but there are also some passive players (UNESCO, 2009). Whether these changes will have a significant impact on Thailand's ability to innovate and compete in both within countries and yet to compare them with significant competitors is to be decided.

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* This study is a Partial Fulfillment of the Requirement for the Degree of Philosophy (Development Administration), National Institute of Development Administration, Thailand

The main concept of NIS (Triple Helix Model) is linkage between Government, Industry, and University (UIG). Universities play important part for research on Innovation. Knowledge capability, Invested capital, and Knowledge transferring are important factors for projects success. Without University-Industry Interaction (UII), projects are facing obstacles.

There is a concern on how easy on the ongoing in changes for the institutional settings to maximize University-Industry Interaction (UII) because the ongoing benefit from academic activities was disregarded. Moreover, the reflection of academic has honored some aspect of the University in University-Industry interaction (UII), as the result there are rooms in the literature.

This is significant of study because research result can be applied by Thailand's National Science and Technology Development Agency (NSTDA), and National Innovation Agency (NIA) for forming the best policy. With better understanding of the linkage, the policy makers can be relied on improving innovative project performance. As the goal for this study is to strengthen National Innovation System interaction between government, industry, and university, the government can allocate suitable budget or other resources as it sees fit.

2. Research Objective

Whereas board picture of the Triple Helix Model and National Innovation System has been studied and report, the literature lacks to extended body of knowledge about inter-parties linkage problem. This study aims at the studying the factor determining success of project resulted from interaction between university and industry. Three objectives for the research are included:

2.2.1. To identify main factors on researcher's project performance that will benefit private firms

2.2.2. To investigate the power of University-Industry Interaction on project's performance

2.2.3. To test the model of University-Industry interaction (UII) and Project's performance as well as their relationship of all factors in the model

3. Background of Thai National Innovation System

The National Innovation System (NIS) has emerged during 1990s. It is the new economy that has altered the relationship between science, technology, innovation, and economic performance. However, to become successfully produce, accumulate and proliferations to promote competition in the knowledge-based or learning economies such relationships between different players within the innovation system are important (Archibugi and Lundvall, 2001, Lundvall and Johnson, 1994).

Even though, the policy makers began to realize the importance of innovation to compete in Thailand, it was also an important public policy issue in Thailand. Thailand's NIS and industrial clusters knowledge is still at the early stage. There are several issues that need detailed exploration along with how to evaluate the performance of the Thai national innovation (Chairatana and Intarakanerd, 2002). Thai policy makers must know the process of innovation and technological changes that will help Thai firms to become more innovative and make more competitive internationally. They also need to consider how to stimulation innovation, better benefit to the society and more efficient trading results from R & D and other innovation investments. Lundvall and Nelson (1993) finds the interaction among different players including Industry, University, and Government which can be described through the national innovation system as shown in figure 1.

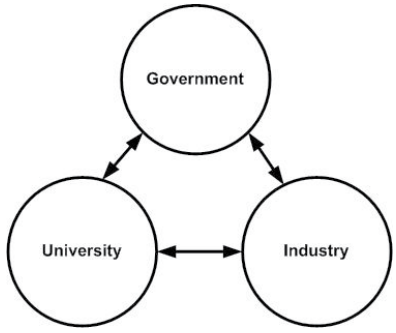

Figure 1 Interaction among Three Main Parties

The National innovation System (NIS) lies on the concept of understanding the relationship between institutions, especially those whose relationship base on the collective system of knowledge creation, diffusion and use. These are an important tool in improving innovation performance of the country. These institutions are both 'Things that pattern behavior', such as rules and legal standards and 'formal structure with clear objectives' such as firms, industrial R&D laboratories, universities, and public R&D institutes (Chairatana and Intarakanerd, 2002)

Triple Helix, the similar approach with the National innovation System (NIS) in term of innovation development, states that the university plays an increasing role in innovation and in increasing the knowledge society while NIS determines firms (the industry) as a leading role in innovation. (Etzkowitz and Leydesdorff, 2000) They are underlying both models confirm importance of university-industry interaction (UII) study.

University-Industry Interaction (UII) in Thailand

Thailand has a poor university-industry linkage (Brooker Group, 1995) . Rather than focusing on long-term and organizational commitments, personal connections between individual researchers and companies are emphasized and the short-term training or ad-hoc use of consulting or research activities is represented the link. This shown the limited in terms of both nature and depth of activities, and institutional sophistication of mechanisms

Numprasertchai and Igel (2005) said the R&D units in Thailand's Universities seem to be obligated in different purposes in external collaboration. For example, lead research units have collaborated with industrial, high-tech companies, and leading research centers in abroad for in-depth knowledge while others have worked with local companies for acquiring research problems and gaining access to research equipments.

The research on successful university in R&D collaboration of Numprasertchai and Igel (2005) found the linkage between in-house research with external partners. With strong interactions and good collaboration, they can improve the potential of Knowledge Management practices to achieve product and service innovation. It is suggested that trust, commitment, and mutual benefits are keys to the success of research collaboration. However, when formulate research strategy, the in-house needs and network development need to be considered.

The structure and incentive systems consist of the centralization and fragmentation of the Thai bureaucracy who act as facilitators of research technology organizations. The system on the university side has been difficult and not favorable to business community's need.

Three dimensions of weakness can thus be specified. First, these linkages tend to involve fairly low levels of technology. Second, they tend to be weakly institutionalized as reflected in the fact that many are of short duration, operate through individuals rather than through more organized ''linkage mechanisms,'' and lack significant linkages to local or regional institutional assets. Third, only a few instances of linkages with significant benefits to both sides, such as improvements in curricula, creation of new academic units, or upgrading on the part of firms.

Although, the private sector seems to be more eager to link up with universities, Thailand's educational infrastructure still has disadvantages for the incentives and institutional capacities for such linkages.

Interestingly, Brimble and Sripaipan (1996) point out characteristics that set universities apart from the private sector. First, the issue of finding the right person to develop the link, university staff operates on the semester base or to the thesis writing period of students, whereas quicker turnaround time is preferred by private sector agents. Second, the issue of academics suspicious for the private sector, the question of ''peripheralization'' and how to ensure that the core disciplines of the university are not contaminated by interaction with the private sector are crucial. Third, the issue in term of individual researchers prefers personal contacts with private companies. Not only it will reduce the benefits accruing to the university, it also creates time allocation conflicts on faculty members. Finally, some of the efforts being made to develop interface initiatives have been too ambitious, resulting in long delays.

4. Theoretical Base and Conceptual Framework

In the review, the author includes three main organizational theories which are Agency theory, organizational information processing theory and Organizational theory to integrate with the external technology.

4.1 Agency Theory

Agency theory is a self-interested actor who tries to manage risks associated with economic activities by negotiating contracts together (Eisenhardt, 1989, Jensen and Meckling, 1976). Principals contact agents on behalf of their respective decision which involve delegating authority to them under the terms of the contract required because principals and agents have important goals and values of different risks. Risk sharing problem is the result of conflict in risk preference between the principal and agents which lead to contradiction in the actions while the agency problem is the major attention for scholars.

The main difference between the principals and the agent called the "agency problem" in the agency theory and is always a basic assumption (Ouyang, 2006). The agency theory has developed over 30 years and came from risk-sharing research even then the issue has existed since it has been invented. The agency theory can be in a wide variety of forms as long as the delegation is involved, such as owner-management, management-employees, principal-professional or congress–bureaucrats (Kiser, 1999). The agency problem comes from three sources including conflicting in goal and compensation, limited information, and difficulty in monitoring the agent's behavior and their outcome (Kiewiet and McCubbins, 1991).

The mission of agency theory is to search for solutions provided base on the human and information assumptions (Eisenhardt 1989). The efficient solutions fall into 3 groups: to find the

right agents, utilizing different forms of supervising, and implement both positive and negative enforcement (Kiser, 1999). To solve the conflict by searching for the agent who shares the same preferences with good trace of work performance. There are several monitoring instruments in which can be revealed the hidden action and unconcealed the agents' information. Also, to apply the solution of hiring third party to monitor can be successful alternative that can engage the influenced elements (Kiewiet and McCubbins, 1991). The contracts and compensation can be judged based on the outcome of the performance for ensuring suited incentives (Fama and Jensen, 1983, Holmstrom, 1982, Jensen and Meckling, 1976, Mirrlees, 1976).

4.2 Organizational Information Processing Theory (OIPT)

The processing of information is the determined production, aggregation, change and distribution of information linked with accomplishing some organizational assignment (Robey and Sates, 1994). While the "'Mechanistic'' organizations is one extreme, the ''organic'' organizations is another which extent the overall variety of information processing proficiency (Burns and Stalker, 1961). In another word, the mechanistic organizations offer inferior levels of information processing than the organic organizations.

The organization information processing theory explains that the task is a key to determine what is needed for the information to process for the organization. A variety of organizational forms and managerial approaches provide information processing capacity where they are properly meet with the quality of task outcomes (Galbraith, 1977, Tushman and Nadler, 1978). When information processing is less than it is required, the task will either fail, delay or completed in higher than expected expense. When the organization utilizes an approach with more information processing power is required, the task will be accomplished in wasteful approach.

To view external technology integration from the viewpoint of organizational information processing theory is very useful. The external technology integration is an interesting task. Although the information sources and transformation requirements may differ which depends on the situation, they all still need to be engaged in some information processing. This theory inspires the theoretical structure of external technology integration.

4.3 Organizational Theory applied to External Technology Integration

The External Technology Integration (ETI) is the integration of technology obtained from an outside foundation into an operational procedure. Once the result is finalized that a technology must be acquired from an external source, there are several procedures that need to be accomplished. The acquirer must study the source of the technology and it also needs an agreement to acquire the technology from the source. The technology is then be installed and integrated into the process of the acquirer organization.

The external technology integration is usually involved as projects. Normally, it should include time, cost, and technical performance (Gerwin and Barrowman, 2002, Swink et al., 2006, Tatikonda, 2007). For the ETI framework, these dimensions effect in three components of ETI project effectiveness which are the practical process of the technology in the target operational process or technical routine, ETI project expenses (financial plan expenditures), and the quantity to which the ETI project reaches original intentions.

There are two critical dimensions that control ETI performance. First is technology ambiguity. For certain of ETI, the general OIPT concept of task uncertainty represents technology

uncertainty. OIPT explains task ambiguity as the deficient of information about how to implement. So, the uncertainty in ETI is known to be short in information required to gain and execute the technology to be included. Especially, technology uncertainty is the difference between the information required by organization's receiver to receive and operate the technology and the information that they in fact has at the start of the ETI process. The second is inter-organizational relations, which has something to do with the general OIPT concept of organizing mode. Inter-organizational relations represent the inter-organizational relationship among the sender and receiver of the technology in an ETI project. Walton (1966) recognized three important ''components of the relationship'' between organizations which are to trade information in joint decision process, arrangement of inter-unit contacts and decision-making and finally thoughts toward other units. These components have a say with how to deal with information or known as communication, organization, and collaboration in the perspective of ETI. So, the higher levels of communication, the higher level of inter-organization interaction is required.

4.4 Conceptual Framework

As shown in the early study on Agency-cost Theory, Organizational Information Processing Theory, and Organizational Theory applied to External Technology Integration, author proposed a theoretical framework that represent relationship between five major factors including Information Communication Technology Capabilities, Social Network, Researcher Characteristics, Firm Characteristics and University-Industry Interaction (U-I) and Project's performance. Details which will be discussed in each factor or construct regard to the conceptual framework are described as the following.

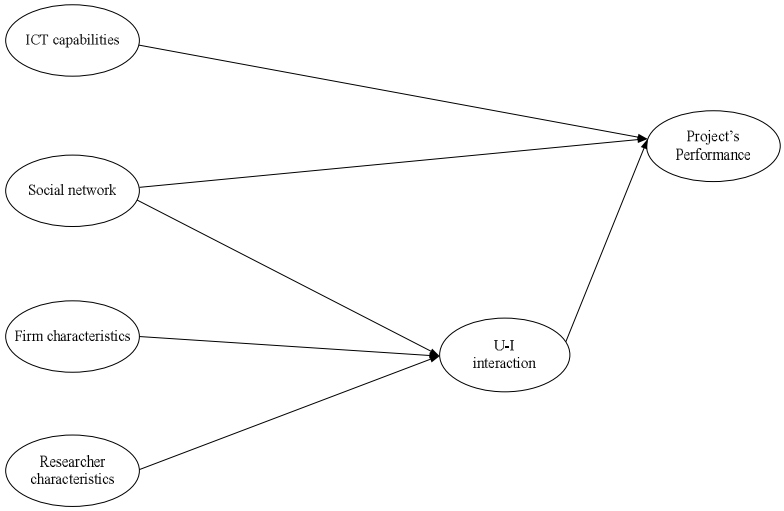

Figure 2 the Conceptual Framework of the Proposed Model

4.5 Key term and definition

For the purpose of this study, some basic definitions are needed to help in understanding the contents of this article. In this section, author define definitions of key terms as follows

Project's performance is referring to the result of project which can be measured by time, cost, and technical performance

University-Industry Interaction is the effort and commitment between university and industry

Information Communication Technology Capability is ability for organization in using technological tools to capture, to exchange useful information and knowledge in manageable manner.

Social Network is the relation composition between the organizations and external groups such as government agency and private firm.

Researcher Characteristic is a specific personal characteristics matter in the process of scientific production.

Firm Characteristic is specific firm characteristics matter including size, geographical location, and technological level

5. Target Population and Sample

The study is focus to collect data from faculty members of Faculty of Science and Technology; and Faculty of Engineering in both Chulalongkorn University and Mahidol University. Total number of faculty member for Faculty of Science and Faculty of Engineering of Chulalongkorn University equal to 360 people amd 315 people respectively. For Faculty of Science, Mahidol University includes 297 faculty members and 125 faculty members for Faculty of Engineering which bring the number of total population for both Universities to 1,097 faculty members.

Table 1 Numbers of Faculty Menbers in Science and Engineering Faculty

Title	No. of Faculty Members
Faculty of Science, Chulalongkorn University	360
Faculty of Engineering, Chulalongkorn University	315
Faculty of Science, Mahidol University	297
Faculty of Engineering, Mahidol Univeristy	125
Total Population	1,097

Source: Chulalongkorn University and Mahidol University website

Referring to Taro Yamane in his book of Elementary Sampling Theory (1967), Total population of this study is 1,097 which the number is fall into the estimate population of 1,097 as shown in the table and given the precision level of +- 5% where confidence level is 95%. Therefore, 291 sets of questionnaire are recommended from table. Moreover, for the structural equation modeling, the minimum sample size should be 150 said Anderson and Gerbing (1998) while, Hair, Black, Babin, Anderson and Tatham (2006) concur at the level of 200 to be small but reasonable.

6. Data Collection and Methodology

The author collected all 296 questionnaires with no missing values, because the author confirm with questionnaire collector to make sure that the respondents completed all questions. The total time spent on the data collection was approximately two months, from July to September 2009.

Statistical testing was designed to empirically test hypotheses and to provide answers to the keys questions. In this study, the author also utilizes the advantages of the SPSS for Windows statistical package as statistical package for the Social Sciences. The SPSS is one of the major computer packages permitting many types of statistical analysis. In additional, the EQS 6.1 or Structural Equation Modeling Software, for all quantitative data analysis also include in this study.

The statistical techniques were implemented in this study including descriptive statistic for describing the main features of a collection of data in quantitative terms, t-test for assessing whether the means between groups are statistically different from each other, ANOVA, and Structural Equation modeling (SEM) for serving purposes similar to multiple regression.

7 Research Result

7.1 Results of Descriptive Statistics

For explaination the statistical variables construct. There are six main constructs including project's performance, university-industry interaction, ICT capabilities, social network, firm characteristics and researcher characteristics. As shown in table 2, the average mean of "Project's performance" construct (4 items) was 5.59. The average mean of "University-Industry interaction" construct (4 items) was 5.55. The average mean of "ICT capabilities" construct (4 items) was 6.08. The average mean of "Social network" construct (4 items) was 5.53. The average mean of "Firm characteristics" construct (4 items) was 5.25. The average mean of "Researcher characteristics" construct (3 items) was 5.58.

Table2 the Summary of Mean of All Constructs

Construct	Number of Samples	Mean	Standard Deviation
Project's performance	296	5.59	.798
University-Industry (U-I) interaction	296	5.55	.886
ICT capabilities	296	6.08	.701
Social network	296	5.53	.974
Firm characteristics	296	5.25	1.010
Researcher characteristics	296	5.58	.889

7.2 Reliability Analysis

High reliability shows that internal consistency exists which indicating that the measures can represent the same latent construct. Hair et al (2006) has declared that reliability is one of the meters of convergent validity. To determine good reliability, Conbrach's alpha value should equal or more than .70. For this study, there are six constructs, as shown in the table 3.

Table 3 Constructs and Reliability Analysis

Constructs	Conbrach's alpha
Project's performance [Perf1-Perf4] (4 items)	.837
University-Industry (U-I) interaction [Int1-Int4] (4 items)	.803
ICT capabilities [ICT1-ICT4] (4 items)	.814
Social network [Social1-Social4] (4 items)	.844
Firm characteristics [Firm1-Firm4] (4 items)	.859
Researcher characteristics [Res1-Res3] (3 items)	.735

From the reliability analysis of the pre-testing, the construct of Firm Characteristic pointed out the highest Cronbach's alpha of .859 (4 items). Second, social network with four items had a Cronbach's alpha of .844 and followed by Project's performance with a Cronbach's alpha of .837 (4 items). ICT capabilities had Cronbach's alpha of .814 (4 items). University-Industry Interaction had Cronbach's alpha of .803 (4 items). All constructs provided high reliability with a Cronbach's alpha greater than.70. The construct with the lowest Cronbach's alpha was Researcher characteristics (.735). Cronbach's alpha of these constructs indicated that all constructs are highly reliable because six constructs were higher than .70.

7.3 Convergent validity

The convergent validity means the capability that the measures to have high proportion of variance in common. Some measures will have high convergent validity when there are extremely related with different constructs. The convergent validity is also the level that highly relates with added measures of the similar construct according to According to Hair et al. (2006). So the consequences shown that the convergent validity can be found by assessing the scale of issue loadings of observed variables on the suggested constructs or latent variables. Anderson and Gerbing (1988) have proposed that good convergent validity is shown when standardized factor loadings of each item exceed .40 (Lin and Germain, 2003) and all t-values are higher than the significant level for example the t-value is higher than 2.

In this study, construct measurement model was tested for convergent validity as shown below.

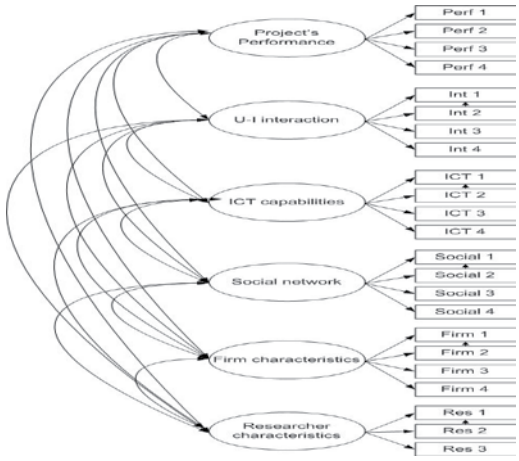

Figure 3 Construct Measurement Model

Table 4 Construct measurement

Factor	Standardized loading [a]
Project's performance (F1)	
Pref1	.761 [b]
Pref2	.780(10.735)
Pref3	.779(10.729)
Pref4	.692(9.482)
University-Industry (U-I) interaction (F2)	
Int1	.630
Int2	.784(8.789)
Int3	.843(9.175)
Int4	.647(7.629)
ICT capabilities (F3)	
ICT1	.811
ICT2	.724(9.943)
ICT3	.772(10.537)
ICT4	.622(8.482)
Social network (F4)	
Social1	.818
Social2	.801(12.112)
Social3	.703(10.353)
Social4	.710(10.488)
Firm characteristics (F5)	
Firm1	.754
Firm2	.759(10.713)
Firm3	.820(11.645)
Firm4	.798(11.307)
Researcher characteristics (F6)	
Res1	.703
Res2	.766(9.433)
Res3	.652(8.205)

Note: [a] t-values from the unstandardized solution are in parentheses
[b] fixed parameter

There were six constructs that were tested for convergent validity which include project's performance, university-industry interaction, ICT capabilities, social network, firm characteristics, and researcher characteristics. In these 6 constructs, there are 23 items included as shown in table 4 Construct measurement.

The goodness of fit is to establish both measurement and structural model validity. The fit criteria are as shown in table 5.

Table 5 The good of fit for Convergent Validity

Items	Fit Indices	Criteria
Normed Fit Index (NFI)	.948	>0.90
Non-Normed Fit Index (NNFI)	.972	>0.90
Comparative Fit Index (CFI)	.976	>0.90
Root Mean Square Error of Approximation (RMSEA)	.054	<0.10

From table 5, testing model fit for Convergent Validity pass all criteria, So, All of these indices confirmed good model fit.

The standardized loading indicates the strength of the relationship between the item and the latent construct and thus, is used to ascertain the convergent and discriminant validity of the scales. From table 4, all standardized loading are exceeded .400 and all associated t-value are significant. So, there are indicating the high strength of the relationship between the items and as the result. The result has shown that all 6 factors are correlated. Hence, we can conclude that convergent validity has been established.

7.4 Discriminant validity

For the discriminant validity, it is for measuring that a construct is actually distinct from another construct that it theoretically should not be correlated with. It is used to provide confirmation that a construct is different from the other. It is to prove that different instruments measurement shall perform different constructs to measure. Or we can say that the discriminant validity shall provide the test to guarantee that each construct is unique and different from one another.

The rule of thumb according to Anderson and Gerbing (1988) and Jiang, Klein, and Crampton (2000), result should exceed $\chi 2$ (1, 0.05) =3.841 for the conclusion that the two constructs have established discriminant validity. In addition, there is more useful measure for evaluating discriminant validity between the two constructs if it is related that is to compute a confidence interval of ± 2 standard errors for the correlation of those two constructs. If the interval does not also equal to 1.0, this can be summarized that discriminant validity occurs between those constructs. For us to verify if the construct is unique, chi-square difference test can be used to assess the discriminant validity. The value of chi-square difference is greater than 3.841 ($p<.05$) which suggests that the two constructs are different and the discriminant validity exists.

To measure discriminant validity is for comparing the average discrepancy that can be extracted from any of the two constructs or more with the squared of the correlated estimation. In isolation, the normal variance extracted has to be larger than the discrepancy of the correlation by Hair et al., (2006). The reason is that a latent construct should give details of its item can be measured better than it clarifies other constructs.

Table 6 Pairwise Analysis of Discriminant Validity

Construct	Construct	χ^2 fixed	χ^2 free	χ^2 difference [d.f. = 1]
Project's performance	University-Industry (U-I) interaction	60.208	42.426	17.782
Project's performance	ICT capabilities	59.466	23.314	36.152
Project's performance	Social network	47.804	39.305	8.499
Project's performance	Firm characteristics	41.422	27.578	13.844
Project's performance	Researcher characteristics	50.305	19.317	30.988
University-Industry (U-I) interaction	ICT capabilities	61.746	33.412	28.334
University-Industry (U-I) interaction	Social network	55.656	43.239	12.417
University-Industry (U-I) interaction	Firm characteristics	44.310	38.914	5.396
University-Industry (U-I) interaction	Researcher characteristics	64.669	36.202	28.467
ICT capabilities	Social network	59.613	42.756	16.857
ICT capabilities	Firm characteristics	72.969	46.245	26.724
ICT capabilities	Researcher characteristics	79.771	43.744	36.027
Social network	Firm characteristics	36.391	32.332	4.059
Social network	Researcher characteristics	35.928	23.891	12.037
Firm characteristics	Researcher characteristics	31.625	11.849	19.776

According to discriminate validity analysis, all constructs indicated that they were distinct from one another, meeting the criteria of the chi-square difference of each pair of constructs exceeding 3.841. In addition, the highest χ^2 difference was 36.125 for project's performance and ICT capabilities, and the lowest χ^2 difference was 4.059 for social network and firm characteristics.

7.5 Model Testing

The proposed model includes three factors which are ICT capabilities, social network, and University and Industry interaction and these factors are in the path of project's performance. Also, another three factors such as social network, firm characteristics, and researcher characteristics are a path for University-Industry interaction as shown in Figure 4.

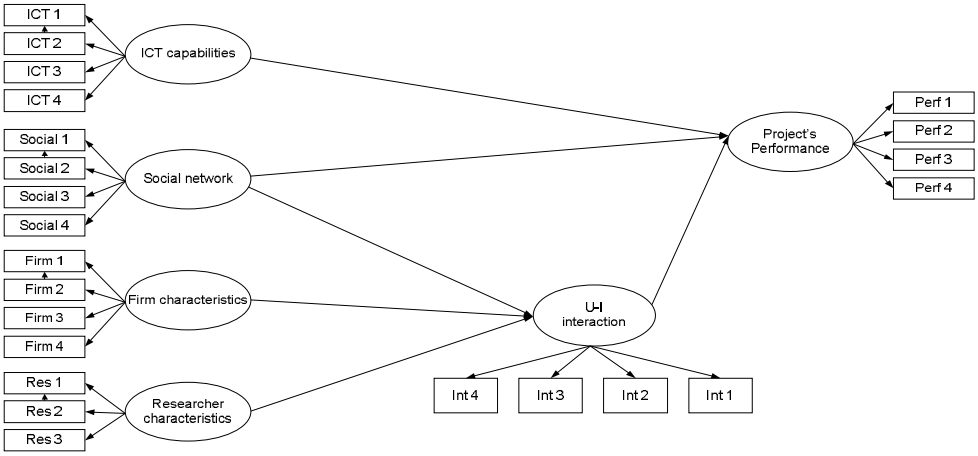

Figure 4 Proposed Model

Table 7 the Results of Proposed Model

Items	Fit Indices	Criteria
Normed Fit Index (NFI)	.908	>0.90
Non-Normed Fit Index (NNFI)	.927	>0.90
Comparative Fit Index (CFI)	.936	>0.90
Root Mean Square Error of Approximation (RMSEA)	0.086	<0.10

According to the fit indices above, the model provided good fit, as Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), and Comparative Fit Index (CFI) indicated, because their values are greater than .90. RMSEA was lower than .10. Therefore, overall the model is sufficient to indicate the model fit.

The result indicated adequate fit indices, showing that the data fitted well with the proposed model.

Table 8 The relation of Parameters and Parameter Estimates of Proposed Model 1

The Relation of Parameters	Standardized Estimates
University-Industry (U-I) interaction → Project's Performance	.511* (5.431)
ICT capabilities → Project's Performance	.184* (2.385)
Social Network → Project's Performance	.168* (3.626)
Social Network → University-Industry (U-I) interaction	.129* (2.714)
Firm characteristics → University-Industry (U-I) interaction	.500* (6.321)
Researcher characteristics → University-Industry (U-I) interaction	.219* (2.444)

Note: * indicated statistical significance at .05 and t-values are shown in parentheses

All relationships are statistically significant for both indirect and total effects of all parameters. University-Industry interaction had a highest positive influence on project's performance (path coefficient = .511 and t-vale = 5.431), while social network had a lowest positive influence on University-Industry interaction (path coefficient = .129 and t-value = 2.714).

7.6 Testing of Research Hypotheses

According to the framework in previous chapter, the author has proposed list of research hypotheses and the results of hypothesis testing are also shown as followed:

H1: University-Industry Interaction (UII) has a positive relationship with Project's Performance.

From the hypothesis that University-Industry Interaction (UII) has a positive relationship with Project's Performance, the result of the hypothesis has a positive relationship with project's performance with path coefficient of .511 and the t-value of 5.431. So, the interpretation for this hypothesis is that higher University-Industry interaction (UII) led to a higher of project's performance. As suggested in the literature, the relationship of University-Industry interaction (UII) has a positive relationship with project's performance. This result is supported by the work of Nonaka, and Takeuchi (1995)

H2: An Information Communication Technology capability has a positive relationship with Project's performance.

The hypothesis is that an Information Communication Technology capability has a positive relationship with Project's performance which the result has shown that it has a positive relationship with the path coefficient of .184 and t-value of 2.385. The communication technology capability is important for enhancing project's performance which is supported by the work of Prez-Bustamante (1999); Chataway, and Wield (2000).

H3: Social Network has a positive relationship with Project's Performance

The third hypothesis was social network has a positive relationship with Project's Performance which has been supported with the path coefficient of .168 and t-value of 3.626. Social Network has led to a higher Project's Performance which the finding can be supported by the work of Buchel, and Raub (2002); Weber, and Hkhademian (2008); and Cross, Parker, Prusak, and Borgatti (2001).

H4: Social Network has a positive relationship University-Industry Interaction (UII).

For the forth hypothesis, the social network has a positive relationship University-Industry Interaction (UII) and the result is significant. The value of path coefficient is .129 and t-value of 2.714. As supported by the work of Lea, Yu, Maguluru, and Nicholas (2006); and Gandhi, and Sauser (2008), social network has led to higher University-Industry Interaction (UII).

H5: Firm characteristics has a positive relationship with University-Industry Interaction (UII)

The fifth hypothesis was supported in the statement that said firm characteristics has a positive relationship with University-Industry Interaction (UII) with path coefficient of .500 and t-

value of 6.321. As supported by the study of Beise and Stahl (1999), firm characteristics led to a higher University-Industry Interaction (UII).

H6: Researcher characteristic has a positive relationship with University-Industry Interaction (UII)

And the sixth hypothesis that stated researcher characteristic has a positive relationship with University-Industry Interaction (UII) is supported with path coefficient = .219 and t-value = 2.444. This finding is supported by the work of Xie, and Shauman (1998).

The conclusion of the above hypotheses testing can be summarized that path coefficients of Information Communication Technology Capability, Social Network and University-Industry Interaction (UII) have shown positive influence on project's performance from the influence of the 3 listed main constructs. With the path coefficients of social network, firm characteristics, and researcher characteristics, the result can be assured that these three main constructs also have a positive influence on and University-Industry Interaction (UII).

However, the level of impact on the relationship between the constructs said to be in the difference. The three constructs which include Information Communication Technology Capability, Social Network and University-Industry Interaction (UII) and their relationship with project's performance have the results that indicated the University-Industry Interaction (UII) with path coefficient of .511 to have positive impact on project's performance and followed by Information Communication Technology Capability with the path coefficient of .184 and social network with path coefficient of .168, respectively.

For impact of three main constructs on University-Industry Interaction (UII), social network, firm characteristics and researcher characteristics, the results indicated that firm characteristics with path coefficient of .500 has positive impact on University-Industry Interaction (UII) and followed by researcher capabilities with path coefficient of .219 and social network with path coefficient of .129, respectively.

Table 9 Summary of results of Hypothesis Testing

Hypotheses	Relationship	Results
H1	University-Industry Interaction (UII) has a positive relationship with Project's Performance.	Supported
H2	Information Communication Technology capabilities has a positive relationship with Project's performance	Supported
H3	Social Network has a positive relationship with Project's Performance	Supported
H4	Social Network has a positive relationship University-Industry Interaction (UII)	Supported
H5	Firm characteristics has a positive relationship with University-Industry Interaction (UII)	Supported
H6	Researcher characteristics has a positive relationship with University-Industry Interaction (UII)	Supported

From the summary table above, the results indicated that all research hypotheses were supported by empirical tests from the data collected from researchers to measure University-Industry interaction (UII), and project's performance.

8 Conclusions and Future Research Line

The objective of this of this theory is that to identify main factors affect project performance on innovation which the research result has enabled this theory to achieve the objectives of the research finding. The result can be concluded that factors that affect project performance in both directly and indirectly through University-Industry interaction (UII) is the factors that affect the project's performance which are University-Industry interaction (UII), Information and Communication Technology capabilities and social network. Factors which have indirect impact on the project's performance are firm characteristics, researcher characteristics, and social network.

The second objective is to investigate the power of university-Industry interaction (UII) on project's performance. From the research, influence of the university-industry interaction (UII) from the above illustration has shown that university-industry interaction (UII) has the most influence out of all of the constructs that have the direct impact on the project's performance with a path coefficient value as high of 0.511.

The third objective aims at testing the model of university-industry interaction and project's performance as well as their relationship of all factors in the model. The results can be summarized that all of the constructs have positive effects on project's performance but they will have different level of impact depending on the relationship factors.

This can be concluded that the factors affecting the performance of the project, either directly or indirectly through university industry interactions (UII) are affecting project's performance which is University-Industry interaction (UII), Information and Communication Technology capabilities and social network. The indirect impacts are firm characteristics, researcher characteristics, and social network. The university-industry interaction (UII) has the most influence out of all of the constructs that have the direct impact on the project's performance. The results can be concluded that all constructs have a positive impact on the performance of the project and have different values depending on the factors and relationships.

In this study, the author studies the relationship between universities and the private sector only. This is just part of the Triple Helix Model only those interested in research in the future can extend the study about university-government interaction, and government-industry interaction in the context of Thailand.

Samples in this study use only two universities which are Chulalongkorn University and Mahidol University. Researchers who need future research can extend the study to include other universities in Thailand.

Education in Thailand is in transition as a result of educational reform. Public universities tend to be autonomous university. Environmental factors in the future may have changed. It could cause results of this study changed. Future research can study about comparative study of university-industry interaction and project's performance prior-educational reform and post-educational reform.

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Abstract

This study examines whether internet financial and sustainability reporting (IFSR) provides information that is reflected in profitability, and investigates whether IFR provides financial information that has a significant impact on stock prices and return, and explores whether the information provided with extended IFSR has a significant impact on stock prices and return. Sample of this research 179 firms were divided into three categories: 73 companies not providing financial and sustainability report in the internet (No website), 58 companies providing financial and sustainability report in the internet with low index (Low Index) and 48 companies providing financial and sustainability report in the internet with high index (High Index). *Simple regression analysis* was employed in this study. The research results consistent with efficient market principle. The efficient market principle was suggests that all available information of a firm should be quickly reflected in its stock price. If this is true, then the stock market's response to the firms providing timely information through IFR should be faster than the corresponding response to firms without IFR. The results of this study confirmed this principle. The research results also consistent with signaling theory. Signaling theory was suggests that companies with superior performance use financial information to send signals to the market. Signaling theory might be used to predict that higher quality firms will use the internet to disseminate "old" accounting information. Signaling theory in this research supported.

Keywords: Internet Financial and Sustainability Reporting (IFSR), voluntary disclosure, profitability, stock price and return.

1. Introduction

The internet is increasingly considered as a comprehensive instrument for investor relation activities. In particular, corporations use their World Wide Web homepage as a platform to present financial data, especially annual reports, databases on press releases and other company-specific information. There are many empirical studies on company disclosure. Disclosure can be categorized as mandatory or voluntary. This paper is concerned with company voluntary disclosure. Owing the recent developments in information technology, companies are beginning to voluntary disclose their financial information on the internet using their websites.

The voluntary nature of information provided on the internet by the public companies has led to non-uniformity in their disclosures (FASB 2000; IASC 1999). The diversity of IFR creates inconsistency on information completeness, comparability and reliability (Ashbaugh el al., 1999;

Debreceny et al., 2002). In particular, equal accessibility by information users has become a major issue when there is exists a gap between the time firms disclose financial information on the internet and the time they file financial reports with the SEC. Incomplete or selective financial reporting through the internet is expected if companies consider IFR as a supplement to the traditional financial reporting. In order to achieve uniformity on IFR, the AICPA, in cooperation with other professional organizations, has promoted the use of Extensible Business Reporting Language, XBRL, but it deals with the format only, not the contents and frequencies. Besides, it has no enforcing power.

Indonesian Company Act 2007 has been arranged about obligation of company to report their sustainability activities (Undang-undang Perseroan Terbatas No. 40 Tahun 2007 or), firms are using internet to supplement their traditional corporate reporting practice. Indonesian security regulations currently do not require firms to disseminate financial information on the internet. Another issue is the lack of formal guidance and the huge differences in the nature and extent of reporting on the web are likely to raise issue concerning the comparability and reliability data. The national standards setters and regulators of accounting practices will not be able to continue to treat financial reporting on the internet as identical to traditional distribution channels of corporate data. The Indonesia government or other regulatory bodies should decide to introduce guidelines that provide both corporations and information users with a framework within which the exchange of data can take place with maximum of efficiency. Budi and Almilia (2008b) show that not all of the firms listed in Indonesia stock exchange disclose sustainability reporting completely.

Internet Financial and Sustainability Reporting (IFSR) among firms in Indonesia is voluntary in nature. The Indonesia Accounting Standards Board and the Indonesia Stock Exchange have not pronounced any regulations governing IFR and, therefore, firms have a great freedom in choosing how and what financial information to disclose on the internet. More importantly, there exists a time gap between a firms' filing of financial reports with the Indonesia Stock Exchange (ISE) and the time the ISE makes them available to the public. This condition of imperfect information in the stock market will lead to the creation of abnormal returns for those who have earlier access to information provided by firm on the internet. This raises a crucial research question: Does internet financial and sustainability reporting (IFSR), in its current state, affect the investors' investment decisions? We studied the case of Indonesia with the understanding that the market-based economy and the modus operandi of the stock exchange in Indonesia are similar in nature to other market-based economies around the world. Under this assumption we believe the conclusions derived from this study could be applied to explain the behavior of internet practices found in other similar economies.

There are many empirical studies on company disclosure, especially on voluntary disclosure on firm websites. Some research examine the quality of internet financial reporting (Cheng, Lawrence and Coy, 2000; Deller, Stubenrath and Weber, 1999; Rikhardsson, Andersen and Bang, 2002; Budi and Almilia, 2008a and 2008b) and some research examine determinant factors of internet financial reporting (Craven and Marston, 1999; Oyelere et al., 2003; Ismail, 2002; Almilia, 2009), but only limited study that examine the impact of internet financial and sustainability reporting on financial and market performance (Lai, Lin and Lee; 2006). This study examines whether internet financial and sustainability reporting (IFSR) provides information that is reflected in profitability, and investigates whether IFR provides financial information that has a significant impact on stock prices and return, and explores whether the information provided with extended IFSR has a significant impact on stock prices and return. The remainder of the paper is organized as follows. Section 2 briefly discusses the relevant literature. Data selection, research methodology, and empirical models are described in Section 3. Section 4 provides analysis and interpretations of the empirical findings and Section 5 concludes the paper.

2. Literature Review and Hypothesis Development

2.1 Internet Financial Reporting Practice

Cheng, Lawrence and Coy (2000) developed a benchmark index to measure the quality of IFR disclosure of the Top 40 New Zealand companies. The results revealed that 32 (80%) on the companies in the sample had websites and 70% of the sample presented financial information on their websites. Of the 32 companies having websites, only 8 (25%) companies scored more than 50% on the index by virtue of having reasonably well-developed sites.

Deller, Stubenrath and Weber (1999) find that more US corporations (91%) used the internet for investor relation activities than UK (72%) and German (71%) corporations. In the USA, corporate reporting on the internet seems to be a standard feature of investor relation strategies. In contrast, Germany only about two-thirds of the corporations used the internet as an alternative way to distribute accounting information and UK corporations are more extensive users of the internet as an alternative distribution channel than German corporation.

Rikhardsson, Andersen and Bang (2002) show that many of the GF500 companies publish social and environmental information on their websites (63% and 79%, respectively for those 481 websites that could be analyzed) and they do not use the technological possibilities of the internet to communicate environmental and social information to their stakeholders. Rikhardsson et al (2002) show that the most popular issued addressed regarding the environments are environmental policies, resources consumption, emissions and product performance. Regarding the social aspect, the most popular issued addressed are workplace performance, stakeholder relationship, and social policies.

Budi and Almilia (2008a) measured the IFR of the 19 go public banks in Indonesia it was shown that, while most go public banks in the sample had websites and provided financial data on their sites. The survey findings show that the nature of IFR disclosure varies considerably across the sample banks. The variation in the content of the websites suggests that firms had different reasons for establishing an Internet presence. Some banks' website contains only product and service advertising. Most financial reporting is confined to PDF, which looks exactly like the paper-based annual reports. Apart from the lower cost consideration, this may be because the firms would like to protect themselves from legal risk in the event of providing uncorrected financial data to the users. Most of the banks in the sample do not take full advantage of the computer technologies. Only one bank allows users to download financial information or provided analysis tool for users to make their own analyses. The common technology feature provided by the banks is the download plug-in spot, but none of the banks in the sample provided download plug-in spot. Another common feature is online feedback. None of the banks used advanced futures (XBRL) to create their websites.

Almilia and Budi (2008) compare quality of banking industry and LQ-45 firms. Almilia and Budi (2008) used 19 banking industry and 35 LQ-45 firms as a samples. The statistic method used to compare internet financial reporting between banking sector and LQ 45 firms is independent sample t-test. The results show that banking sector has highest score on technology and user support component than LQ 45 firms.

2.2 The Determinant factors of Internet Financial Reporting

Craven and Marston (1999) finds a statistically significant positive relationship between the size of a company and the use and extent of disclosure on the internet, and no significant association between industry type and disclosure. Oyelere et al. (2003) indicate that firm size, liquidity,

industrial sector and spread of shareholding are determinant of voluntary adoption of internet financial reporting (IFR). Abdelsalman et al. (2007) find that corporate internet reporting comprehensiveness of London listed companies associated with analyst following, director holding, director independence, and CEO duality. Ismail (2002) found that firm assets, profitability, and leverage affecting the decision to disseminate financial information on the internet.

In Indonesia, Almilia (2009) used ordinal logistic regression to examine the determinant internet financial and sustainability reporting. The result of this research show that firm size, leverage, majority shareholding, auditor size and industry type as a determinant factor of internet financial and sustainability reporting index in Indonesia, whereas leverage not statistically significant as determinant factors of internet financial and sustainability reporting index in Indonesia.

2.3 The Stock Market Reaction to Internet Financial Reporting

In this section, we develop hypotheses to test the stock market reaction to IFR by Indonesia firms. The theory of efficient markets would predict that if markets are efficient then, in equilibrium, stock prices only respond when useful information is entering the market (Beaver 1968; Ball and Brown 1968). A generally-accepted theory with regard to the characteristics of useful information is that information, if useful, must be relevant to the decision to be made and that information must be provided timely to be relevant to decision-makers. (FASB 2000).

Beaver (1968), using this concept of information usefulness, theorized that if the information of a firm's profit announcement could lead to the change of the firm's stock price, it, then, has the information content, signaling useful information to investors. Information must be timely to be relevant, and consequently, timeliness is a necessary dimension of useful information. What, then, is considered timely on the investment market? Beaver (1968) defined timely in terms of two elements, reporting delay and reporting interval. The shorter is the delay and the interval, the timelier is the information. This definition of information timeliness was further supported by Han and Wild (1997) who used the "information transfers structure" to examine the impact of timely information on business operations. Furthermore, a considerable amount of literature has emerged in the last few decades which examines voluntary corporate financial reporting (e.g., Easley et al., 2002; Frankel et al. 1999; Sengupta 1998; Botosan 1997; Welker 1995). The literature suggests that the corporation benefits with voluntary disclosure. Voluntary disclosures on company's activities reduce information asymmetry between the investors and the management about a firm's financial condition and results of operations in the corporate environment. Leftwich et al. (1981) show that voluntary disclosure of significant information, financial or non-financial, will add value to the information that is legally required for disclosure to the public. Each of such disclosures will lead investors to re-examine their appraisal of the value of the stock and make their decisions to sell or to hold. In view of the evidence suggested by prior research, IFR, on the voluntary basis, should provide greater information value to investors and should spell more impact on stock prices. Once information is disclosed through IFR, it is instantaneously available to all investors, thereby reducing information asymmetry and shortening information accessibility delay.

Traditionally on the Indonesia stock market, quarterly financial information of the firm is not available until it was delivered to the Indonesia Stock Exchange that, in turn, makes it available to the public. Thus, if a firm does not disclose financial information on the internet at the same time as it delivers the information to the Indonesia Stock Exchange, there will be a longer time interval for investors to receive the information. That also means a longer information delay to investors. Thus, shortening time intervals in information delivery leads to shortening decision making cycle by investors, thereby quickening the pace of change in stock prices. Lai et al. (2006) show that the lag

lengths of each firm's stock price affected by its own past stock prices. The results show that the lag lengths of the firms with IFR are significantly less than those without the IFR. Lai et al. (2006) show that the results from the event study methodology show that the cumulative abnormal returns of the firms with IFR are significantly higher than those of the firms without IFR, lastly, the results indicate that firms with a higher degree of information transparency yield a higher abnormal return on their stock prices.

Hypotheses 1 and 2 are posed as follows:

Hypothesis 1: *The internet financial and sustainability reporting (IFSR) have positive impact on firm stock price.*
Hypothesis 2: *The internet financial and sustainability reporting (IFSR) have positive impact on firm stock return.*

2.4 Signaling Theory and Voluntary Disclosure

Signaling theory was suggests that companies with superior performance use financial information to send signals to the market. Signaling theory might be used to predict that higher quality firms will use the internet to disseminate "old" accounting information. Gray and Roberts (1989) considered the cost and benefits of voluntary disclosure and investigated perceptions of costs and benefits empirically. Gray and Roberts (1989) found that for British multinationals, the most important perceived benefits of voluntary information disclosure were: (1) improved image/reputation of the company, (2) better investment decisions by invertors, (3) improved accountability to shareholders, (4) more accurate risk assessment by investors, (5) fairer share prices. And the most important cost factors constraining voluntary information disclosure were: (1) cost of competitive disadvantage, (2) cost of data collection and processing.

The signaling theory points out that without information transparency between buyers and sellers, buyers will haggle with their sellers on prices to the point that prices are so low that sellers have to lower qualities of products to sustain a profit. This economic behavior eventually leads to the disappearance of sellers with high-quality products--a phenomenon called adverse selection (Spence, 1973). To avoid this situation on the investment market, Beaver (1968) claimed that profitable companies would disclose as much information as possible so that investors were able to differentiate good companies from bad ones. It implies that unprofitable companies will do just the opposite as far as information transparency is concerned. We adopt the definition of "transparent financial disclosure as those from which needed information can be more easily extracted and more effectively used to understand firm economics" (Hunton, et al., 2006, p. 138). Voluntarily disclosing additional information, financial and non-financial, on the internet, creates greater information transparency. Information transparency reduces information asymmetry between owners (or investors) and management which in turn affects the cost of equity capital (Botosan 1997), cost of debt capital (Sengupta 1998), firm values (Frankel et al. 1999) and market liquidity (Welker 1995). Moreover, the literature in the timing pattern of disclosure (early vs. late; good vs. bad news) provides complementary evidence in this line of reasoning. The literature based on studies of earnings announcements in both mature markets and emerging market shows that firms with good news to report tend to accelerate the release of good news and delay the release of bad news when the news are bad about the company

Hypotheses 3 are posed as follows:

Hypothesis 3: *The internet financial and sustainability reporting (IFSR) have positive impact on firm profitability.*

3. Research Design

This section describes the research design of the study including sample description, variable identification and data collection.

3.1 Sample

This survey is based on data that were collected on the listed companies in Indonesia Stock Exchange. Sample of this research divided into three group samples, where the categorizing group sample based on companies disclosed financial and sustainability on the web. The screening of the corporate websites was carried out in November 2007 and February 2008.

3.2 Variable Measurement

This study empirically examines the differences between some variables that may motivated companies to disseminate financial and sustainability on the internet. The data collected are related to the variables that represent the core interest for this research:

Independent Variable

Dependent variable of this research is internet financial and sustainability reporting. First of all, models have been developed to assess quality of corporate website like www.IRGlobalRanking.com or www.JungleRating.com. In order to evaluate company websites a checklist of criteria has been developed. The criteria were used to construct an Internet Financial Reporting Index, which was used to assess company websites. Then, the index developed to favor the importance of technology rather than the content of information statements. Therefore, in order to add weight to content over technology enhancements, the index criteria were divided into four parts and assigned weights – content (40%), timeliness (20%), technology (20%) and user support (20%). An index was developed by basing closely on the work of Cheng et al. (2000) who had devised their framework from three stages of website financial reporting as identified by Lymer et al. (1999). Internet financial reporting instruments are content, timeliness, technology and user support.

1. In terms of **Content**, this category includes the components of financial information from statement of financial position, cash flow through shareholder information and social responsibility disclosures. For example, financial information disclosed in html format scores higher (2 points) than disclosure in PDF format (1 point), since the former makes better use of the web technology and as a result it is easier for users to access effectively. A copy of the content index is attached as Appendix 1.

2. **Timeliness**, since the web can provide information in real time it is important to find out the extent to which this facility is utilized. These real time data include press release, unaudited latest quarterly results, vision/forward-looking statements, and charts of future profits forecast. For disclosure of press releases and stock quotes, there is an added score for the recently of information (on a scale from 0 to 3). Companies receive a score for disclosing unaudited quarterly results and

vision statements and a score is also given for appropriate disclaimers. This is included since companies may face potential legal risk if they endorse the unaudited or forward-looking statements and omit meaningful cautionary disclaimers. A copy of the timeliness index is attached as Appendix 2.

3. **Technology**, these items related to enhancements that cannot be provided by printed reports. Those items that uphold the quality of the electronic financial reporting and facilitate communication with site users score highly on the index. The elements are download plug-in on spot, online feedback, use of presentation slides, use of multimedia technologies (audio and video clips), analysis tools (for example, Excel's Pivot Table), advanced features (such as implementing an "Intelligent Agent" or XBRL). A copy of the technology index is attached as Appendix 3.

4. **User Support**, users' computer skills are different. Some of them are experts and some are novice. Those who do not have state-of-the-art technology may find themselves unable to use a site at all. Companies score is higher if they implement tools that facilitate use of the internet reporting irrespective of computer skills. The tools scored in the index are: search and navigation tools (such as FAQ, links to homepage, site map, site search), number of clocks to get financial information (on a scale from 0 to 3), and consistency of web page design. A copy of the User Support index is attached as Appendix 4.

Internet Sustainability Reporting Index, replicate the item which issued on www.junglerating.com. Internet sustainability reporting index divided into 21 items, a copy of the internet sustainability reporting items is attached as Appendix 5. The index of Internet Financial and Sustainability Reporting (IFRS) were divided into two parts and assigned weights – internet financial reporting index (50%) and internet sustainability reporting index (50%).

Dependent Variable

Data for relevant variables in this research were collected from corporate websites for companies with internet financial report and Indonesia Capital Market Directory. The detailed measurements of independent variables are: **(1)** Stock Price that measure with annual closing price, **(2)** Stock Return [(Stock Price $_t$ – Stock price $_{t-1}$)/ Stock price $_{t-1}$], **(3)** Profitability [net profit divided by total assets].

3.3 Statistical Analysis

This study attempts to determine whether internet financial reporting has significant impact on the profitability, stock price and return. *Single regression analysis* is use to examine the impact of internet financial and sustainability reporting on profitability, stock price and return. The single regression equation is formulated as follows:

$$PRICE = \beta_0 + \beta_1 IFSR \quad \text{..... (1)}$$

$$RETURN = \beta_0 + \beta_2 IFSR \quad \text{..... (2)}$$

$$PROFITABILITY = \beta_0 + \beta_3 IFSR \quad \text{..... (3)}$$

4. Results

4.1 Descriptive Statistics

For the descriptive statistics analysis, the sample of this research divided into three group samples, where the categorizing group sample based on companies disclosed financial and sustainability on the web. The first group sample is firm with no web or non-financial and sustainability information on the web, the second group sample is firm with low score of IFSR and the third group sample is firm with high score of IFSR. The 179 firms were divided into three categories: 73 companies not providing financial and sustainability report in the internet, 58 companies providing financial and sustainability report in the internet with low index and 48 companies providing financial and sustainability report in the internet with high index. Descriptive statistics pertaining to the independent variables for IFSR are presented in Table 1 and 2.

Table 1 Descriptive Variables for Firms with IFR and Firms without IFR

Variable	Group Sample	N	Mean
ROA	With IFR	106	.0455408322
	Without IFR	73	-.0054808881
PRICE	With IFR	106	2169.4811320755
	Without IFR	73	1130.1369863014
RETURN	With IFR	106	.4541378135
	Without IFR	73	.5916782114

Table 2 Descriptive Variables for Firms with High IFR and Firms with Low IFR

Variable	Group Sample	N	Mean
ROA	High IFR	48	.0611034736
	Low IFR	58	.0326614047
PRICE	High IFR	48	3005.3819444444
	Low IFR	58	1477.7011494253
RETURN	High IFR	48	.6490034555
	Low IFR	58	.2928696959

4.2 Results of Hypothesis Testing

In order to test Hypothesis 1, 2 and 3, all samples were tested using the *simple regression analysis*. Hypothesis 1, 2, and 3 stated that the internet financial and sustainability reporting (IFSR) have positive impact on firm stock price, stock return and profitability. Table 3 indicated the degree of independent variables which affect the dependent variables. The value of Adjusted R^2 is 0.043 for model 1; it means that 4.3% firm stock price affected by internet financial and sustainability reporting in the model. The value of Adjusted R^2 is 0.002 for model 2; it means that 0.2% firm stock return affected by internet financial and sustainability reporting in the model and the value of Adjusted R^2 is 0.056 for model 3; it means that 5.6% firm profitability affected by internet financial and sustainability reporting in the model.

This study shows that internet financial and sustainability reporting has a significant and positive impact on firm stock price and profitability. This finding supports H1 and H3. This study

also shows that internet financial and sustainability reporting has positive but not significant impact on firm stock price and profitability. These findings not support H2.

Table 3 The Result of Simple Regression Analysis

	Model 1	**Model 2**	**Model 3**
Dependent Variable	PRICE	RETURN	ROA
Independent Variable	IFSR	IFSR	IFSR
Standardized Coefficients	0.211	0.012	0.240
t statistic	4.989	0.266	5.696
Sig.	0.000	0.790	0.000
F statistic	24.888	0.071	32.443
Sig.	0.000	0.790	0.000
Adjusted R Square	0.043	0.002	0.056

The research results consistent with efficient market principle. The efficient market principle was suggests that all available information of a firm should be quickly reflected in its stock price. If this is true, then the stock market's response to the firms providing timely information through IFR should be faster than the corresponding response to firms without IFR. The results of this study confirmed this principle. The research results also consistent with signaling theory. Signaling theory was suggests that companies with superior performance use financial information to send signals to the market. Signaling theory might be used to predict that higher quality firms will use the internet to disseminate "old" accounting information. Signaling theory in this research supported.

5. Conclusion

This study focuses on whether the disclosure of financial information on the internet, in terms of timeliness and relevance, has an immediate impact on profitability stocks prices and return, and whether the degree of information disclosed on the internet and the scope of IFR have a significant impact on profitability, stocks prices and return. We analyzed data collected from the Indonesia Stock Exchange and data collected from actual observations of websites established by the respective companies listed in the Indonesia Stock Exchange.

A number of conclusions can be drawn from this analysis. **First,** the survey findings show that the nature of IFR disclosure varies considerably across the sample firms. The variations in the content of the websites suggest that firms had different reasons for establishing an Internet presence. Some website contains only product and service advertising. Most financial reporting is confined to PDF, which looks exactly like the paper-based annual reports.

Second, under the efficient market principle, all available information of a firm should be quickly reflected in its stock price. If this is true, then the stock market's response to the firms providing timely information through IFR should be faster than the corresponding response to firms without IFR. The results of this study confirmed this principle. When relevant information is provided on a timely basis regarding a firm's performance, investors will immediately reevaluate the firm's worth and readjust their portfolio, as a consequence.

Third, signaling theory was suggests that companies with superior performance use financial information to send signals to the market. Signaling theory might be used to predict that higher

quality firms will use the internet to disseminate "old" accounting information. Signaling theory in this research supported.

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Appendix 1 The Content Index of Internet Disclosure Instruments

Index Items	Explanations	Score	Multiplier	Max
1. Component of Financial Information				
1.1. Statement of Financial Position				
PDF	1 = Yes, 0 = No	1	1	1
HTML	1 = Yes, 0 = No	1	2	2
1.2. Statement of Financial Performance				
1.3. Statement of Cash Flows				
1.4. Statement of Movement in Equity				
1.5. Notes to the Financial Statement				
1.6. Disclosures of Quarterly Results				
1.7. Financial Highlight/Year-in-Review				
PDF	1 = Yes, 0 = No	1	1	1
HTML	1 = Yes, 0 = No	1	2	2
Growth rate, ratios, charts	1 = Yes, 0 = No	1	2	2
1.8. Chairman's Report				
1.9. Auditors' Report				
1.10. Stakeholder Information				
1.11. Corporate Information				
1.12. Social Responsibility				
2. Number of years/quarters Shown				
Annual Report	No. of years	1	0.5	2
Quarterly Report	No. of quarters	1	0.5	2
3. Past Information (HTML Only)				
Annual Report	1 = yes, 0 = no	1	1	1
Quarterly Report	1 = yes, 0 = no	1	1	1
Graph of Share Price	1 = yes, 0 = no	1	2	2
4. Language				
English	1 = yes, 0 = no	1	2	2
Other than English or Indonesia	1 = yes, 0 = no	1	1	1
5. Address (HTML only)				
Company Address	1 = yes, 0 = no	1	1	1

Appendix 2 The Timeliness Index of Internet Disclosure Instruments

Index Items	Explanations	Score	Multiplier	Max	
1. Press Releases					
Existence	1 = Yes, 0 = No	1	2	2	
Number of days since last updated news	See note 1	1	1	3	Note 1: Press Release
2. Unaudited Latest Quarterly Result (3 = updated on the date of investigation)					
Existence	1 = Yes, 0 = No	1	2	2	2 = 1 week or less before the date of investigation
With proper disclaimer	1 = Yes, 0 = No	1	1	1	1 = 2 weeks or less before the date of investigation
3. Stock Quote (0 = news is updated more than 2 weeks ago)					
Existence	1 = Yes, 0 = No	1	2	2	
Updated in how many hours	See note 2	1	1	3	Note 2: Stock Quote
4. Vision Statement/Forward Looking Statement (3 = updated every hour or less)					
Existence	1 = Yes, 0 = No	1	2	2	2 = update every day or less
Proper disclaimer	1 = Yes, 0 = No	1	1	1	1 = updated every week or less
Charts of future profit forecasts/trends	1 = Yes, 0 = No	1	1	1	0 = updated every week or less

Appendix 3 The Technology Index of Internet Disclosure Instruments

Index Items	Explanations	Score	Multiplier	Max	
Download Plug-in On Spot	1 = Yes, 0 = No	1	2	2	
Online Feedback	1 = Yes, 0 = No	1	2	2	
Use of Presentation Slides	1 = Yes, 0 = No	1	2	2	
Use of Multimedia Technology	1 = Yes, 0 = No	1	3	3	
Analysis Tools	1 = Yes, 0 = No	1	4	4	
Advance Features (XBRL)	1 = Yes, 0 = No	1	5	5	

Appendix 4 The User Support Index of Internet Disclosure Instruments

Index Items	Explanations	Score	Multiplier	Max	
Help and Frequently Asked Questions	1 = Yes, 0 = No	1	2	2	
Link to Home Page	1 = Yes, 0 = No	1	1	1	
Link to Top	1 = Yes, 0 = No	1	1	1	
Site Map	1 = Yes, 0 = No	1	2	2	
Site Search	1 = Yes, 0 = No	1	2	2	Note 3: Number of Clicks to get to financial Info
Number of Clicks to get to Financial Info	See note 3	1	1	3	3 = 1 clicks
Consistency of Web Page Design	0 = poor, 1 = fair, 2 = good	1	2	4	2 = 2 clicks

Appendix 5 Sustainability Reporting Index

No.	Content
1.	The companies have placed 'sustainability' as a separate item in their main navigation
2.	A sustainability-related FAQ on websites and a sustainability-related glossary on websites
3.	The companies inform their visitors on specific contact persons for sustainability.
4.	The companies do invite visitors pro-actively to get in touch with the company
5.	The companies provide photos regarding one of the three sustainability pillars on their website
6.	The companies offer presentations given by executives, which reflect the company's vision on sustainability
7.	On website the visitor can choose between at least two languages
8.	The companies provide the option to personalize the corporate newsletter for sustainability related news
9.	The companies do inform on their executives, although the extensiveness of the bios differs
10.	The corporate websites we did not find clear and concise information about the companies' locations by means of for example a location finder
11.	The companies have press releases about sustainability on their website (either social, environmental or economic)
12.	The websites case studies on social issues are available, present environmental case studies and present case studies from an economic point of view
13.	Nearly every company provides either a sustainability report or both a social and an environmental report
14.	All companies provide an external assurance statement within their online sustainability section
15.	The companies quantitatively inform on the geographical dispersion of their workforce
16.	Provides quantitative information on injuries, accidents and/or lost-day due to sickness
17.	The companies explain to some extent the role and nature of the various materials they use in their production processes. All companies do provide quantitative information on the materials used as well
18.	The companies provide a clear overview of their geographical breakdown of sales
19.	All companies inform about their donations to society
20.	A code of conduct is available on websites
21.	The companies, communicate on last years sustainability performance compared to that of previous years

Electric Train as an Alternative Public Transportation Mode In Congested Area In Developing Country: A Case Study In Padalarang - Bandung - Cicalengka in Indonesia

by

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Abstract

Indonesia is a country with the fourth largest population in the world. Large cities in Indonesia include Bandung have high density of population. Because Bandung is the center of economic activities, traffic generation rate between Bandung and small towns around it is high. Electric train as a mass public transportation mode is an effective, efficient, and potential alternatif to ease existing severe traffic congestion problem in rural main roads. Electric train is chosen because of a number of reasons, i.e. building road infrastructure cannot solve the problem because annual vehicle growth rate is higher than annual road network development, the mode is effective and efficient in terms of fuel consumption saving, pollution emission saving, and land use saving. Case study is carried out on Padalarang – Bandung – Cicalengka railway for the length of 42 km. In order to support successfully the implementation of the electric train next year, in 2010, as planned by Indonesia Railway Corporation, Operation District 2 Bandung, as the railway authority of Bandung, analysis of service of the transit system including analyses of headway is crucial. The result indicated that the service of the electric train as a transit system is fulfill the passenger demand with the value of headway 51 minutes during peak hours and 60 minutes during off peak hours.

Keywords: Electric Train, Alternative Transportation Mode, Congested Area, Developing country, Headway Analysis

1. Introduction

Indonesia is a country with the fourth largest population in the world. The population of Indonesia is 240,271,522 million people (U.S. Census Bureau, Population Division, 2009). The highest density of population in Indonesia is in Java island i.e. 1203.21 people per km^2 (Statistical Bureau of Bandung Municipality, 2007) and most of them are in West Java Province, especially in the city of Bandung as the capital city of West Java Province. Bandung is a city with the third largest population in Indonesia, after Jakarta and Surabaya. The area of Bandung is 16,730 ha and population of 2,364,312 million with 1.06 % annual growth rate. The road infrastructure density of Bandung is only 3% and has to serve 1,207,455 vehicles excluded 2,253,379 motorcycle (Samsat Kota Bandung, 2008).

In addition, the city of Bandung is the center of education and economic activities of small towns around Bandung. Moreover, economic activities have an impact in increasing traffic generation between Bandung and towns around it that cause severe traffic congestion problem in rural main roads. Severe traffic congestion occurs also because annual vehicle growth rate is higher than annual road network development.

Travel between Bandung and the towns can be reach using passenger cars or public transportation modes, for examples: buses, taxies, and diesel train. However, the existing severe traffic congestion problemin rural main roads among city and towns indicated that existing transportation modes cannot carry passenger demand anymore. In order to solve this problem, both road and railway authorities realise that building road infrastucture alone cannot solve the problem. Nowadays, diesel train as a public transportation mode operating between Bandung and towns around it is not efficient because of lack of fuel consumption saving, pollution emission saving, and high cost of maintenance. Therefore, Indonesia Railway Corporation, Operation District 2 Bandung, as the railway authority of Bandung has planned to operate electric train in 2010 to change diesel train. Electric train is an alternative mode which is effective and efficient in terms of fuel consumption saving, pollution emission saving, land used saving, and as a mass public transportation mode. Train with 6 cars may have a capacity of 1,500 passengers, seated and standing (Khisty, 1998) that equal with 20 buses (Hess, 2007).

Meanwhile, the railway authority of Bandung has also planned to increase electric power that will available for the next 20 years (PT. KAI, 2006) to also support electric train operation planning. Based on this conditions, electric train is a relevant and potential mass public transportation mode to developt.

The important thing is to operate electric train succesfully. Therefore, the purpose of this paper is to analize the used of electric train in changing existing diesel train. In more details are to determine time headway between two trains in order to fullfill passenger demand, appropriate load factor, limit of train speed, safe stopping distance, and dwell time factor, during peak and off peak hours.

Case study is carried out in Padalarang – Bandung – Cicalengka railway for the length of 42 km, as planned by the railway authority of Bandung. Nowadays, railway improvement and intensive maintenance are being done. The results of this paper are belief to be very beneficial to support the operation of the electric train succesfully next year, in 2010, which is planned by the railway authority of Bandung, Indonesia.

2. Public Transportation

Public transportation is a passenger tranportation service that is available to any person who pay a prescribed fare (Khisty, 1998). It usually operates on specific fixed tracks or with separated and exclusive use of potential common track, according to established schedules along designed route or lines with specific stops (Wright and Fjellstrom, 2003). Regarding train as heavy rail transit system, it is designed to move large number of people at one time on a long route with few stations at high speed, reliability, on exclusive or fully controlled right-of-way (R/W) category A (Khisty, 1998; Vuchic, 2005). Transit service is the transit system as experienced by its actual and potential users. Transit system characteristics are classified in four categories as follows:

a. System performance refers to the entire set of performance elements, the most important of which are frequency (f), operating speed (v_0), reliability (percentage of vehicle arrivals with less than a fixed time deviation from schedule), safety, line capacity (c), productive capacity (P_c), productivity, and utilization;
b. Level of service (LOS) as the overall measure of all service characteristics that affect users;
c. Impacts are the effects that transit service has on its surroundings and the entire area it serves;
d. Costs are usually divided into two major categories: investment cost (capital cost) and operating cost.

Evaluation analysis of transit systems must include all four categories: performance, LOS, impacts, and costs of the system as the most advantages combination.

In developing countries where cities are growing much faster than those in developed countries (Sutandi, 2007), rail transit system has been used as a mass public transportation mode, for example in Caracas, Bangkok, Mexico, Kuala Lumpur, Tunisia, and Bogota (Wright and Fjellstrom, 2003). Rail based system is relevant and potential to developt among cities in developing countries which experience high traffic congestion in terms of little impact to land use pattern, fulfill high rate of passenger demand with high operating speed.

3. Electric Train

Based on technology, electric train is similar with diesel train. Electric train has been used since human beings were able to convert the electric to mechanic energy (traction motor). The obstacle of generator and fuel consumption of diesel train, cause larger weight and need of wider space. In addition, the cooling installation thereof causes loss of energy in a very significant amount. The other obstacles are high cost of large number of spare parts and lubrication, limited fuel tank which cause shorter distance prior to refueling, and high cost of investment regarding larger weight. On the other hand, the weigh of electric locomotive is only 60% of the diesel train. The less weight does not only affect locomotive structure, and infrastructure, but also saved energy consumed. Furthermore, electric train produces minimum noise pollution and no air pollution. It does not mean that electric train has no weakness; investment, development, and maintenance cost of electric network are also high and depend on the number of frequency and operating speed (Kramadibrata, 1987).

Electric train which will operate in Padalarang-Bandung-Cicalengka railway is Tokyu series 5000 from Japan. It is going to use Over Head Catenary with 1,500 volt direct current (DC) (PT. KAI, 2006). This train has to be complemented by electricity installation, prime mover, driver trainman cabin,

and electricity panel (Decree of Minister of Communication and Telecommunication, Republic of Indonesia, 2000; Government of Republic of Indonesia, 2007).

4. Transit Operation And Scheduling Service

4.1 Transit Operation

In transit operation, the most commonly elements used are headway, frequency, capacity, work, productivity, travel time, and speed. Headway *h* is the time interval between the moments two successive vehicles (trains) pass a fixed point on a transit line in the same direction. In scheduling it is expressed in minutes. Passengers are interested in having short headways to minimize their waiting time. However, since any given passenger volume, it is cheaper to operate a small number of large trains than a large number of small trains, a transit agency is usually interested in operating long headways. Consequently, headways are usually determined as a compromise between passenger travel time and convenience, and the cost of operation (Vuchic, 2005). The basic transit system operating elements and performance measures is presented in Figure 1.

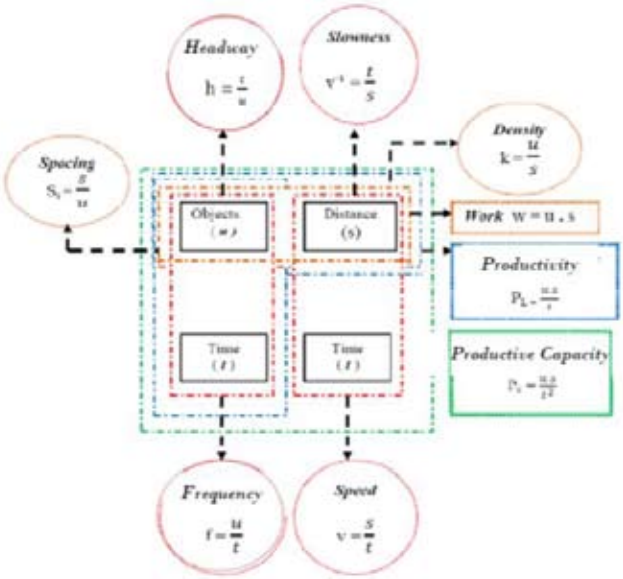

Figure 1 Basic Transit System Operating Elements and Performance Measures (Vuchic, 2005)

The longest headway scheduled for a line is determined by the minimum level of service considered acceptable for that line; it is therefore called *policy headway* h_p. The *minimum headway* h_{min} on a line is, on the other hand, determined by the physical characteristics of a system (technology, method of driving and control, and degree of safety required) and station operations (for example: rate of boarding / alighting and departure control). The former factors influence the shortest headway achievable on open line between stops, *way headway* $h_{w\ min}$, and the latter determined the shortest headway that can operated at stations, *station headway* $h_{s\ min}$. The greater of the two represents the minimum headway for the line:

h_{min} = Max ($h_{w\,min}$, $h_{s\,min}$) (1)

Furthermore, the number of *transit units* (TUs) passing a point on a transit line in one direction during one hour (or some other time interval) represents *frequency of service f*. Thus, frequency is the inverse of the headway:

$$f = \frac{60}{h} \quad \left|\frac{f}{TU/h}\right| \left|\frac{h}{min/TU}\right| \tag{2}$$

and it is one of the components of quality of offered service.

Capacity of a system facility in a broad sense refers to its maximum ability to perform under prevailing conditions. For public transport systems two different capacities are particularly important: *vehicle capacity*, expressed in spaces per vehicle, and *transit line capacity*, with the dimension of spaces per hour.

Vehicle capacity, C_v (seats only or seats and standing spaces) can be defined as:

$$C_v = m + \frac{A_n - m.p}{\sigma} \quad \text{and} \quad A_n = m.\rho + m'.\sigma \tag{3}$$

with m is number of seat passengers, m' is number of standees, A_n is vehicle area, ρ is a convenience factor of seat passenger (0.35 m^2/seat – 0.45 m^2/seat), and σ is a convenience factor of standees (0.1 m^2/standing space – 0.25 m^2/standing space).

With these dimensions, they represent *offered capacities C* (sps/h). Maximum number of passengers, or flow of passengers per hour that are actually transported, represents the demand or *utilized capacity P* (prs/h). The ratio of utilized to offered capacity is the *capacity utilization coefficient* α, also known as *load factor*, with the dimension of persons transported divided by spaces offered (Vuchic, 2005):

$$\alpha = \frac{P}{C} \quad \left|\frac{\alpha}{prs/sp}\right| \left|\frac{P}{prs/h}\right| \left|\frac{C}{sps/h}\right| \tag{4}$$

and *offered capacities C* is defined:

$$C = c\ x\ C_v = f_{max}\ x\ n\ x\ C_v = \frac{60\ x\ C_v\ x\ n}{h_{min}} \tag{5}$$

$$\left|\frac{C}{sps/h}\right| \left|\frac{C_v}{sps/veh}\right| \left|\frac{c}{veh/h}\right| \left|\frac{n}{veh/TU}\right| \left|\frac{f}{TU/h}\right| \left|\frac{h}{min/TU}\right|$$

4.2 Scheduling Service

The scheduling of line operations is based on the concept of *transit unit* (TU) which is defined as a set of n vehicles travelling physically coupled together. For single vehicle operation such as buses, *n* = 1; for train operation, *n* > 1 (in rail transit terminology this *n* is also known as *train consist*). Thus, TU is the common concept for single vehicles and trains, whichever is used on a transit line. Frequency of

operation on a line *f* is expressed in TU/*h*, so that the number of vehicles past a fixed point during one hour is *f x n*.

Transit vehicles, including rail, are referred to collectively as *fleet*. For rail modes the specialized terms *rail cars* and *rolling stock* are often used. *Fleet size* N_f is the total number of vehicles needed for operation of a line, or of an entire network. The vehicle fleet consists of the vehicles required for regular service N (determined by the peak hour operation), vehicles needed for reserve N_r, and vehicles on maintenance and repair N_m:

$$N_f = N + N_r + N_m \tag{6}$$

The utilization of a fleet, which depends in its physical condition and schedule efficiency, is measured by the fleet utilization factor φ, defined as percent of fleet available for service:

$$\varphi = \frac{N + Nr}{Nf} \quad \left|\frac{\varphi}{-}\right| \left|\frac{N}{veh}\right| \tag{7}$$

In scheduling for regular case, the *design hour volume* P_d divided by the average number of passengers a TU will carry on maximum value of α or *maximum load section* (*MLS*) gives the required frequency (Vuchic, 2005):

$$f = \frac{P_d}{\alpha . n . C_v} \quad \left|\frac{f}{TU/h}\right| \left|\frac{P_d}{prs/h}\right| \left|\frac{\alpha}{prs/sp}\right| \left|\frac{n}{veh/TU}\right| \left|\frac{C_v}{sps/veh}\right| \tag{8}$$

and its inverse, the headway:

$$h = \frac{60}{f} = \frac{60.\alpha . n . C_v}{P_d} \quad \left|\frac{h}{min/TU}\right| \left|\frac{f}{TU/h}\right| \left|\frac{\alpha}{prs/sp}\right| \left|\frac{n}{veh/TU}\right| \left|\frac{C_v}{sps/veh}\right| \left|\frac{P_d}{prs/h}\right| \tag{9}$$

In rail design particularly, safe stopping distance is a major concern. A safety factor is used for safe design on the *brick-wall-stop (BWS) concept*. For example, when the lead vehicle on a track stops instantaneously, the following vehicle must be able to stop safely, with a factor of safety of *K*. K can be assumed to be 1.5. The following vehicle in such cases is considered to stop with constant deceleration. Based on this principle, *minimum headway* h_m can be defined (Khisty, 1998):

$$h_{min} = \frac{K . V_0}{2\, d} + \frac{\rho . L}{V_0} \tag{10}$$

with v_0 is cruise speed, L is vehicle length, and d is deceleration rate.

The value of minimum headway is also depended on *dwell time* and *clearance time*. Dwell time is time needed for the purpose of serving passengers. It includes the total passenger service time plus the time needed to open and close doors. Clearance time is all time losses at a stop (for example at a station and minimum of 15 seconds) other than passenger dwell times. It can be viewed as the minimum time between one transit vehicle leaving a stop and the following vehicle entering.

5. A Case Study

Padalarang-Bandung-Cicalengka railway in Bandung Regency, Indonesia for the length of 42 km is used as a case study. Location of the railway is presented in Figure 2 and operated conditions and stations along Padalarang-Bandung-Cicalengka railway is presented in Figure 3. Data is collected during peak and off peak hours. Train operation day is 365 days per year and 17 hours per day from 04:00 am up to 09:00 pm. Morning peak hours is between 05:30 am up to 08:30 am and afternoon peak hours is between 03:00 pm up to 06:00 pm.

Figure 2 Railway in Bandung Regency, Indonesia (Pt. Kai, 2006)

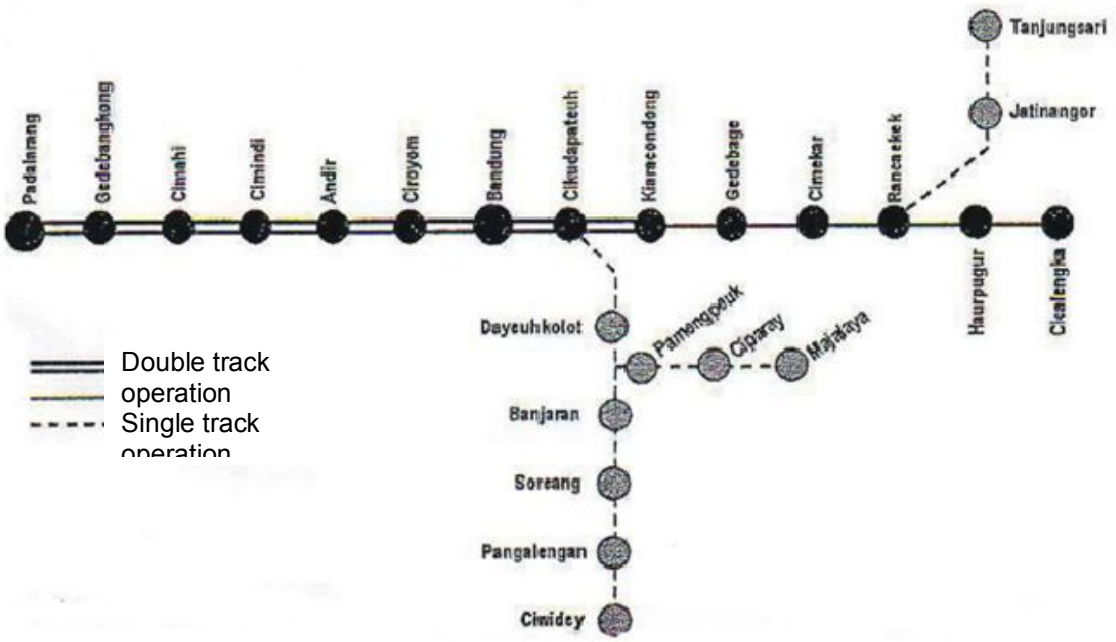

Figure 3 Operated Conditions along Padalarang-Bandung-Cicalengka Railway, Indonesia (Pt.Kai, 2006)

Primary data is collected in a number of stations including dwell time. Secondary data is obtained from Research Institute of Bandung Institute of Technology and Indonesia Railway Corporation, Operation District 2 Bandung, as railway authority of Bandung, including specification of electric train, operation cost of electric train for one direction, headway policy, and a number of train passenger demand of Padalarang-Bandung-Cicalengka and Cicalengka -Bandung- Padalarang directions. Data used in this paper are presented in Table 1 – Table 3 and Figure 4 – Figure 5.

Table 1 Tokyu Series 5000 Electric Train Specification (Pt.Kai, 2006)

Specification	Dimension
Material	Stainless Steel
Trailer Car (TC) Length	20 m
Motor Car (MC) Length	21.2 m
Car Width	2.8 m
Car Height	3.64 m
TC Area	49.25 m^2
MC Area	52.25 m^2
Operational Speed	60 km/h – 90 km/h
Acceleration	0.8 m / sec^2
Deceleration	0.8 m / sec^2
Voltage	1,500 v DC Overhead
Rail Width	1.067 m
Electric Train Configuration	TC + MC +MC + TC
Company	Tokyo Car Corporation

Table 2 Dwell Time of Padalarang - Bandung - Cicalengka Direction during Peak and Off Peak Hours

Station	Peak Hours		Off Peak Hours	
	Boarding passengers/h	Dwell Time (minutes)	Boarding passengers/h	Dwell Time (minutes)
Padalarang	448	4.73	163	1.88
Cimahi	147	1.72	54	0.79
Cimindi	82	1.07	30	0.55
Ciroyom	116	1.41	42	0.67
Bandung	452	4.77	164	1.89
Cikudapateuh	121	1.46	43	0.68
Kiaracondong	180	2.05	65	0.90
Cimekar	32	0.57	12	0.37
Rancaekek	283	3.08	103	1.28
Haur Pugur	89	1.14	33	0.58
Cacalengka	0	0	0	0

Table 3 Dwell Time of Cicalengka - Bandung - Padalarang Direction during Peak and Off Peak Hours

Station	Peak Hours		Off Peak Hours	
	Boarding passengers/h	Dwell Time (minutes)	Boarding passengers/h	Dwell Time (minutes)
Padalarang	0	0	0	0
Cimahi	49	0.74	18	0.43
Cimindi	27	0.52	10	0.35
Ciroyom	39	0.64	14	0.39
Bandung	151	1.76	55	0.80
Cikudapateuh	40	0.65	15	0.40
Kiaracondong	60	0.85	22	0.47
Cimekar	11	0.36	5	0.30
Rancaekek	94	1.19	35	0.60
Haur Pugur	30	0.55	11	0.36
Cacalengka	**549**	5.74	**200**	2.25

Figure 4 Passengers While Boarding Into the Train in Bandung Station, Indonesia 2009

Figure 4 shows real condition of passengers who tried to get into the car train. This difficulties influence the value of dwell time.

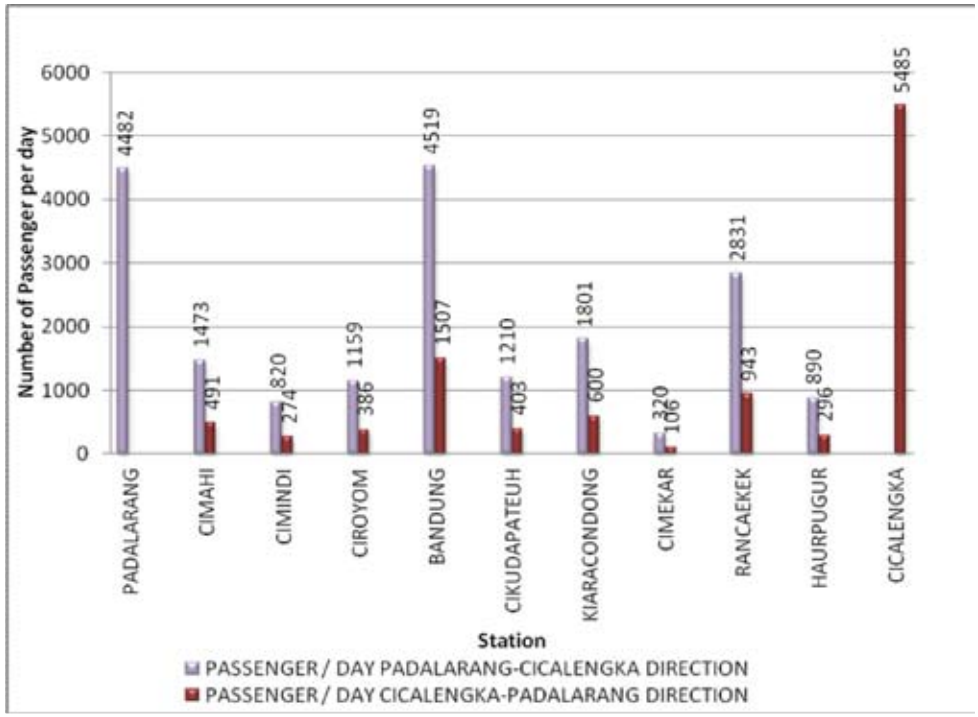

Figure 5 Electric Train Passenger Demand of Two Derections

6. Analyses

In analyzing the service of transit system, determination of headway value is crucial. As was mention previously, headways are usually determined as a compromise between passenger convenience and the cost of operation. Therefore, in order to determine a headway value, a number of headway analyses of the electric train will be discussed in this section.

6.1 Headway Analysis Based on Space Combination and Line Capacity

Passenger convenience is important thing to take into account in order to improve train station service. The convenience is for seat passenger and standees. The combination of seat passenger convenience and standees convenience will influence number of passenger per direction (a line capacity) and the value of headway. Table 4 presents the analysis of headway based on a number of space combination and line capacity. Line capacity or train configuration as was presented previously in Table 1, consist of 2 Trailer Car (TC) and 2 Motor Car (MC) in one line (PT. KAI, 2006), whereas Table 5 presents those for Cicalengka – Bandung – Padalarang direction. The results of analyses are then presented in Figure 6 and Figure 7.

Table 4 Analisys of Headway Based on Space Combination and Line Capacity, Padalarang - Bandung - Cicalengka Direction

	ρ	σ	Trailer Car (TC)				Motor Car (MC)				n TC	nMC	nCv		Peak Hour		Off Peak Hour	
Combination	(m2/seat)	(m2/space)	m	m'	An	Cv	m	m'	An	Cv	(spc/veh)	(spc/veh)	(spc/veh)	α	Pd	h	Pd	h
			(prs)	(prs)	(m2)	(spc/veh)	(prs)	(prs)	(m2)	(spc/veh)					(prs/h)	(min)	(prs/h)	(min)
combination 1	0.35	0.15	100	115	49.25	195	115	125	52.25	195	2	2	780	1	452	**104**	164	**285**
combination 2	0.35	0.20	100	115	49.25	172	115	125	52.25	175	2	2	694	1	452	**93**	164	**253**
combination 3	0.35	0.25	100	115	49.25	157	115	125	52.25	163	2	2	640	1	452	**85**	164	**234**
combination 4	0.40	0.15	100	115	49.25	162	115	125	52.25	157	2	2	638	1	452	**84**	164	**233**
combination 5	0.40	0.20	100	115	49.25	146	115	125	52.25	146	2	2	584	1	452	**78**	164	**213**
combination 6	0.40	0.25	100	115	49.25	137	115	125	52.25	140	2	2	554	1	452	**73**	164	**203**
combination 7	0.45	0.15	100	115	49.25	128	115	125	52.25	119	2	2	494	1	452	**66**	164	**180**
combination 8	0.45	0.20	100	115	49.25	122	115	125	52.25	118	2	2	480	1	452	**64**	164	**176**
combination 9	0.45	0.25	100	115	49.25	117	115	125	52.25	117	2	2	468	1	452	**62**	164	**172**

Table 5 Analysis of Headway Based on Space Combination and Line Capacity, Cicalengka - Bandung – Padalarang Direction

Combination	ρ (m2/seat)	σ (m2/space)	Trailer Car (TC)				Motor Car (MC)				n TC (spc/veh)	nMC (spc/veh)	nOv (spc/veh)	α	Peak Hour		Off Peak Hour	
			m (prs)	m' (prs)	An (m2)	Ov (spc/veh)	m (prs)	m' (prs)	An (m2)	Ov (spc/veh)					Pd (prs/h)	h (min)	Pd (prs/h)	h (min)
combination 1	0.35	0.15	100	115	49.25	195	115	125	52.25	195	2	2	780	1	549	**85**	200	**234**
combination 2	0.35	0.20	100	115	49.25	172	115	125	52.25	175	2	2	694	1	549	**76**	200	**208**
combination 3	0.35	0.25	100	115	49.25	157	115	125	52.25	163	2	2	640	1	549	**70**	200	**192**
combination 4	0.40	0.15	100	115	49.25	162	115	125	52.25	157	2	2	638	1	549	**70**	200	**192**
combination 5	0.40	0.20	100	115	49.25	146	115	125	52.25	146	2	2	584	1	549	**64**	200	**175**
combination 6	0.40	0.25	100	115	49.25	137	115	125	52.25	140	2	2	554	1	549	**61**	200	**166**
combination 7	0.45	0.15	100	115	49.25	128	115	125	52.25	119	2	2	494	1	549	**53**	200	**148**
combination 8	0.45	0.20	100	115	49.25	122	115	125	52.25	118	2	2	480	1	549	**52**	200	**144**
combination 9	0.45	0.25	100	115	49.25	117	115	125	52.25	117	2	2	468	1	549	**51**	200	**140**

It can be seen in Figure 6 and Figure 7 that headways during peak hours and off peak hours on Cicalengka – Bandung – Padalarang direction are lower than those on Padalarang – Bandung – Cicalengka direction, and the value of headway based on space and line capacity are 51 minutes for peak hours and 140 minutes for off peak hours. However, the decision to determine headway value has also to consider the operation cost for one direction.

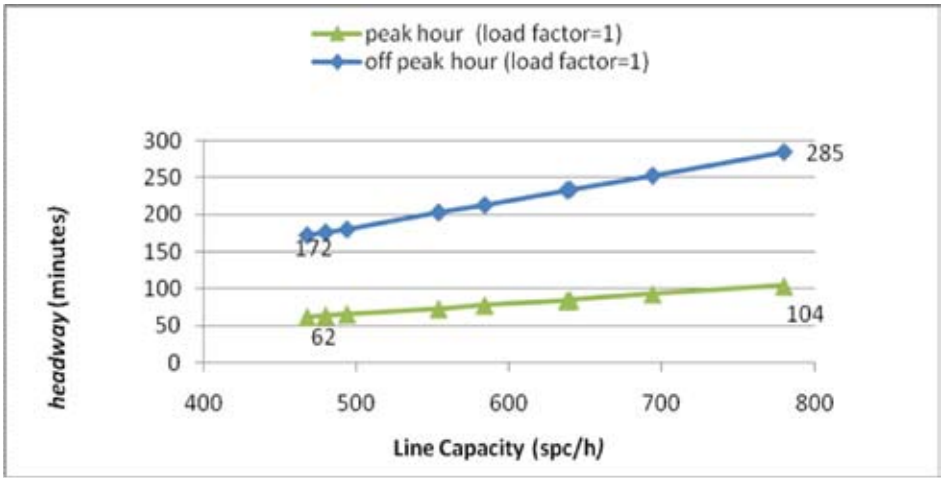

Figure 6 Headway Value Based On Line Capacity Padalarang – Bandung – Cicalengka Direction

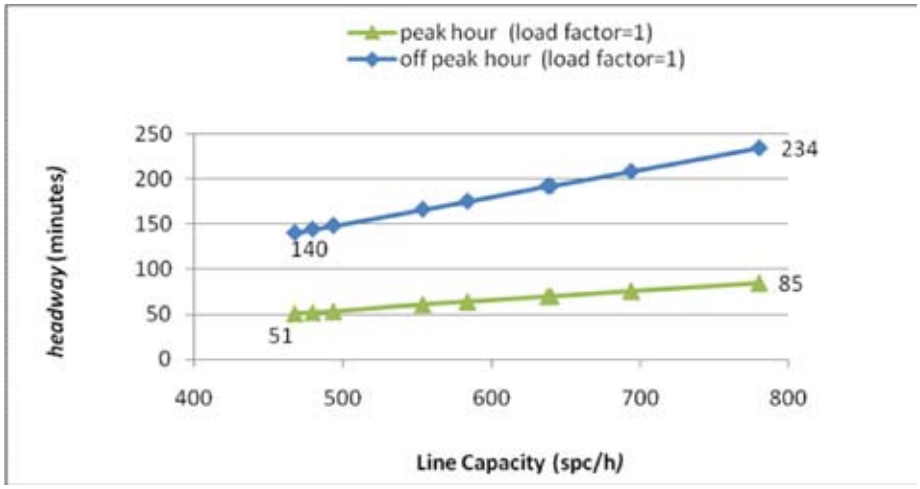

Figure 7 Headway Value Based On Line Capacity Cicalengka – Bandung – Padalarang Direction

6.2 Headway Analysis Based on Train Operating Speed and Deceleration

Train operation speed (v_0) is between 60 km/h – 90 km/h and deceleration value is 0.8 m/sec^2. With 4 cars in one line and length of each car is 20 m, and safety factor is 1.5, therefore headways value (sec) are presented in Figure 8. If the average train operating speed is 75 km/h, therefore the value of headway based on operating speed and deceleration is 23.4 seconds.

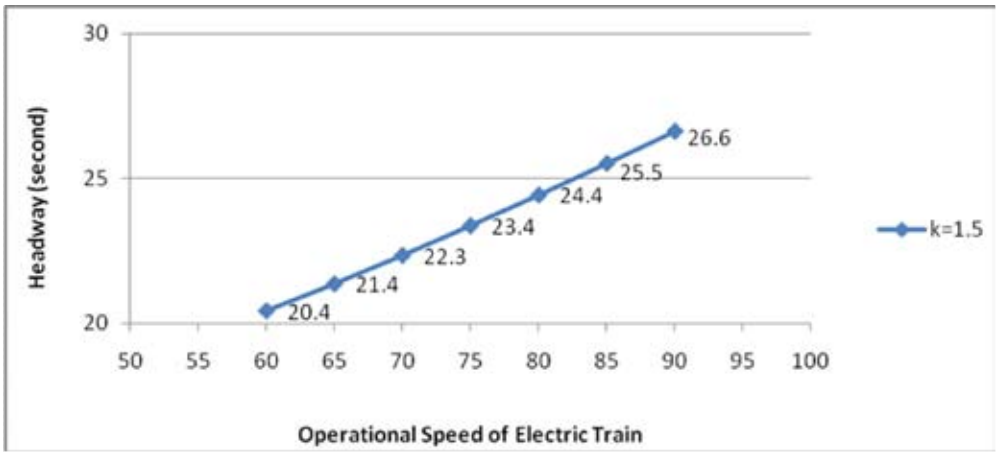

Figure 8 Headway Value Based On Operational Speed and Safety Factor

6.3 Headway Analysis Based on Dwell Time

In this section, the value of headway is determined based on highest number of boarding passengers per hour at each station and dwell time (minute) as was presented previously in Table 2 and Table 3. The values of headway are presented in Table 6. Table 6 shows that based on the highest

number of boarding passenger per hour during peak and off peak hours, the value of headways are 11.48 minutes (549 prs/h) and 4.5 minutes (200 prs/h), respectively.

Table 6 Analysis of Headway Based On Dwell Time for Two Directions

Station	Headway value (minute) during Peak Hours		Headway value (minute) during Off Peak Hours	
	P – B – C	C – B – P	P – B – C	C – B – P
Padalarang	9.46	0	3.76	0
Cimahi	3.44	1.48	1.58	0.86
Cimindi	2.14	1.04	1.10	0.70
Ciroyom	2.82	1.28	1.34	0.78
Bandung	9.54	3.52	3.78	1.60
Cikudapateuh	2.92	1.30	1.36	0.80
Kiaracondong	4.10	1.70	1.80	0.94
Cimekar	1.14	0.72	0.74	0.60
Rancaekek	6.16	2.38	2.56	1.20
Haur Pugur	2.28	1.10	1.16	0.72
Cacalengka	0	**11.48**	0	**4.50**

P – B – C is Padalarang – Bandung – Cicalengka direction.
C – B – P is Cicalengka – Bandung – Padalarang direction.

6.4 Headway Analysis Based on Cost Operation and Company Income

Operational cost of electric train in one direction is Rp. 1,611,762.00 (PT. KAI, 2006). The cost is the same for 2 directions. Whereas, income per direction is based on number of passengers at a combination based on passenger convenience (see Table 4 and Table 5), and the prescribed fare of Rp. 4,000.00 per passenger per direction. Figure 9 up to Figure 12 show comparative value of income per direction (in rupiah, Rp.) and number of combinations of line capacity, during peak and off peak hours.

In these figures, all combinations income per direction, with assumption of full passenger, is above the operation cost per direction. However, income based on passenger demand (red line in figures) is above operation cost per direction, only during peak hours as presented in Figure 9 and Figure 11. Therefore, the value of headway is 51 minutes (combination 9, during peak hour, as was presented in Table 5).

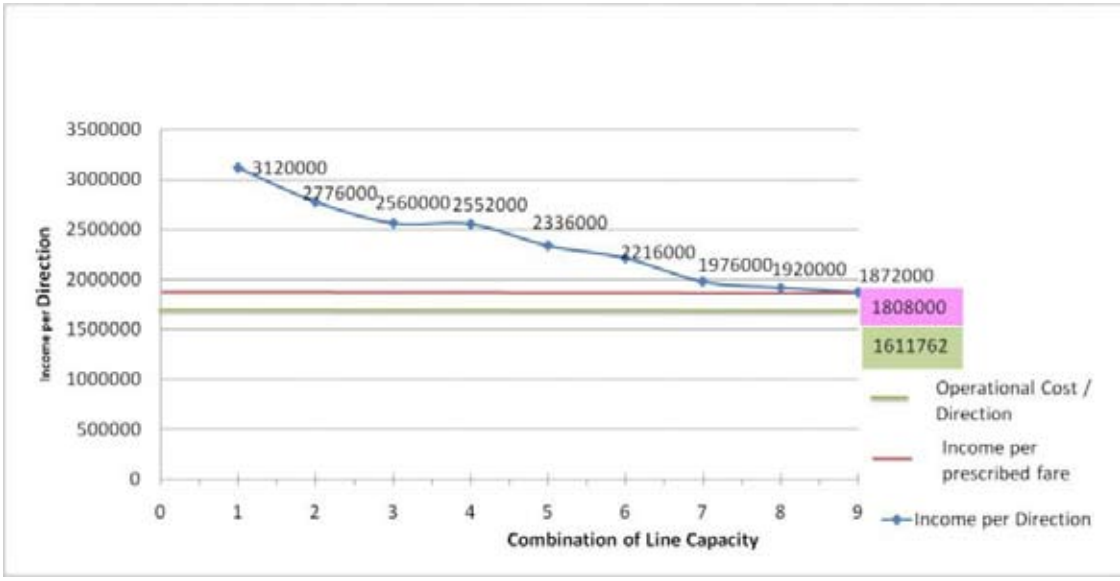

Figure 9 Operational Cost Vs Income per Direction Padalarang – Bandung – Cicalengka (Peak Hour)

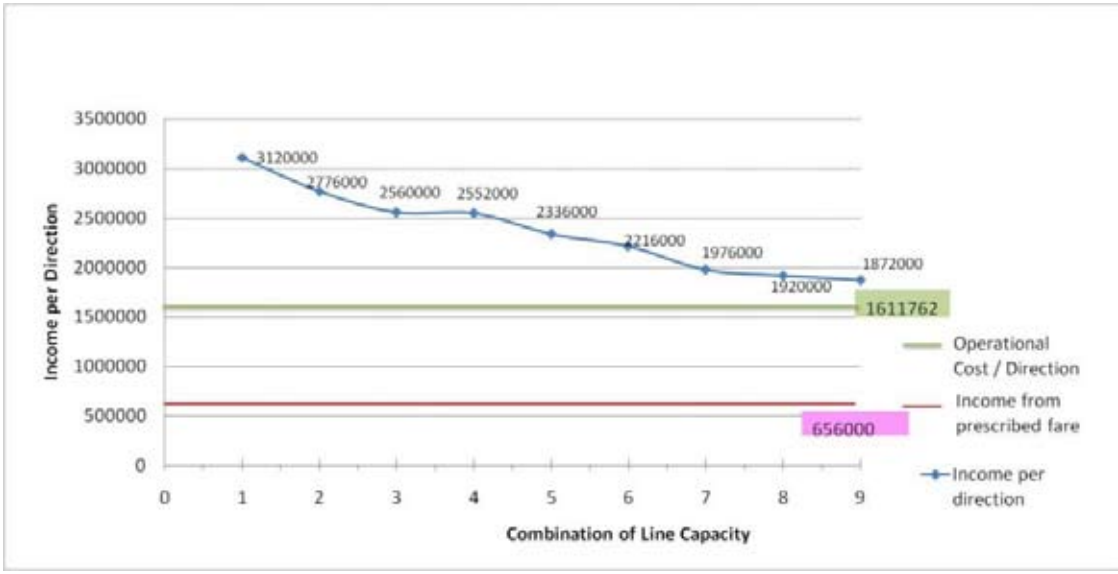

Figure 10 Operational Cost Vs Income per Direction Padalarang - Bandung - Cicalengka (Off Peak Hour)

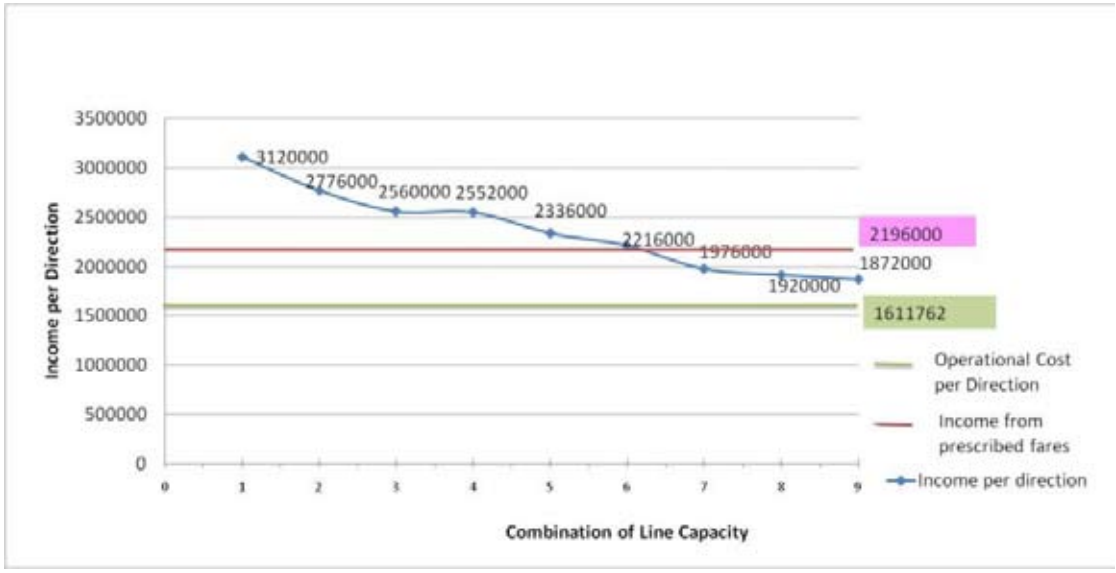

Figure 11 Operational Cost Vs Income per Direction Cicalengka - Bandung - Padalarang (Peak Hour)

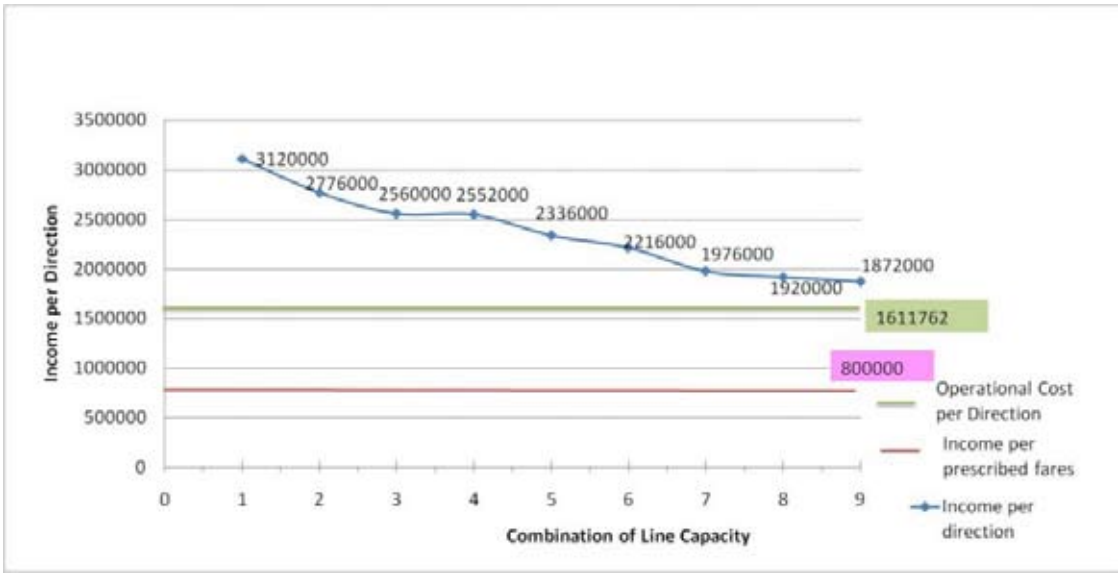

Figure 12 Operational Cost Vs Income per Direction Cicalengka - Bandung - Padalarang (Off Peak Hour)

6.5 Determination of Headway Value

Based on previous analyses of headway, the results summary can be presented in Table 7. Table 7 shows that based on all analysis of headways. Headway value during peak hours is 51 minutes and headway value during off peak hours is 140 minutes. The result indicated that the service of electric

train as a transit system is fulfill the passenger demand with the value of headway 51 minutes during peak hours. However, based on the policy of Indonesia Railway Corporation, Operation District 2 Bandung, as railway authority of Bandung, the headway value during off peak hours is determined 60 minutes (PT. KAI, 2006).

Table 7 Results Of Analyses Of Headway

Periods	Analyses of headway based on:			
	Space combination and line capacity	Train operating speed and deceleration	Dwell time	Cost of operation and company income
Peak Hours	51 minutes	23.4 minutes	11.48 minutes	51 minutes
Off Peak Hours	140 minutes	23.4 minutes	4.5 minutes	--- (below operation cost per direction)

7. Conclusion

Electric train is an effictive and efficient public transportation mode alternative in congested area in developing country, the mode is a mass transportation to fulfill passenger demand between large city Bandung, Indonesia as a center of economic activities and small towns around it. Existing severe transportation problem in rural main road indicated that the road infrastructure cannot fulfill passenger demand. The results presented in this paper are regarding the analize of the service of transit system. Determination of headway value has been analized based on a number of headway analyses including the cost operation and company income. The resuls are belief to be very beneficial dan applicable to successfully support Indonesia Railway Corporation, Operation District 2 Bandung, as the railway authority of Bandung, to operate the electric train next year, in 2010.

8. Acknowledgments

Thank you to Indonesia Railway Corporation, Operation District 2 Bandung, as railway authority of Bandung in supporting preliminary data and for involving researchers from university to support the planning operation of electrical train succsessfully in 2010.

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Foreign Direct Investment (FDI) Inflows and Economic Integration - A Comparative Study of SAARC Countries

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Abstract

Globalization simply represents as a process when an economy gets integrated with the rest of the world. In the era of globalization when increased competition and rapid technological change are very frequent, role of Foreign Direct Investment (FDI) is very complementary, catalyst, and valuable to the nations and thus helps in boosting economic development. Regional integration typically reduces barriers to trade in goods as well as investment among members. Regional integration not only stimulates to Trade but to FDI also. Specific regional integration initiation can influence FDI inflows between member countries as well as outsiders. For the promotion of Trade and investment the regional trade groups are being effectively used as important device. The member countries of the EU, the NAFTA, the ASEAN, and others have made sustainable socio economic progress. Their macro economic stability has made them the nerve centre for FDI inflows as well as outflows. The liberalization of trade process in the SAARC region has infused dynamism to the economy of region in various ways. Economics are becoming more open, outward oriented, and more receptive to foreign investment and Trade. After the implementation of SAPTA in 1995 under the broad framework of SAARC the process of economic integration in South Asia also gathered momentum. This paper highlights on an initial study Of economic integration, the nature of Intra-SAARC investment flows and presenting the results of study of the emerging trade and investments linkages within the SAARC. It also focuses on pattern of FDI inflows in SAARC countries, Sectors attracting FDIs as well as problems in attracting FDI etc.

Keywords: FDI, Regional Integration, SAARC, ASEAN

1. Introduction

The World has become a global village due to the process of liberalization of the economies of the countries under the regime of WTO. In this era globalization has become a very popular and widely used word in all over the world. Globalization simply represents as a process when an economy gets integrated with the rest of the world. In the era of globalization when increased competition and rapid technological change are very frequent, role of Foreign Direct Investment (FDI) is very complementary, catalyst, and valuable to the nations and thus helps in boosting economic development. Realizing this, emerging economies like India and China are in transition and increasingly see FDI as a source of economic development, modernization and employment generation and have liberalized their FDI regimes to attract investment

FDI refers to investment in a foreign country where the investor retains control over the investment. It typically takes the form of starting a subsidiary, acquiring a stake in an existing firm, or starting joint venture in the foreign county.

UNCTAD's World Investment Report defines Foreign Direct Investment as an investment involving a long term relationship and reflecting a lasting interest and control by a resident entity in one economy (Foreign direct investor or Parent enterprise) in an enterprise resident in an economy other than that of the foreign Direct investor (FDI enterprise or affiliate enterprise or foreign affiliate).

FDI may undertake by individual as well as by business entities.

FDI flows comprise two distinct forms:
(I) Equity
(II) Non- Equity

Equity flows comprise foreign direct investor's purchase of shares of an enterprise in a foreign county. The non-equity form of FDI include investments through such activities as joint ventures, setting up of wholly owned subsidiaries, management contracts, turnkey arrangement , franchising , Licensing and product sharing.

On the one hand FDI provides the much needed resources leading to accelerated capital formation on the other it facilitated transfer of technology, knowledge skills and above all the organizational and managerial capabilities. The proponents of FDI also emphasize on its role in accessing international marketing networks.

FDI may be horizontal or vertical type according to firms' motives for affiliate operations abroad. *Vertical FDI* is the case where a firm pursues FDI in order to take advantage of international differences in factor prices, by locating its labor-intensive processing abroad and keeping capital-intensive input production and knowledge intensive designing and R&D at home. On the other hand, *horizontal FDI* arises when a firm can reduce trade costs by setting up foreign affiliates replicating the parent firm. Hence, the literature of horizontal FDI emphasizes the importance of trade costs and access to local markets as the main motives of FDI location decisions.

Generally, Economic integration is the process of removing progressively the discrimination which occurs at borders. Due to such discrimination the flow of goods and services and the movement of factors of production either directly or through economic activity via the factor of production are being affected. Balassa identified five main stages of regional integration as free trade areas, custom unions, common market, economic union and total economic integration, such stages are the outcome of policy decisions taken by regional intergovernmental for and/or supranational institutions in order to affect the depth and breadth of regional integration .

The meaningful integration through increased participation in the world economy; generates a lot of benefits. These are efficient allocation of resources, due to the changing production patterns at near to at par with comparative advantage, domestic competition gains international standards of efficiency, wider options for consumers, the ability to tap international capital markets for smoothing consumption in the face of short term shacks (as well as to achieve higher long term growth) and exposure to new ideas, technologies, and products. The ultimate objective of economic integration particularly among the developing countries given their limited scarce resources is either to achieve an acceleration of economic growth, expansion of social welfare, in the partner countries or alternatively to minimize the cost in terms of the use of scarce resources for realizing a given level of growth and social welfare.

Global economic events of the past decades or so particularly those driven by technological advances, regional integration and the realignment of economic systems and policies; have altered fundamentally the perception of the Governments of the host countries of how Foreign Direct Investment can contribute towards their economic and social goals. This is indeed a subject matter of developing countries for accumulation capital to fuel the gap between saving and investment with an ultimate goal of economic development by creating employment, by transferring technology, and to achieve sustained economic growth. Moreover different countries have also been taking different legal and institutional measures to cope with the globalizing economy and to reform the national economic policies to accommodate the pressures from different supranational organization like IMF, the World Bank, WTO, and IFC etc.

Successful experiences with regional economic integration in the industrialized countries in Europe and North America have prompted South and South East Asian countries to adopt economic integration strategies. The Association of South East Asian Nations (ASEAN) decided to set up the ASEAN Free Trade Area (AFTA). South Asian Association for Regional Co-operation has agreed to create a SAARC Free Trade Area(SAFTA). Bilateral free trade agreements between countries have also helped economic integration in the region. Another significant development is Bay of Bengal Initiative for Multisectoral Techno Economic Co-operation (BIMSTEC) involving five South Asian Economics(Bangladesh, Bhutan, India, Nepal, and SriLanka) and two South east Asian countries (Myanmar, and Thailand) . Moreover China, Japan and India are engaged in negotiations of free trade arrangements with ASEAN and South Korea. These are important for broader regional economic co-operation in Asia.

South Asia consists of seven countries namely India, Bangladesh, SriLanka, Nepal, Bhutan and the Maldives. South Asia is one of the poor regions and most overpopulated one (1401million) in the world. Though it accounts for 20 percent of the global population, it is estimated that 43% of the region's population live below poverty line. India alone represents 80 percent of the regions population and also its GDP. The growth of South Asia remained at 4.3 percent (2002) with her per capita income growth 2.6%. Similarly per capita income of South Asia remained at US $ 2390(PPP), comparatively

low in comparison to East Asia, i.e. US$ 4160 (2002). More than one sixth (nearly 17.5percent) of world's labour force is in South Asia. Economic growth in most South Asian countries accelerated in 1980's and targeted programmes for the poor were adopted, the percentage of population in absolute poverty has been declining in recent years in almost all the South Asian countries. The economic structure of the region is mixed with predominance of agriculture. In Nepal and Bhutan, agriculture continues to be dominant, contributing nearly about 40 percent of GDP and providing employment opportunity to a majority of the workforce.

This paper tries to examine some critical points of Foreign Direct Investment (FDI) within SAARC countries. These points includes present scenarios of FDI in the region the existing and potential benefits from intra regional flows of FDI, the present and potential threats to FDI and some remedial suggestions in achieving the targets set by the respective nations. It also tries to find out the economic interdependence amount the countries of SAARC interms of FDI. It has been observed that SAARC countries performance in attracting FDI is not up to the mark. The reasons for such situations have been analyzed and factors affecting low performance have been identified. It has been discussed that these countries can use FDI as an important tool of reducing for eliminating poverty that can also act in building an effective SAARC by reducing regional imbalances in trade and FDI.

2. Literature Review

In international economics Foreign Direct Investment is one of the sensitive areas. Dunning (1958) published a comprehensive book on the consequences on inbound FDI for host countries where he took United Kingdom as a subject of study. Later on there have been more publications on the substantive studies for Canada (Safarian, 1966), Australia (Brash,1966), Norway (Stonchill,1965), New Zealand (Deane,1970), the Netherlands (Stubenitsky,1970), Kenya (Longdon,1981), Singapore (Mirza,1986), the United States(Graham and Krugman,1989), India (Kumar,1990), Mexico (Peres-Nunez,1990), and Central and Eastern Europe(Aristien, Rojec and Svetlicic,1993), which carry weights in the field of FDI.These days hundreds of books, theses and Governments reports and thousands of papers in academic and professional journals have been written on FDI (Dunning,1994). There are different dimensions covered by different books and articles. Market failure theory (Vernables, 2004) states that a firm organizes international production to avoid market failure that might arise from licensing to a third party. Inter –firm rivalry theory (Knickerbocker, 1973) states that firms invades each other's home market to fight and create an oligopolistic market. Vernon's product Life-Cycle theory states that as product and markets mature, firms move production overseas to appropriate balance rent from the declining phase in the product life cycle.Dunning's Eclectic Paradigm Theory(1996) of 'OLI-Ownership, Location and Internationalization states three TNC motives or a combination of these to conduct foreign investment.

The Impact of FDI to economic growth has been debated quite extensively in the literature. The traditional argument is that an inflow of FDI improves economic growth by increasing the capital stock, whereas recent literature points tot the role of FDI as a channel of International technology transfer (Lensink and Morrissey, 2001). A comprehensive Study by Bosworth and Collins (1999) provides evidence on the effect of capital inflows on domestic investment for 58 developing countries during 1978-95. The sample covers nearly all of Latin American and Asia, as well as many countries in Africa.

The authors distinguish among three types of inflows: FDI, Portfolio investment, and other financial flows (Primarily bank loans).

A comprehensive study has been done by Agrawal (2000) to evaluate the economic impact of FDI in South Asia where he took Bangladesh as one of sample countries of his study. He found that the impact of FDI inflows on GDP growth rate was negative prior to 1980, mildly positive for early eighties and strongly positive over the late eighties and early nineties supporting the view that FDI is more likely to be beneficial in more open economies.

3. Benefits of Foreign Direct Investment (FDI)

1) Transfer of Technology: With the increase in FDI there will be a transfer of Technology. Since foreign firm maintain control over the firm, it is argued that they do not mind exporting their state of the art technology.

2) Transfer of Capital: FDI might be the solution for developing countries for their in adequate access to foreign capital. It could be the driving force for economic growth and development. Developing countries have learnt over the years that domestic savings alone might not be enough to solve their outstanding developmental needs.

3) Enhancement of managerial capacity and Skills: Since profit maximization is the goal of MNC, they will manage the firm efficiently; they will hire the best management staffs and provide adequate trainings to home their skills. All this happens in pursuit of self interest.

4) Access to World Market: MNCs are considered to be better positioned to penetrate foreign markets. MNCs have subsidiaries in many countries. In addition they also have the resources and expertise to study foreign markets and come up with excellent strategies to enter their markets.

5) Employment Generation: MNCs will undoubtedly hire local people. It would be helpful in creating employment opportunity in the host country.

4. Prospect of FDI in South Asia

There are many reasons as to why South Asia could and should be an attractive location for FDI. The most important factor is its huge market potential. India alone has more than 1.2 billion population. China's to the region is also an added advantage since the demand for many goods, for example automobiles and other white goods is increasing there. The industries could therefore be set up to cater to the demands in China, in addition to those in the region. Besides the availability of cheap labour, abundant natural resources and skilled computer literate human resource offer further opportunities. Some areas holding immense potential in the region include investments in power Sector (hydropower); exploration and exploitation of oil and gas resources, export processing Zones (EPZs); software development and service sector.

5. Stages of Regional Integration

Regional Integration	Definition	Example
Free Trade Area (FTA)	An area where tariffs and quotas are abolished for imports from area members, which, however, retain national tariffs and quotas against third countries	- In 1992 ASEAN countries launched the ASEAN Free Trade Area (AFTA) plan. On 1 January 2002,six out of ten ASEAN countries reduced internal Tariffs on most goods to levels ranging between zero, and five percent. The whole ASEAN area is, scheduled to become a full-fledged free trade area in the coming years. - The USA, Canada, and Mexico are in the process of completing a North-American FTA (NAFTA):many tariffs were eliminated already in 1994, with others being phased out over periods of 5 to 15 years.
Customs union (CU)	A FTA setting up common tariffs and quotas for trade with non-members	- European Economic Community since 1968 - The MERCOSUR (Southern Common Market: Argentina, Brazil, Uruguay, Paraguay) aims at becoming a fully-fledged CU by 2006.
Common Market (CM)	A CU abolishing non-tariff barriers to trade (product and services markets integration) as well as restrictions on factor movement (factor market integration)	- European Community since 1993 (establishment of the European Single Market). The CM was already set up as an objective under the Treaty of Rome
Economic Union (EUN)	A CM with a significant degree of coordination of national economic policies and/or harmonization of relevant domestic laws	- European Union nowadays
Total Economic Integration (TEI)	An EUN with all relevant economic policies conducted at the supranational level, possibly in compliance with the principle of subsidiary. For this, supranational laws need to be in place.	- The euro area (i.e., 12 out of 15 countries of the European Union) can be currently classified somewhere between an EUN and TEI. Supranational authorities and rule making were established already with the Treaty of Rome in 1957, and subsequently enhanced.

Source: The Process of Economic Integration of South Asia: International Finance Division, Research Dept.Nepal Rashtra Bank.

6. Economic Integration: Trade and Investment Liberalisation Efforts in SAARC Countries

Till 1970s the economies of South Asian Countries were highly protectionist even more, importantly non-tariff barriers were extremely high, state interventions in economic activity had become

pervasive, attitude to foreign investment were negative and often hostile, and stringent exchange controls were in place. This situation began to change in the 1970s. The Asian clearing Union(ACU) with seven members in the region; Bangladesh, India, the Islamic Republic of Iran, Myanmar, Nepal, Pakistan and SriLanka, came into force in 1974. The Bangkok agreement in 1975 which covered the exchange of tariff concessions between five members namely, Bangladesh, India, the Lao People's Democratic Republic. The Republic of Korea and SriLanka. In 1977 SriLanka initiated a process of policy liberalization and was in turn followed by other countries in 1980s. However this was often a rather hesitant Liberalization process and was very uneven across countries. It was from the early 1990s with the start of a major reform started to Liberalize.

Over the past decades all South Asian countries have pursued substantial trade Liberalization as a essential component of Structural adjustment programme. With the emergence of powerful regional block such as NAFTA, Asia pacific Economic co-operation(APEC), South Asian countries also turned its attention to adopt economic integration strategic. The historic 1992 decision to establish an Asian Free Trade Area(SAFTA) is by far the best reflection of the determination on the part of the ASEAN6(i.e. Brunei, Indonesia, Malaysia, the Philippines, Singapore and Thailand) to deepen their level of economic co-operation.

The process of economic in South Asia gathered momentum with implementation of South Asia Prefential Trade Agreement (SAPTA) in 1995 under the broad framework of the South Asian Association for Regional Co-operation (SAARC). SAPTA is viewed as an interim platform in the move towards economic integration in South Asia. In a recent initiative SAARC member countries agreed that SAPTA would begin the transformation into a South Asian Free Trade Area (SAFTA) by the beginning of 2006 with full implementation completed between 2009 and 2013.

SAARC countries policy and attitudes toward FDI regimes have been changed sharply and reforms to the FDI policy regime have been accompanied with trade liberalization. All SAARC countries now actively encourage and seek FDI and a range of measures have been implemented to enhance their attractiveness towards potential investors. These include provision of various tax, duty and other incentives, removal of restrictions on repatriation of profits, establishing current account, convertibility, reduction of the member of prohibited or restricted sectors, relaxation of ownership restrictions, nondiscrimination in favour of domestic investors, fast tracking nationalization and expropriation, and the setting in place of internationally acceptable dispute resolution and mechanism.

7. Foreign Direct Investment in the Globe

With the advent of Liberalization of economics under the WTO regime, the world has become a global village .The flood gates for trader between countries have opened. The interdependence of nations on each other has grown at a faster pace with the internationalization of trade and commerce.

It is very important to understand the significance of FDI in global trade and in economic development. The world FDI stock as a percentage of world output was about 9.2 percent in 1990 in contrast to 9.0percent in 1913 and almost twice by 1999 (i.e. 17.3 percent) . This is mostly due to the significant advance in deep integration of contemporary globalization. Another is its drastic diversification in contrast to earlier periods. It pertains to the economic activity to which FDI is directed.

In 1913, 55 percent of the FDI stock was in the primary sector; 10% towards manufacturing and the rest was directed towards transportation; trade and distribution (UNCTAD, 1994). Now this has an opposite direction of FDI. Now only 6.3percent of FDI stock is in the primary sector, 42.5 percent in the manufacturing sector, and another 48.5 percent is in the service sector (UNCTAD, 1999).

In the years after the Second World War global FDI was dominated by the United States as much of the world recovered from the destruction wrought by the conflict. The US accounted for around three quarters of new FDI (including reinvested Profits) between 1945 and 1960. Since that time. FDI has spread to become a truly global phenomenon. FDI has grown in importance in the global economy with FDI stocks now consisting over 20% of Global GDP. It is noteworthy the phenomenal growth of FDI in the last two decades of the 20th century.

The average value of FDI has increased from $6.6billion during 1965-69 to $25.6 billion during1975-79. After a steady upward trend in 1970s, FDI dropped between 1981 and 1986 but recovered in latter half (World Bank, 1993). In 1970, the total FDI inflows in the Globe amounted to $ 2.2 billions and increased to $202.3billions in 1990 and then increased to $1.271trillions in the turn of century (UNCTAD, 2001). In short, in the matter of 20 years FDI inflows had multiplied about 100 times. This flows were vary consistent with both developed and developing countries. However the lion's share of the inflows mostly went into the developed economies. The cumulative inflows of FDI for developed countries were increased from a low of $137.1millions during 1989-94 to $401millions during 1995-2000. On the contrary for developing countries, the cumulative flows of FDI were increased from a low of $63millions during 1989-1994 to $190.8millions during 1995-2000.

The Global stock of FDI at the end of 2006 stood at $10trillion which is equal to the current combined GDP of the four largest economies of the world after USA, Japan, China , Germany and the United Kingdom. The Global FDI in 2005 increased to $730billion registering a growth of 18 percent over $648billion of 2004 of the total FDI flows, the developed world contributed $637billlion out of which half is from only three countries- US, UK and Luxemburg. In 2005 the net outflows from the developed world exceeded the inflows by $260 billion. For the US the largest economy in the world with $ 12.5 trillion GDP FDI outflow increased by 90 percent to $229 billion in 2005.

The FDI inflows in case of developing nations were fairly stable in the 1980s.The 1990s witnessed a gradual rise in FDI largely brought about by the dramatic changes in the policy structure of the Asian Tigers because of the structural Liberalization and recovery of the Latin American economies. There was a negative growth in FDI inflows in 2000 and 2001 partially because of a global recession. However both the quantum of FDI to developing countries and the rate of growth in FDI have been rising steadily since 2002. There was a growth of over 20% of the GDP in the period 1980-1999. In the year 1980 FDI inflows for developing economies was 6 percent of GDP and in the Year 1999 it is 28%.In East Asia and Pacific developing countries between 1995 and 2003 alone net inward FDI totaled more than $ 483 billion. FDI inflows to East-Asia rose by 8%in 2006. The China seems to be the biggest beneficiary in the East Asia. FDI inflows to South-East Asia rose by 25% in 2006.

8. Foreign Direct Investment in the South Asia

The FDI inflows in the South Asia region have been continuously increasing over he years and particularly since 2000. (Table 2). An open FDI climate and improving economic situation encouraged inflows to India, at record levels of $5 billion. The cross border M & A in India in 2004 as the telecommunication, BPO, and Pharmaceutical industries saw an increase in large deals. In Pakistan and Bangladesh the privatization of assets and improved investment environment contributed to increased FDI inflows. In the region overall business confidence has been improved.

From Table-3 It is clear that the FDI figures for South Asia are negligible. The share of South Asia in the FDI inflows of developing countries is about 3% its share in the Global FDI inflows is almost negligible at 1.08%.

The countries of the South Asian region have been trying consistently to attract more FDI by liberalizing their FDI policy framework to compete with other countries in the region. In this region India has been attracted maximum FDI. Although in comparison to the major Latin American and East Asian economies India's share of FDI is lower, it receives the most FDI in South Asia. Pakistan and SriLanka is also doing well in attracting FDIs.

9. Foreign Direct Investment (FDI) Inflows to South Asia: Source Country and Sector Wise

9.1 Foreign Direct Investment (FDI) Inflow in India

The inflow of Foreign Direct Investment (FDI) has registered robust growth in the current financial year. As per latest report of UNCTAD, India surpassed South Korea to become the fourth largest recipient of FDI in the region. Cumulative FDI inflows since August 1991 up to August, 2007 were Rs.258, 511crore (US $61.07billion). Rapid economic growth has led to improved investor confidence in the country. The sustained growth in income has made the country increasingly attractive to market seeking FDI. Indeed foreign retailers such as Wall Mart have started to enter the Indian market. At the same time, a number of United states TNC's such as General Motors, IBM are rapidly expanding their presence in the country as are several large Japanese TNCs such as Toyota, NISSAN etc. The trends of FDI inflows have been discussed by observing, the trend of approved and actual FDI inflows, the trend in the share of investing countries in the FDI inflows into India and the FDI inflows into the different sectors in the economy.

FDI Inflows into India

From the Table-2 it is clear that FDI inflows into India have been increasing from 1985-2001 and 2004 onwards. In case of FDI inflows except in the year 2002 and 2003 in all other years increases than the earlier years. The FDI inflows into India have been increased from US $ 62 million to $ 4734 million during the period 1980-85 to 2001. There was a negative growth in the year 2002, and 2003. Then the FDI has been increased from $5771million in 2004 to 416881 million in 2006 This shows that India has been able to accelerate FDI inflow in to its economy as compared to other countries in the region.

FDI Inflow into India by Country Of Origin

A through analysis of country wise data on FDI inflow into India shows that India is able to attract FDI inflows from all the major economies. Table-4 shows that Out of the total FDI inflows into India during the period from Jan, 1991 to August,2007 US $ 20966 million were from Mauritius accounting to 43.68 percent of the total FDI inflows into India. The next best contributing economy in USA amounting to US $ 6213 million is 12.96 percent of the total FDI inflows into India during the period. The other major contributors are Japan, UK, Netherlands, Germany, France, South Korea, Singapore and Switzerland. Though India is able to attract FDI inflows from major economies of the world, its performance trend moved southwards. The analysis of FDI from all the countries exhibited a falling trend, except the FDI inflows from Switzerland and the Netherlands.

FDI Inflow into India by Sector Wise

The FDI inflows into India are mainly concentrating on ten sectors of the economy. These sectors are: Energy, Telecommunication, Electrical Equipment, Transportation, Service Sector, Metallurgical Industries, Chemical (other than Fertilizer), Food & food processing, Hotels & Tourism and Textiles. Among these sectors, Electrical Equipment sectors have received 17.54 percent of FDI inflows amounting to US $ 6.27 billion during January, 1991 to September, 2006. The next best sector attracting the FDI inflows into India is Service sector, accounting to 12.69 percent of FDI inflows. The Telecommunication ranked the next best position with 10.39 percent amounting to US $ 3.78 billion.. The sector wise FDI inflows are given in the Table-10. From the table it is clear that the sector such as Energy, Telecommunication, Electrical Equipment, Transportation and Services are playing dominant role in attracting the FDI inflows into India.

Here it is worth mentioning that the FDI inflows do not seem to be coming to those industries which have been made more attractive through policy concession by the government. This is an encouraging sign which is worth appreciation as this means the FDI inflow into the country are guided more by market and economic conditions rather than the incentives offered by the government.

9.2 Foreign Direct Investment (FDI) Inflow in Pakistan

FDI Inflows into Pakistan

From the Table-2 it is clear that FDI inflows into Pakistan have been in all the years, increasing than earlier years during the period from 1980 to 2006. It reveals a stable growth in FDI inflows into Pakistan. The FDI inflows have been increased from US$ 75 million in 1980-85 to US $ 4273milion in 2006. This shows a positive growth of FDI inflows during the period. The FDI inflows into Pakistan are second highest in the region but still it is much lower than India.

FDI Inflow into Pakistan by Country Of Origin

A through analysis of country wise data on FDI inflow into Pakistan shows that Pakistan is also able to attract FDI inflows from all the major economies. Table-5 shows that Out of the total FDI inflows into Pakistan during the period 2001-2006 US $ 2073 million from UAE accounting to 27.28 percent. The next best contributing country is USA amounting to US $ 1711.6 million which is 22.52

percent of the total FDI inflow s to Pakistan. The other top most contributors are UK (10.93percebt), Switzerland (6.94percent) and Norway (6.22percent).

FDI Inflow into Pakistan Sectorwise

The FDI inflows into India are mainly concentrating on the nine sectors of the economy. These sectors are: OIL & GAS, FINANCIAL BUSINESS, TEXTILES, TRADE,CONSTRUCTION, POWER, CHEMICAL, TRANSPORT, COMMUNICATION (IT & TELECOM). Among these sectors, Communication sector has received 36.21percent amounting to US $ 4613million during 2001 to 2007. The next best sector attracting FDI inflows into Pakistan is Financial Services accounting to 15.28 percent of total FDI inflows amounting to US $ 1947.1. Oil & Gas is ranked the next best sector with 14.5percent amounting to US $ 1789.7. The sector wise FDI inflows are given in
Table 12. From the table it is clear that Communication (IT & Telecommunication), Financial Services, Oil & Gas are playing dominant role in attracting the FDI into Pakistan.

9.3 Foreign Direct Investment (FDI) Inflow in Bangladesh

FDI Approvals and Inflows into Bangladesh

From the Table-2 it is clear that FDI inflows into Bangladesh except in the year 2001, 2004 and 2005 in all other years fell down than earlier years. There was a negative growth in the year 2002, 2003, and 2006. It shows that Bangladesh failed to accelerate the FDI inflows into its economy in the recent years.. It has been able to attract FDI to some extent but as compared to India and Pakistan it is much lower.

FDI Inflow into Bangladesh by Country of Origin

A through analysis of country wise data on FDI inflow into Bangladesh shows that Bangladesh is able to attract FDI inflows from all major economies of the world but the size is not so large during the period 1990-2006. Table-6 shows that out of the total FDI inflows into Bangladesh during the period US$ 6540million from USA accounting to 43.62percent. The next best contributing economy is UK amounting to US$ 2088 million, which is 13.93 percent. The other major contributors are Hong Kong (10.08 percent), Singapore (7.29percent) and Norway (7.11percent).

FDI Inflow into Bangladesh by Sector Wise

The FDI inflows into Bangladesh are mainly concentrating on nine sectors of the economy. These sectors are: AGROBASED, FOOD, TEXTILE, PRINTING & PUBLICATION, LEATHER & RUBBERS, CHEMICAL, GLASS CERAMIC AND OTHERS, ENGINEERING, SERVICES. Among these sectors, Service sector has received 24.12percent of total FDI inflows amounting to US $ 1229.7million. The next best sector is Textile accounting to 19.99percent amounting to US $ 1018.8million. The chemical is the next best sector accounting to 10.30 percent of total FDI inflows amounting to US$ 524.82million.The sector wise FDI inflows are given in the Table-11. From the Table it is clear that the sector such as Agro based, Textile, chemical are playing dominant role in attracting the FDI inflows into Bangladesh.

9.4 Foreign Direct Investment (FDI) Inflow in Srilanka

FDI Inflows into Srilanka

SriLanka's investment is no different from those of its neighbour countries. Table-2 shows that the FDI inflows into SriLanka have been increasing in all the years than earlier year during the period 1985-2006. The FDI inflows though increased from US $42 million to US$ 480 million but still the FDI inflow is much lower as compared to India, Pakistan and Bangladesh.

FDI Inflow into Srilanka by Country of Origin

In SriLanka also developed countries have made the largest investment. Singapore makes the largest investor in Srilanka accounting to 16.5 percent of total FDI. The next best contributor is UK accounting to 13.9 percent of total FDI inflows. The other major contributors are Japan (12.1percent), Republic of Korea (11.5percent) and Hong Kong China (10.0percent).

FDI Inflow into Srilanka by Sector Wise

The FDI inflows into Srilanka are mainly concentrating on manufacturing, Services and agriculture sector. Among these sectors manufacturing sectors, it is accounted to 41.7 percent of total FDI inflows into Srilanka. The next best sector is Service sector accounting to 55.6 percent of total FDI followed by agriculture 2.7percent.

9.5 Foreign Direct Investment (FDI) Inflow in Nepal

FDI Inflows into Nepal

In the South Asian region Nepal being the least developed country has attracted the least amount of FDI inflows as compared the other countries in the region. Because of the Maoist struggle it could attract very negligible amount of FDI inflows. India is the largest investor in FDI into Nepal.

FDI Inflow into Nepal by Country Of Origin

Among the investors India is the largest investor in FDI in the Nepal. India's FDI investment is accounted to 36.40 percent amounting to US$419.7million of total FDI inflows into Nepal. The next best contributor is USA accounting to 15.10 percent, which is amounted to US$174.1million of total FDI .The other major contributor are China (9.85percent), Virgin Island (4.45percenT) and Japan (3.52percent)

FDI Inflow into Nepal by Sector Wise

The FDI inflows into Nepal are mainly concentrating on Agriculture, Tertiary, Construction, Hotels and Restaurants, Transport, Storage and Communication, Business Activities etc. The Construction sector accounting to 45.68percent amounting to US$131.1million of total FDI inflows. The next best sector is Hotel & Restaurants accounting to 24.02percent amounting to US$68.9million of total

FDI inflows. The other sectors are Agriculture, Teritiary and Transport, storage and communication etc. Sector wise FDI inflows are given in Table-13.

10. Future Prospects for Intra-Regional Flows in SAARC

It is reflected in various statistics that there exists acute poverty in the member states of SAARC. There are various causes behind the poverty of the region. One of the reasons is low level economic dynamism. The South Asian Centre for Policy studies (SACEPS)and Asian Development Bank have identified two causes of economic backwardness investment capital accumulation and regional cooperation. Investment capital can be accumulated through FDI that can be ensured by effective regional cooperation. If we look at East and South East Asia it is found that the regional cooperation initiative has contributed significantly to the economic growth of the countries in this region. But as compared to that regional cooperation in South Asia is still very weak. An opportunity for accelerated growth and further energizing the economies of South Asia does exist by increasing investment through regional cooperation. Therefore enhancing investment cooperation and facilitating investment amount countries in the region will be crucial for development of the economies in the region (Sobhan, 2004). It has been found that despite having gone through economic reforms since 1990s total investment flows have not increased significantly. Therefore it is important that regional integration is deepened to attract foreign direct investment into the region. (Agarwal, 2008).

11. Constraints in Attracting Foreign Direct Investment

Despite the gains of recent years South Asia remains a less attractive destination for FDI compared to other regions. In 2006, FDI inflows into South Asia were very limited. The top two FDI host regions were the European Union (EU) and North America with shares of world total FDI of 40% and 19% respectively (UNCTAD, 2007). Among Asian regions South Asia was the less attractive FDI destination. The bottlenecks that hinder FDI in South Asia are:

1) Poor Business Environment: The World Bank (2007e) reported that South Asia is the second least business friendly region in the world, after Sub-Saharan Africa based on its Doing Business 2008 survey of the perceptions of foreign investors of 178 countries. Table.17 Shows the World Bank's global ranking of the case of doing business for each South Asian Country for 2007 and 2008. Only India and Bhutan posted slight improvements in their global rankings in 2008, suggesting an improving business climate in those countries. Conversely the global rankings of the remaining South Asian countries deteriorated in 2008 indicating a worsening business environment in those countries. These deteriorating rankings are considered to derive from foreign investor perceptions of poor infrastructure, restrictive labour policy and labour unrest, political uncertainties and civil conflicts, weak regulatory system and rampant corruption.

2) Poor Infrastructure: In adequate a poor quality infrastructure is a primary reason, the business environment in South Asia is not that attractive to foreign investor. Based on World Economic Forum (WEF)'s Global competitive Index Scores on infrastructure, India had the best ranking in the region 67, closely followed by Pakistan (72), and SriLanka (73).Bangladesh and Nepal were judged to have the poorest quality infrastructure in the region and placed among the lowest ranked countries in the world

with the ranking of 120 and 128 respectively. Indeed Infrastructure directly influencing business activities has been one of the bottlenecks to FDI in South Asia.

3) Restrictive Policy: The different regulatory regimes, different tax systems and custom laws, rules of origin, standardization, certification etc makes difficult to attract investment. Therefore the harmonization of rules, procedures and prior consultation before imposing sanction assume considerable importance. According to the World Bank (2007b) labour policy in South Asia is characterized as restrictive and inflexible; and may hamper FDI in the region. Out of Seven regions in the world based on the World Bank's Doing Business in South Asia Survey for 2007, South Asia ranked sixth in terms of "employing workers' making it the Second Worst region in this category. South Asia ranked last in terms of the "Cost of firing" workers with firing cost equivalent to 72 weeks of wages" (the highest in the world). In addition, South Asia ranked second worst in terms of the "difficulty of firing" index and was the poorest performer in terms of "enforcing contracts". On the other hand it had the lowest hiring cost worldwide. The rigidities in labour regulations increase the likelihood of frictions between employers and workers which can affect decisions on foreign investment.

4) Political Problem: The political problem in the region undermined the efforts to foster regional economic cooperation in South Asia. Political instability and civil conflicts have been found to be a major factor in reducing the attractiveness of South Asia as a host of foreign capital. Pakistan, Srilanka continues to face political uncertainties and security challenges that are likely to hinder FDI.

5) Legal problems: The slow and weak legal systems and delay in procedures are other obstacles in attracting FDIs in the region. The existing regulatory systems governing investments in South Asia are weak. Specifically corruption continues to be rampant, governance remaining poor, "red tape regulatory obstacles" commonly affect the conduct of business activities, and Capital flows are a lack of facilitating harmonized frameworks on competition and infrastructure.

12. Conclusion

From the above analysis it could be observed that regional integration could play a big role in promoting economic development in individual countries, irrespective of size and the level of growth. The constraints like political problems, Trade policy barriers, Domestic structural problems, legal problems are the bottlenecks for tapping the potentialities of the region. To solve these problems and exploit its potentialities a strong and deeper Cooperation is required in the region. This regional cooperation would also help the individual countries of the South Asia region to compete with the rest of the world.

Table 1 Size of Economies in SAARC Member Countries

Country	Population (million) 2005	Population density Per Sq. Km. 2005	Population growth rate (%) 2005	GDP (US$ million) 2005	GDP Per Capita 2005	GDP growth rate	Export (US$ Million) 2005	Import (US$ Million) 2005
Bangladesh	153.28	1064	1.8	67519	1827	6.2	8655	13147
India	1134.40	345	1.5	779245	3072	*8.1*	103404	149750
Nepal	27.09	184	2.0	6635	1379	2.8	830	1858
Pakistan	158.08	199	1.8	107744	2109	7.6	16050	25097
SriLanka	19.12	291	0.5	16645	4088	5.8	6160	8307

Source: UNESCAP, Asia-Pacific figure, 2006

Table 2 Foreign Direct Investment (FDI) Total Net

(US $ million)

Countries	1980-85	1990-2000	2001	2002	2003	2004	2005	2006
Bangladesh	-0.1	190	550	391	376	460	692	625
Bhutan	NA	.2	-	2.1	2.5	3	9	6
India	62	1705	4734	3217	2388	5771	6676	16881
Nepal	0.2	80	21	10	--	---	2	7
Pakistan	75	463	286	483	771.0	1118	2201	4273
SriLanka	42	159	172.2	185.5	201.4	233	272	480
Maldives	-0.03	9	11.7	12.4	13.5	15	9	14
South Asia	178.8	2539	5468.3	5881.7	5727.56	7601	9866	22274
Asia	5043	76616	111854	94989	110489	169999	208744	259434
Developing Countries	12634	134670	204801	162145	175138	283030	314316	379070
World	49813	495391	815574	678751	710755	742143	945795	1305852

Source: UNCTAD, WIR, 2007

Table 3 Share of Individual Countries in SAARC FDI Inflows in Selected Years (1990-2006)

Share in South Asia's FDI Inflows	1990-2000	2001	2002	2003	2004	2005	2006
Bangladesh	7.48	13.51	6.65	6.11	6.31	7.09	2.81
Bhutan	0.08	----	0.04	0.02	0.01	0.01	----
India	67.15	86.58	54.70	80.05	74.97	67.57	75.79
Nepal	3.15	0.38	0.17	0.26	----	0.05	----
Pakistan	18.24	5.23	8.21	9.32	15.31	22.36	19.18
SriLanka	6.26	6.26	3.15	3.99	3.19	2.79	2.15
Maldives	0.35	0.20	0.20	0.24	0.21	0.41	----
Share of South Asia in:							
Asia	3.31	4.89	6.19	5.18	4.64	4.88	8.59
Developing countries	1.89	2.67	3.63	3.27	2.65	2.92	5.88
World	0.51	0.67	0.87	1.03	1.03	1.07	1.71

Source: UNCTAD (2007)

Table 4 Share of Top Investing Countries In FDI Inflows in India

(Amount in US$million)

Country	1991-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08 (April-Aug)	Total FDI inflows	% of Total
Mauritius	3420	830	1670	1520	567	1129	2570	6363	2897	20966	43.68
USA	2310	420	370	280	410	669	502	856	396	6213	12.96
UK	660	70	290	350	190	101	266	1878	122	3927	8.12
Japan	820	230	220	410	90	126	208	85	491	2680	7.21
Netherland	610	30	230	160	250	267	76	644	167	2434	5.07

Source: FDI Data Cell, Ministry of Commerce, Govt. Of India

Table 5 Share of Top Investing Countries in FDI Inflows in Pakistan

($million)

Country	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	Total
USA	92.7	326.4	211.5	238.4	325.9	516.7	1711.6
UK	90.5	30.3	219.4	64.6	181.5	244.0	830.3
U.A.E	5.2	21.5	119.7	134.6	367.5	1,424.5	2073
Japan	9.1	6.4	14.1	15.1	45.2	57.0	404.8
Hong Kong	3.6	2.8	5.6	6.3	32.3	24.0	472.9

Source: BOI, Pakistan

Table 6 Share of Top Investing Countries in FDI Inflows in Bangladesh (1996-97 to 2002-03)

(US$ million)

Country	1996-97	1997-98	1998-99	1999-2000	2000-01	2001-02	2002-03	Total
USA	8	1378	382	1178	309	3	12	3270
UK	73	32	827	16	28	4	64	1044
HONG KONG	485	157	13	35	1	60	5	756
SINGAPORE	132	33	273	20	86	2	-	547
NORWAY	0	0	0	0	518	-	1	

Source: BOI, Bangladesh

Table 7 Share of Top Investing Countries in FDI Inflows in Nepal (1998-2001)

(US$ Million)

Country	FDI Inflow
INDIA	419.7
US	174.1
CHINA	113.6
BRITISH VIRGIN ISLANDS	51.3
JAPAN	40.6

Source: Nepal Govt. Website

Table 8 Share of Top Investing Countries in FDI Inflows in Srilanka

Country	Share in Total FDI
Singapore	16.5
UK	13.9
Japan	12.1
Republic of Korea	11.5
Hong Kong	10.0

Source: BOI, Srilanka

Table 9 Share of 5 Top Investors in Individual South Asian Countries (%)

Host Country	Top 5 Countries	Share of Countries	Share of top 5 countries
India	Mauritius(1) USA(2) UK(3) Japan(4) Netherlandd(5)	43.68 12.96 8.12 7.21 5.07	77.04
Bangladesh	USA(1) UK (2) HONG KONG(3) SINGAPORE(4) NORWAY(5)	43.62 13.93 10.08 7.29 7.11	82.03
Pakistan	UAE(1) USA(2) UK(3) Switzerland(4) Norway(5)	27.28 22.52 10.93 6.94 6.22	73.89
Nepal	India(1) USA(2) China(3) Virgin Island(4) Japan(5)	36.40 15.10 9.85 4.45 3.52	69.32
SrIlanka	Singapore(1) UK(2) Japan(3) Republic of Korea(4) Hongkong,China(5)	16.5 13.9 12.1 11.5 10.0	64.0

Source: BOI-Pakistan and Bangladesh, FDI Data, Cell Ministry of Commerce, Govt .of India, DOI-Nepal, Unescap-Bhutan

Table 10 Sectors Attracting Highest FDI Inflows in India (January1991 to September- 2006)

(Amount in US$ Million)

Sectors	FDI Inflows	% with Total Inflows
Electrical Equipments(including computer software and electronics)	6270	17.54
Service Sector (financial and non financial)	4600	12.69
Telecommunications (radio paging, cellular mobile, basic telephone services)	3780	10.39
Transportation Industry	3440	9.31
Fuels(Power + Oil refinery)	2720	7.45
Chemicals (other than fertilizers)	2240	5.79
Food processing Industries	1210	3.12
Drugs and Pharmaceuticals	1060	2.91
Metallurgical Industries	770	2.14
Cement and Gypsum Products	760	2.14

Source: FDI Data Cell, Ministry of Commerce, Govt. of India

Table 11 Sectors Attracting Highest FDI Inflows in Bangladesh (2001- 2005)

(Amount in US$ Million)

Sectors	FDI Inflows	% with Total Inflows
AGROBASED	328.13	6.44
FOOD	124.43	2.44
TEXTILE	1018.83	19.99
PRINTING & PUBLICATION	178.85	3.51
LEATHER & RUBBERS	11.06	0.22
CHEMICAL	524.82	10.30
GLASS CERAMIC AND OTHERS	247.06	4.85
ENGINEERING	415.82	8.16
SERVICES	1229.71	24.12
MISCELLANEAUS	1018.73	19.99

Source: BOI, Bangladesh

Table 12 Sectors Attracting Highest FDI Inflows in Pakistan (2001- 2007)

(Amount in US$ Million)

Sectors	FDI Inflows	% with Total Inflows
OIL & GAS	1789.7	14.05
FINANCIAL BUSINESS	1947.1	15.28
TEXTILES	230.3	1.81
TRADE	464.3	3.65
CONSTRUCTION	364.2	2.86
POWER	682.3	5.36
CHEMICAL	292.3	2.29
TRANSPORT	222.0	1.74
COMMUNICATION (IT & TELECOM)	4613.0	36.21
OTHERS	2133.8	16.74

Source: BOI, Pakistan

Table 13: Sectors Attracting Highest FDI Inflows in Nepal (1998- 2001)

(Amount in US$ Million)

Sectors	FDI Inflows	% with Total Inflows
AGRICULTURE	11.1	3.87
TERTIARY	131.0	45.68
CONSTRUCTION	11.1	3.87
HOTELS & RESTAURANTS	68.9	24.02
TRANSPORT, STORAGE AND COMMUNICATION	32.6	11.37
BUSINESS ACTIVITIES	0.9	0.31
OTHER SERVICES	31.2	10.88

Source: Nepal Govt. Website

Table 14 Sectors Attracting FDI Inflows in Srilanka (End 2000)

(Amount in US$ Million)

Sectors	% with Total Inflows
Manufacturing	41.7
Agriculture	2.7
Services	55.6

Source: BOI Srilanka

Table 15 Intra-Regional Trade of South Asia by Country (Percentage of Each Country's Intra-Regional Trade)

Country/ Year	1980	1985	1990	1996	2001	2003
EXPORTS:						
Bangladesh	8.7	7.7	3.5	1.8	1.9	2.1
Bhutan	---	---	---	98.2	98.6	99.1
India	3.6	2.2	2.7	5.0	4.7	4.9
Maldives	26.2	17.0	13.4	18.6	22.3	13.9
Nepal	37.8	33.6	6.9	19.2	33.1	50.6
Pakistan	6.3	5.3	4.0	2.6	2.9	2.9
SriLanka	7.0	4.2	3.6	2.7	3.3	6.8
Intra-South Asia	4.9	3.6	3.1	4.5	5.0	2.4
Extra-South Asia	95.1	96.4	96.9	95.5	95.0	97.6
IMPORTS:						
Bangladesh	3.7	3.5	7.0	12.0	10.6	11.6
Bhutan	---	----	----	79.0	85.7	92.5
India	0.9	0.7	0.4	2.6	2.7	2.8
Maldives	23.0	9.1	13.0	19.8	23.5	22.3
Nepal	47.8	33.0	11.5	29.8	19.1	23.7
Pakistan	2.3	1.6	1.6	2.5	2.9	2.6
SriLanka	6.5	6.4	6.9	7.9	8.1	12.9
Intra-South Asia	2.4	1.9	1.9	4.5	4.4	4.6
Extra-South Asia	97.6	98.1	98.1	95.5	95.6	95.4

Note: The percentage of each country's intra regional trade is defined as reporter country "ith' trade (Tij) with partner countries (7 countries combined) in South Asia (j) as a percentage of reporting country's trade with world (T_{iw}) i.e. T_{ij}/T_{iw}

Table 16 Intra-Regional FDI in South Asia(% Of Total Regional FDI Inflows)

Source of FDI	Recipient of FDI				
	India	Pakistan	Sri Lanka	Bangladesh	Nepal
India	■		2.60	0.20	51.00
Pakistan		■	0.60	0.10	0.03
Sri Lanka	0.01		■	0.10	
Bangladesh	0.01	0.08	0.18	■	
Nepal					■
Share of South Asia	0.04		2.10	0.40	37.60

– data not available, FDI – foreign direct investment.
Source: Bhattacharya, Debapriya. 2007. South Asia: Intra-Regional Opportunities and Challenges. Presented at the Fostering Trade through Private-Public Dialogue Expert Meeting on Regional Integration in Asia, New Delhi, 28 29 March; other sources and time periods.

Table 17 Global Ranking on the Ease of Doing business by South Asian Country, 2007-2008

	2007	2008
Afghanistan	156	159
Bangladesh	102	107
Bhutan	122	119
India	132	120
Maldives	58	60
Nepal	104	111
Pakistan	73	76
Sri Lanka	100	101

Source: World Bank. 2007c. *Doing Business 2008: Overview*. Washington DC. Available: http://www.doingbusiness.org/documents/DB-2008-overview.pdf

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